

**Student Handbook
For
General Duty Assistant–Trainee**

Class - XII

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Editorial

Development of nursing care as a profession has references in the Indian history. Evidences suggest Lord Buddha took services of nuns for providing nursing care to patients. References of detailed qualities of a nurse in CharakaSamhita, AstangaHridaya and SushrutaSamhita stand to explain the nobility of the profession. The pioneering efforts of Florence Nightingale were instrumental in the extensive development of nursing as a career.

Inpatient services provide for continuous care to patients, requiring at least an overnight stay in a hospital. A patient is referred for hospitalisation in case of emergencies, planned hospitalisation or ambulatorycare (discharge on the same day). The roles of a General Duty Assistant, serving for inpatient facilities, include the following:

- planning and organising the unit
- nursing care
- assistance in housekeeping and sanitation
- transportation of patients and specimens
- participating in ward management, post-mortem care, etc.

The services to be offered by the GDA may be medical, surgical, acute care, mental health treatment or invasive procedures. The duties of the GDA during hospitalisation include recording health-related information of a patient, shifting her/him to a room, aiding in personal care activities, ensuring basic comforts for stay, informing the nursing staff about the condition of the patient, cleaning the equipment, and above all, ensuring the patient's welfare till discharge.

Hence, the GDA will function in many departments, for example, clinical, nursing, laboratory, dietary, laundry, housekeeping, sanitation, etc. The duties may vary according to the situation. The GDA plays a significant role in providing the right care to patients.

The book includes in the unit explain the skills required by a GDA for performing related tasks. The tasks include providing support for personal care, identifying the vital signs, making bed for the patient and care for the body after death. These require the GDA to act in a way, considering the psychological needs of patients and their caretakers. All these important factors are discussed in the book.

Regards,

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UNIT I

HOSPITAL MANAGEMENT SYSTEM

INTRODUCTION

Health care includes all services provided to a person or population by various health and related agencies. These are delivered by the health care system, which includes the management of the health sector and its organization structure.

This unit imparts knowledge to students about General Duty Assistance (GDA). The GDA assists doctors, nurses and other support staff while working in a hospital set up. Being informed about the duties, role and limitations, she/he benefits more by focusing on quality work. Securing personnel rights or understanding the codes of conduct related to a job role is expected to bring efficiency towards work commitment that ultimately improves patient care standards. GDA duty is to ensure patients comfort and maintain a clean and hygienic environment in the hospital.

Personal hygiene supplements good health. Neglect of cleanliness may cause many infectious diseases. Therefore, improvement in hygiene standards can prevent many epidemics. The contribution of every individual in maintaining personal and environmental hygiene influences the health standard index of the society. We follow a set sequence of oral hygiene, bathing, dressing, etc., which inculcates in us the habit of keeping our body clean.

GENERAL DUTY ASSISTANT (GDA)

Admission of a patient means arranging a stay in the hospital for observation, investigations and treatment of the disease. The patient can either be admitted to a hospital for emergency or just routine check-up. Emergency admission means that the patient is admitted in acute conditions, requiring immediate treatment e.g., patients with heart attack, accidents, acute appendicitis, poisoning, labor pain, diarrhea, dysentery, hyperpyrexia, hematemesis, dyspnea, shock etc.

Therefore, the patient must be admitted to the casualty department or emergency ward without any delay and the treatment must be initiated immediately to save patients life. Routine admission means that the patient is admitted for investigations and planned treatments, e.g., patients with hypertension, jaundice, hernia, cirrhosis of liver, chronic renal failure, nephritis, bronchitis etc.

Essential duties and responsibilities

The essential duties of a GDA include the following:

1. Assist professional health care staff in performing physical examinations and related procedures, which include measuring and recording vital signs, and physiological input and output assessment.
 - Patient data, such as vital signs and measurement of water intake and urination, etc., are taken and recorded according to the policies and procedures of a hospital.
 - Changes and abnormal findings in a patient's data are communicated timely to the registered nurse and other team members.
 - The patient is assisted with personal hygiene.
 - She/he is given assistance with ADLs (Activities of Daily Living), exercise and ambulation as directed by therapists and health care staff.
 - Personal care and patient-related services are provided in the patient's home or hospital as needed.

2. Help in maintaining the safety of patients
 - The patient's environment, including her/his room, examination room or treatment area is kept neat and clean.
 - Meal preparation and slight housekeeping duties may be necessary in the home setting to maintain a safe environment.
 - Equipment maintenance and safety checks are completed according to the policies and procedures followed by a hospital.
 - Events and incidents are reported promptly to those concerned using the health system's reporting process, which includes computer and various software.
3. Perform administrative support functions
 - Medical record duties, including file maintenance and record-keeping, are completed when necessary.
 - Orders related to purchases and supply of inventory are completed according to the hospital guidelines.
 - Duties, including scheduling diagnostic procedures, meeting and greeting patients, or delivering specific supplies and pharmaceuticals, are performed efficiently.
4. Master necessary skills and competencies
 - Competency in the use of new equipment (i.e., lifting and moving patients) is achieved and maintained.
 - Opportunities for professional development are identified and goals for self-improvement are set.
 - The education and development of others is fostered by sharing information learned through individual professional development.
 - A positive environment for the professional development of co-workers is encouraged.
 - Annual mandatory training activities and regulatory in-service hour requirements are completed within set timeframes.

Organizational duties

The organisational duties of a GDA include the following:

1. Communicate to maintain good interpersonal relationships
 - Positive professional qualities of an employee are reflected in her/his verbal and non-verbal communication.
 - Information about patients and staff is provided in a supportive and timely manner.
 - Interpersonal conflicts are resolved as per organizational policies.
 - Diverse perspectives in personal and social areas are accommodated to nurture inclusive work environment.
 - Clear communication pattern is followed.
2. Service extended to internal and external customers
 - Confidentiality for patient and employee information must be maintained.
 - Appropriate resources are used consistently to meet customer needs.
 - Relationships with staff are fostered to meet internal and external customer needs.
 - Positive work relationships with peers, management and customers are maintained at all times.
 - Organisational values must be followed with respect, integrity, excellence and must be evident in the GDA's behaviour.

3. Participate in performance improvement activities
 - An initiative taken by an employee is demonstrated by trying to resolve problems of the people around.
 - Change is faced with positive and supportive behaviour.

RECORDING PERSONAL AND MEDICAL DATA OF PATIENTS

The clerk in the record session is responsible for recording for certain data that are essential for the identification of a patient. The clerk may ask questions to the patient or his/her family members the name and address, age, gender, religion, occupation, income, marital status, address, mobile number and address of nearest relatives.

The information is recorded in the outpatient record. Patients who are too ill must be admitted immediately and necessary information must be obtained from family members/ relatives.

In order to provide appropriate and adequate services and to give immediate care it is necessary to know the diagnosis, the duration of illness and the name of the physician who has been referred to. This can be obtained by asking relevant questions to the patient. The patient is given an outpatient number for further reference.

HISTORY TAKING PROCESS

The collection of a health history from a patient – i.e., subjective data which focuses on the patient's symptoms - is the first step in health observation and assessment, and is a fundamental skill working in a clinical area.

Types of health history

- A comprehensive health history. This collects detailed information about a patient - including their biographical data, present health status, past medical history, family history, personal situation and a review of all body systems. It is usually completed on admission to a health care facility and during a general health check-up.
- A rapid or focused health history. This collects specific information about a clear health-related issue or need with which a patient presents. The information gathered is used to inform the immediate care of the patient.

OBSTETRICAL HEALTH HISTORY

An **obstetric history** involves asking questions relevant to a **patient's previous and current pregnancies**.

- Previous obstetrical history

It is important to ask about a woman's previous obstetric history, as this may help inform the assessment of risk in the current pregnancy and have implications for the mode of delivery.

Gravidity is the number of times a woman has been pregnant, regardless of the outcome.

Parity is the total number of pregnancies carried over the threshold of viability (typically 24 + 0 weeks).

Abortion/ miscarriage A **miscarriage** is the loss of a pregnancy **before 24weeks** gestation.

Living – number of living children

Death – number of deaths

- Current obstetrical history
Gestation-current gestational age of the pregnancy.
Antenatal check -up
Immunization status
Mental health history

TRANSPORTING PATIENT IN VARIOUS WAYS

The hospital transportation system for patients in internal, external and various methods of triage. Internal transportation includes the use of trolleys, stretchers, lift, escalators etc., for transporting patients, equipment and other supplies whereas, external transportation includes ambulances, relief vans or trains etc. Transportation is done to ensure that a victim reaches the hospital with deterioration in his/her condition. A severely injured or ill person must be immobilized unless there is a threat to his life.

| Category | What does this mean | What can you do |
|----------|---|--|
| I | Those with emergency signs require immediate emergency treatment | Help in evacuating and safely transporting a patient to a medical centre |
| II | Those with priority signs should be given priority in queue for rapid assessment and treatment | Comfort the injured |
| III | Those who have no emergency or priority signs are non – urgent cases and wait their turn for assessment and treatment | Give first aid and arrange for transportation |

Table1: Color coding system as triage

Triage in treatment (first aid and transportation)

Red tag (emergency)

Cardiac arrest, severe breathing difficulty, burns involving respiratory tract, poisoning etc.

Yellow tag (priority)

Severe burns, spinal injury, moderate hemorrhage, multiple fracture, head injuries

Green tag (non- urgent)

Minor fracture, minor bleeding, moderate or minor burns

Transportation by stretcher

It is used for seriously ill or injured patients.

Types

- A comprehensive health history.
- Farley stretcher (general stretcher)
- Trolley bed
- Neil Robertson stretcher (used for rescue purpose)
- Improvised stretcher
- Utile stretcher (foldable from the centre)

Carrying a loaded stretcher

1. The head must be higher than the feet.
2. Load the feet first, except in the following situations:
 - When carrying a victim to the side or from bed
 - While going downhill, or when the victims' lower limbs are injured, or when there is hyposthenia
 - While loading the victim in an ambulance

PHYSICAL EXAMINATION

It is a complete examination or comprehensive study of the body or parts of the body to determine the general condition of the body. It involves collecting, validating and analyzing data about the patient's health. It includes gathering both the subjective and objective data.

- Subjective data: Information that is experienced or known only by patient, and which is collected during patients' health history.
- Objective data: Information that is directly observed or is elicited through examination.

Purpose of physical examination

1. To gather baseline data about the patients' health
2. To make early diagnosis
3. To make clinical judgements about patients changing health status and management
4. To evaluate the physiological outcomes of care

Technique of physical examination

1. Inspection

- It is a process of observation
- All body movements are watched and inspected carefully
- To use inspection effectively, observe the following principles:
 - Make sure good lightning is available
 - Position and expose body parts so that all the surface can be viewed
 - Inspect each area for size, shape, color, symmetry, position and abnormalities
 - Compare each area inspected with the same area on the opposite site of the body
 - Use additional light to inspect body cavities
 - Do not hurry for inspection.

2. Palpation

- Palpation is done through the sense of touch
- The patient should be relaxed and positioned comfortably because muscle tension during palpation impairs its effectiveness
- Use a gentle approach.
- Note any nonverbal signs of discomfort
- Tender areas are palpated last
- Palpation may be light or deep palpation – it is controlled by the amount of pressure applied with the fingers or hand

3. Percussion



Fig1: Technique of Percussion

- It involves tapping the body with the fingertips to evaluate the size, borders and consistency of body organs or absence of fluids in body areas
- The character of the sounds depends on the density of the underlying tissue
- Two methods of percussion are:
 - Direct method: It involves striking the body surface directly with one or two fingers
 - Indirect method: Performed by placing the middle finger of the non-dominant hand (pleximeter) firmly against the body surface, keeping the palm and remaining fingers off the skin. The tip of the middle finger of the dominant hand (Plexor) strikes the base of the distal joint of the pleximeter.
- Percussion produces five sounds:
 - *Tympany*: A hollow drum -like sound over a gastric or bubble
 - *Resonance*: A low pitched and loud sound @ lungs
 - *Hyperresonance*: exaggerated resonance @ emphysematous lungs
 - *Dullness*: Diminished resonance @ liver, heart
 - *Flatness*: A high pitched sound with short duration @ an abnormally solid part

4. Auscultation

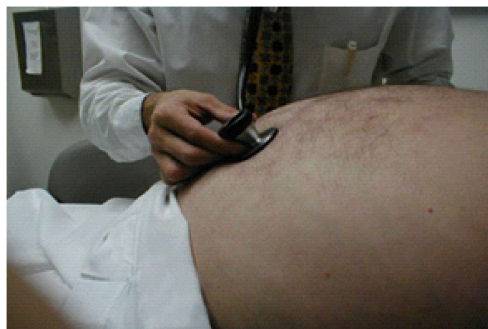


Fig2: Technique of Auscultation

- Listening to sounds produced
- Should be carried out last except during the abdominal examination
- Auscultation is done using a stethoscope- Bell is best for low pitched sounds such as heart sounds @ murmur and marmur is best for high pitched sounds such as bowel and lung sounds

4. Manipulation

It is the moving of a part of the body to note its flexibility.

Testing of reflexes

The response of the tissues to external stimuli is tested by means of a percussion hammer, safety pin, wisp of cotton or hot and cold water.

Precautions to be taken while examining height and weight of the patient

Height: Have the patient stand erect.

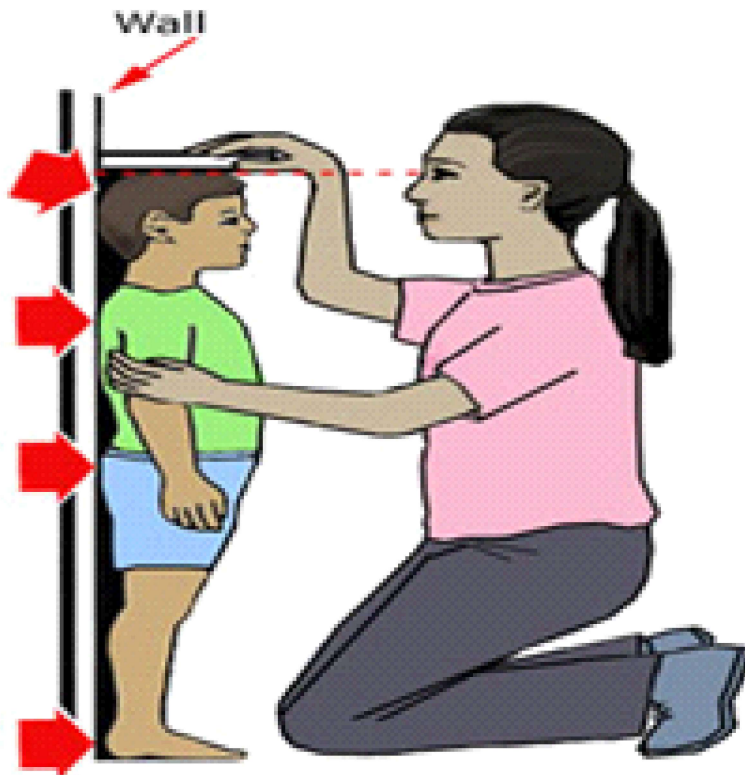


Fig3: Technique of height measurement

Weight: Weigh at the same time of the day on the same scale, to allow an objective comparison of subsequent weights.

TECHNIQUE FOR CHEST AND ABDOMEN

THORAX AND LUNGS

Inspection

- Inspect the shape and symmetry of the patient's chest from front to back.
- Look for deformities, position of the spine, slope of the ribs, retraction of the intercostal spaces during expiration.
- Observe the accessory muscles of respiration- sternocleidomastoid, trapezius and abdominal muscles.

Palpation

- Measures chest excursion or the depth of breathing.

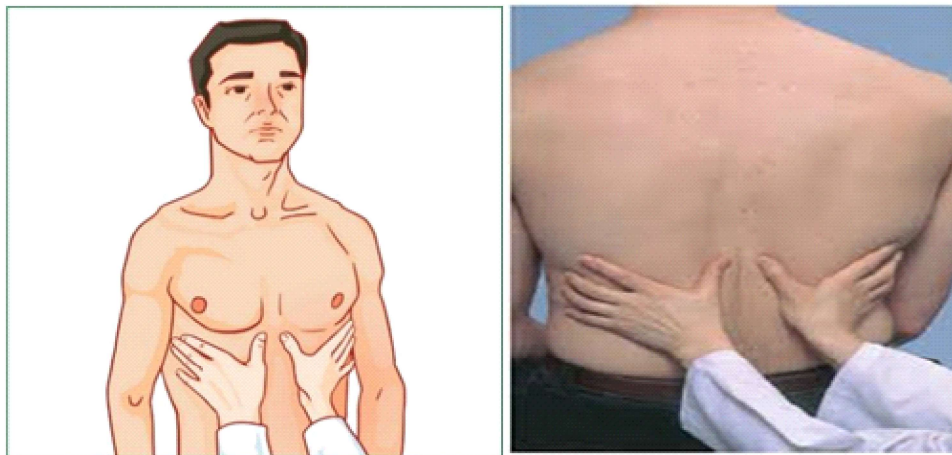


Fig 4 (a): Techniques of palpation

- Palpate for tactile fremitus. Normally there is a faint vibration when the patient speaks. Compare both side of the thorax, moving from top to bottom.

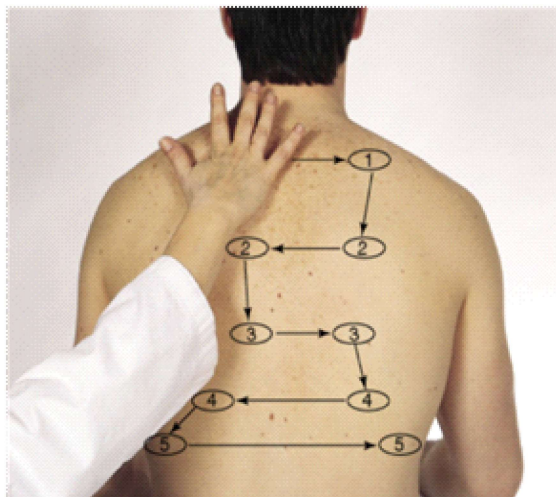


Fig 4 (b): Techniques of palpation

- Vibrations are strongest at the top, near the level of the tracheal bifurcation.

Percussion

- Determines whether the underlying tissue is filled with air or fluid or is solid.
- Using the indirect technique, percuss the intercostal spaces over symmetrical areas of the lungs moving side to side.
- Resonance- air filled lungs.
- Flat- lungs mass.
- Hyper resonant- hyper infiltration of lungs tissue.
- Dull- atelectasis, pleural effusion, pneumothorax or asthma.

Auscultation

- Assess the movement of air through the tracheobronchial tree and detects mucus or obstructed airways.
- Ask client to take slow, deep breaths with the mouth slightly open.
- Compare both lungs in one region on one side of the body with sounds in the same region on the opposite side.
- Auscultate for normal and abnormal or adventitious sounds (crackles, rhonchi, wheezes and pleural friction rub).

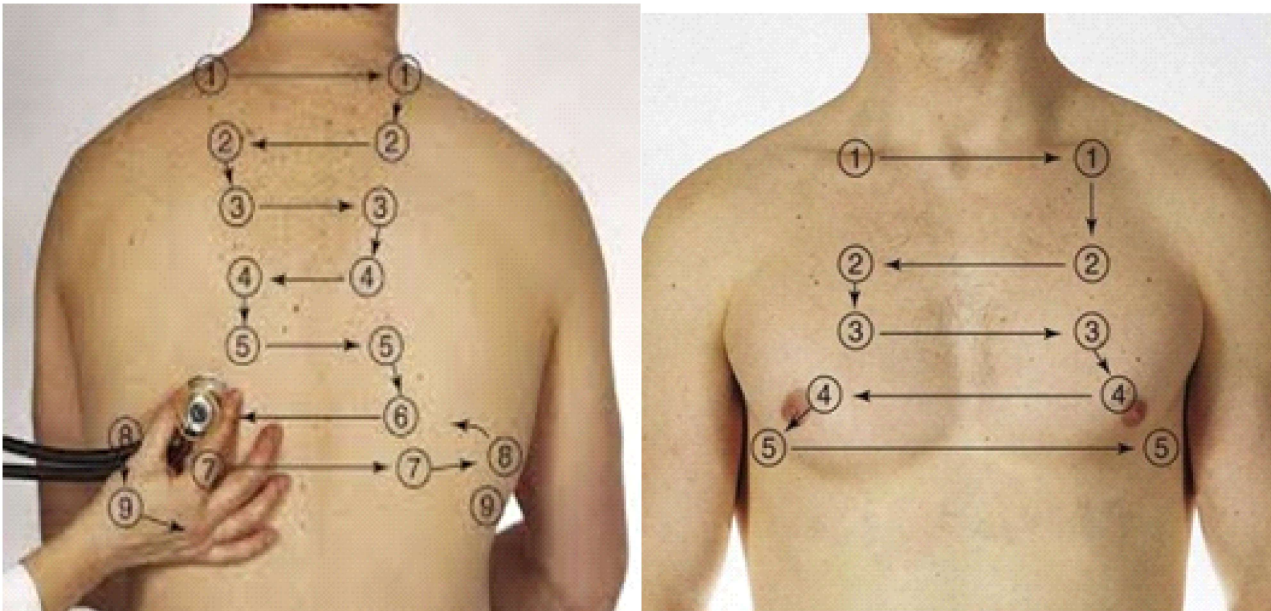


Fig5 (a): Techniques of Auscultation

HEART

- Look for visible pulsation.
- Palpate for the apical impulse and any source of vibrations.
- Begin with assessment of the base of the heart and move toward the apex.
- Auscultate in all the six anatomical of the heart (Aortic, Pulmonic, second pulmonic area, Tricuspid, Mitral, Epigastric).

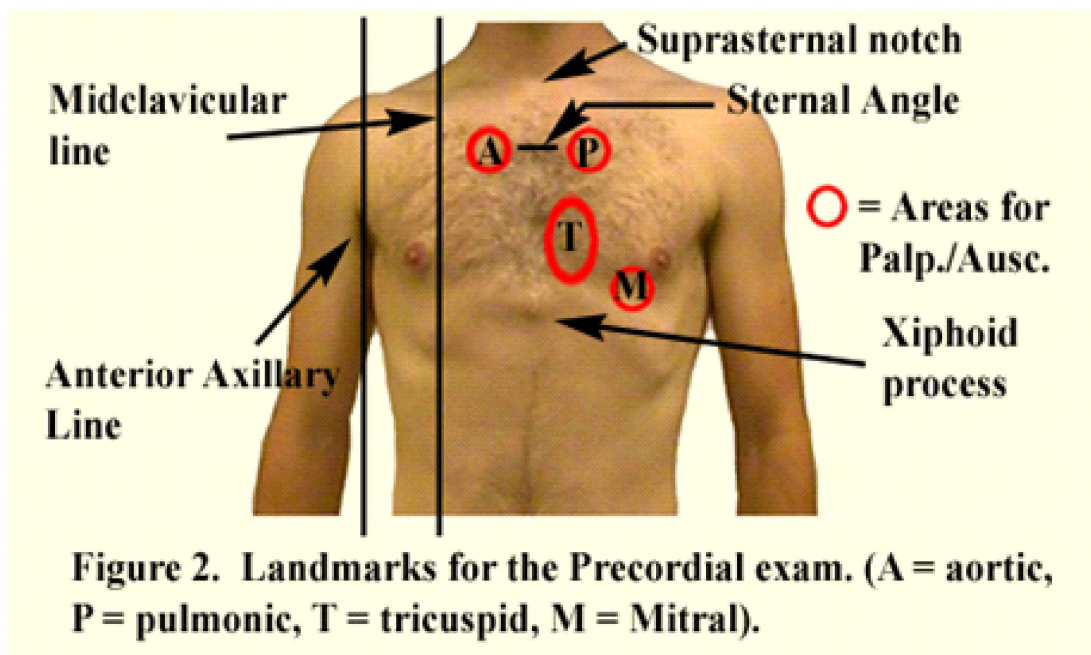


Fig5 (b): Techniques of Auscultation

- Auscultation detects normal heart sounds, extra sounds and murmurs.
- S1 is heard when the mitral valve closes to prevent regurgitation of blood into the atrium, creating the first heart sounds, and described as “lub”. It is high pitched and heard best at the apex.
- S2 is heard when the aortic valve closes, described as “dub”. It is best heard at the aortic area.

BREAST

- Usually, breast extend from the third to the sixth ribs, with the nipple at the level of fourth intercostal space.
- Inspect the breast for size and symmetry.
- Observe for contour or shape of the breast and note masses, flattening, retraction or dimpling.
- Inspect nipple and areola for size, color and discharge.

ABDOMEN

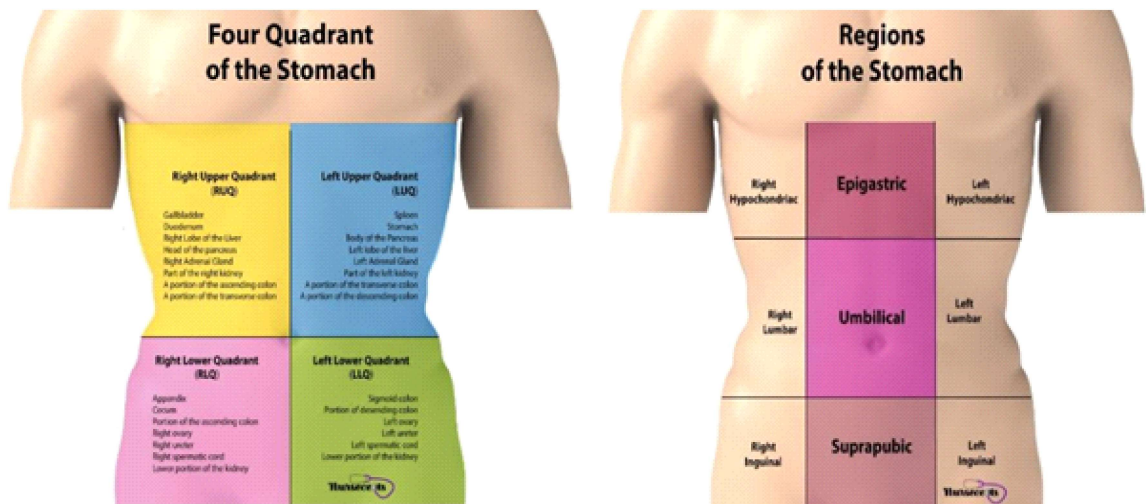


Fig 6: Quadrants and Regions of Stomach

- It includes examination of the lower GIT in addition to the liver, stomach, uterus, ovaries, kidneys and bladder.
- Ask the patient to void before beginning the assessment.
- Ask client to lie supine or in a dorsal recumbent position with the arms at the sides and knees slightly bend.
- Ask patient to report pain and point out tender areas. Assess the tender area last.
- Inspect skin over the abdomen for color, scars, venous patterns, lesion and striae (stretch marks).
- Assess for contour or shape, symmetry and surface motion of the abdomen, noting any masses, bulging or distension (do not confuse with obesity and distension).
- **Auscultation** precedes percussion and palpation during the abdominal assessment because manipulation of the abdomen may alter the frequency and intensity of the bowel sounds.
- Auscultate abdomen for bowel sounds. A gurgling or clicking sounds occur irregularly 5-35 times per minute.
- Absent sounds may indicate cessation of GI motility.
- **Percussion:** Tympany predominates because of air in the stomach and in the intestine. A dull percussion sound is heard over solid masses such as liver, spleen, pancreas, kidneys and distended bladder.
- **Palpation:** Detect areas of abdominal tenderness and note the quality of abnormal distensions or masses.
- Palpate tender areas last.
- Use both light and deep palpation. Do not use deep palpation over surgical incision and tender areas.
- If tenderness is elicited, test for rebound tenderness.
- Observe patients face for discomfort.

TECHNIQUE OF COLLECTING SPECIMEN OF URINE, STOOL, SPUTUM, BLOOD

Urine specimen

Urine is one type of specimen that can be easily collected from a patient.

1. **Routine or random sample:** The patient is given a non-sterile collection container and instructed to collect a midstream specimen in the container. This type of specimen is routinely used for urinalysis and may not be used for a culture and sensitivity.
2. **Clean-catch mid-stream specimen:** Patients with orders for a urine culture and sensitivity are collected mid-stream urine sample.
 - Open the collection package but DO NOT TOUCH INSIDE OF CUP OR RIM.
 - Gently grasp the container.
 - Begin to void urine, letting the first 20-25 ml pass into the toilet. Position the cup in the stream of urine until the container is about one-half to two-thirds full. Finish voiding into the toilet.
 - After obtaining the urine specimen, screw the lid on tightly again being careful to avoid touching inside the container or lid.
 - Bring the specimen to the laboratory.

3. **Timed specimen:** These specimens are used when the physician requires urine samples to be taken at specific intervals during the day. Twenty-four (24) hour urine specimens are required for creatinine clearance tests and many other hormone studies.
 - The patient is given a large container (approximately 1 gallon) that is labelled with the patient's name and date. Space is provided to write the time the collection begins and ends.
 - The 24-hour urine specimen is brought to the laboratory as soon as possible as the 24- hour period is over.
4. **Catheterized specimen:** These specimens are collected by specially trained personnel only.

Stool specimen

Stool sample does a variety of tests — for example, to screen for bacteria, viruses, intestinal parasites or other possible causes of your diarrhoea, bloody stool, abdominal pain or other symptoms. Physician may order a stool test in the absence of these symptoms to assess you for possible digestive problems, such as the malabsorption of certain sugars, fats or nutrients.

- Collect stool into a clean, dry container.
- Specimens must not be contaminated with urine or water, so collection from toilet bowls is unacceptable.
- Don't overfill the container.
- Label patient name, date and time on the container.
- Deliver the specimen to the lab immediately.

Sputum specimen

- Explain the procedure to the patient.
- Position the patient in an upright position in a chair, or the edge of the bed or well-supported by pillows in bed (high Fowler position) as this will ensure maximum lung expansion
- Ask the patient to take several deep breaths – breathing in through the nose and exhaling though the mouth – to help loosen secretions
- Ask the patient to force a deep cough to ensure a sample is obtained from the lower respiratory tract.
- The patient should expectorate into the specimen pot and secure the lid to prevent contamination. Ensure the specimen is sputum rather than saliva, as samples contaminated with oropharyngeal secretions and saliva are difficult to interpret and can be misleading
- Label the sample and send to microbiology laboratory.

Blood sample collection

Ensure that the indications for blood sampling are clearly defined and in a written documented instruction.

- Identify the right patient and explain the procedure.
- Assemble the equipment.
- Wash hands or put pair of don gloves.
- Select the site.
- Securely fasten a tourniquet around the patient's arm, just above the elbow. Instruct the patient to keep his arm as straight as possible and to make a fist (if possible). Gently palpate the antecubital area in search of a suitable vein. It may be necessary to examine the other arm, wrists, or hands.
- Securely fasten a tourniquet around the patient's arm, just above the elbow. Instruct the patient to keep his arm as straight as possible and to make a fist (if possible). Gently palpate the antecubital area in search of a suitable vein. It may be necessary to examine the other arm, wrists, or hands.

- When a vein has been located, thoroughly cleanse the site with disinfectant. Allow to dry.
- Assemble the vacuum collection set of syringe and needle. Remove the needle cap or sheath.
- Grasp the patient's arm (or hand) with your free hand to hold the skin and underlying tissue taut.
- Insert the needle into the vein by using a quick, deliberate motion. Begin to withdraw the blood by inserting the vacuum tube(s) onto the sheathed end of the multi-draw needle, or by pulling back on the syringe plunger. If blood does not return, it may be necessary to make small adjustments to the position of the needle to penetrate the vein.
- When sufficient blood has been withdrawn, release the tourniquet. Place the clean gauze sponge or cotton ball over the puncture site. Simultaneously withdraw the needle while using the sponge to apply pressure to the site.
- Instruct the patient to apply pressure to the puncture site with the other hand. If the patient is unable, you should continue to apply pressure to the site until bleeding has stopped.
- Failure to apply adequate pressure can result in a hematoma, or bruise, to the draw site.
- Label the sample vial and send to laboratory.

FURNISHING PATIENT UNIT

Cot or bedstead: the hospital beds are made up of metal, simple in design, light and easily moveable, easy to clean, and strong durable with hard rubber castors. Some bed will have side rails to prevent the patient from falling.

Over bed table or cardiac table: generally, this is used for patients suffering from cardiac diseases to lean and rest forward when he has breathing difficulty. It can also use for eating, reading, and writing and for placing articles for self-care.

Bedside locker: it is used to store the patient personal articles.

Bedside table: it can be used for taking the meals and other purposes.

Chair and stool: the chair can be used for the patients when he is out of bed, i.e., while changing the bed linens or bathing the patients. The workers and visitors should sit on the chair and not on the patient's bed.

Bedside commode: it is a chair or wheelchair that has opening in the centre of a seat under which a bedpan can be inserted. It is used for defecation and urination.

Bedpan and urinals: for a bedridden patient, these are used for defecation and urination.

Sputum cup: it is used to collect the sputum and spitting

Kidney tray: it is used to collect vomits body fluids and soiled dressings.

Call signal: a bell is kept near the patient to call the nurse in his need

Bedding and bed linens: the mattresses and pillows should be firm, thick and smooth and all should have a washable cover. It gives support to the patients. Bed sheets are made up of strong cotton material, which are used to protect the mattress from soiling and to cover the patients; draw Mackintosh sheet, extents from the patient shoulder to below knee, made up of rubber or plastic material, which is used to protect the mattress and bottom sheet from soiling. Sometimes, Kelley's pads are used in place of a Mackintosh.

UNIT II

Sterilization and Disinfection

UNIT AT A GLANCE

- ❖ *Sterilization*
- ❖ *Disinfection*
- ❖ *Hospital acquired infection*
- ❖ *Human diseases and their causative organisms*
- ❖ *Dressing and its types*



Learning Outcome:

- Demonstrate the knowledge of process of disinfection.
- Demonstrate the knowledge of care of articles in hospital.
- Provide assistance in disinfection of wards in a hospital.
- Demonstrate the knowledge of general surgical asepsis practices.
- Demonstrate the knowledge of disinfection of operation theatre
- Demonstrate the knowledge of surgical dressing.
- Describe the diseases caused by microorganisms.
- Demonstrate the knowledge of common human diseases and their causal agents.
- Demonstrate the knowledge of hospital acquired infections.
- Perform disinfection of wards and equipment

DISINFECTION

The definition of disinfection taken from BS5283 (1986) states ‘The destruction of microorganisms, but not usually bacterial spores. It does not necessarily kill all microorganisms but reduces them to a level acceptable for a defined purpose, for example a level which is harmful neither to health nor to the quality of perishable goods.’

The acceptable level of microbial contamination on a surface or piece of equipment has to be determined; obviously, no pathogens should be found. The state of sterility is defined as free from all living microorganisms. This is not achievable in the food factory by using acceptable chemicals ('acceptable' meaning safe for humans, plant materials and products). Disinfectants are used after the detergent application in cleaning-in-place (CIP) operations where the term 'terminal sterilant' may be used. They are also used after hand cleaning. Equipment should be left in a soak bath until it is ready to be used, thus ensuring that it remains free from recontamination. There are a wide range of disinfectants available. The choice of disinfectant depends on the user's requirements, the type of processing and cleaning equipment, the method of use, and, to some extent, the personal preference of the user.

Types of Disinfectant

Disinfectants can be split into two broad groups, oxidizing and nonoxidizing. Oxidizing disinfectants include the halogens, chlorine, iodine, bromine, and chlorine dioxide, and oxygen-releasing materials such as peracetic acid and hydrogen peroxide. Nonoxidizing disinfectants are as follows: quaternary ammonium compounds, amphoteric, biguanides, and acid anionics.

Concurrent Disinfection:

Concurrent disinfection means the immediate disinfection of all contaminated articles and bodily discharge during the course of the disease. It includes the following:

1. Cleaning the isolation unit daily, including the floor, using an effective disinfectant.
2. Disinfection of all articles, including the soiled linen, contaminated articles, etc. before they are sent out of the unit.
3. Disposal of all wastes by incineration.
4. Safe disposal of excreta.

The stool and urine in enteric isolation should be mixed with equal quantity of freshly prepared lime (1 part of lime to 4 parts of water) and allowed to stand for 2 to 4 hours. Then it is dispensed by burial. The stools can be burned after mixing it with saw dust. In hospital practice, however, the septic tanks are in use and they are the best means of the disposal of excreta. No stool with any disinfectant should be discarded in a septic tank because the disinfectant will hinder the natural biological action. The sputum can be collected in a sputum cup with a lid. The containers need to contain either water or disinfectant lotion so that the sputum will not stick to the sides. When the container is full, it needs to be boiled or burned.

Terminal Disinfection:

The terminal disinfection is the disinfection of the client's unit with all the articles used on discharge, transfer or death of a client who had been suffering from an infectious disease. Fumigation is often used for this purpose. The commonly used agents are sulphur and formalin. The doors and windows, including all crevices, are closed prior to fumigation. Fumigation with Sulphur. The room should be filled with steam by boiling a kettle of water in the room as the sulphur fumes act better on a damp surface. A small room of 100 placed in an earthenware which stands in a large oven containing water. A little methylated spirit is poured over the sulphur to ensure burning the sulphur completely. Lit fire to the sulphur and close the door. The room is opened after 24 hours. The effectiveness of this method depends upon several factors, such as gas concentration, temperature of the room, exposure time and humidity. All articles should be kept open for thorough penetration by the sulphur fumes.

CARE OF ARTICLES IN A HOSPITAL

Care of Rubber Goods:

The rubber goods in common use are air cushions, mackintoshes, hot water bottles, ice caps, ice collars, rubber tubes catheters, rectal tubes, gloves and rubber beds. The GDA should make all efforts to prolong the life of the rubber goods. Natural and synthetic rubbers deteriorate with age, exposure to heat, light, moisture and by chemicals. They should not be creased or folded, never use any pins to fix rubber goods in any place. Never expose them to sunlight. Boiling water ruins rubber. Rubber goods should never be dried by artificial heat, nor by contact with a radiator or stove. They should be free from grease and acids. These should not come in contact with metal goods. Any fluid split on them should be wiped off immediately. When storing, care must be taken so that no two surfaces come in contact with each other. They should not be pressed out of shape by any weight. They should not be tied in knots. They should not be hung on hooks or nails. If boiling process is used, put them in boiling water. If autoclaving is used, short period of exposure is recommended (10 to 15 min) with less pressure.

Cleaning of Rubber Mackintosh:

1. Spread the mackintosh on a table or a flat surface and wet it with cold water.
2. Rub the upper surface with soap and water using a clean cloth or towel.
3. Turn the other side and repeat the process as above.
4. Wash both surfaces under running water.
5. If stains are present, care should be taken to remove them by appropriate methods.
6. For disinfection, use Lysol or Dettol 1 : 40.
7. Hang them on a horizontal cylindrical pole in shade to dry. Spread them without wrinkles.
8. When both surfaces are absolutely dry, powder them lightly with French chalk powder.
9. Store them either flat or rolled and never folded, taking care to see that two mackintosh surfaces do not lie together, but are separated by old linen or paper. Store them in a dark cool place in airtight containers, whenever possible.

Care of Rubber Gloves:

1. The wearer of the gloves should wash them on their hands just before they are removed to prevent adherence of blood and other organic materials.
2. After removing from the hands, they are washed with soap and cold water, first on the outside, then invert and repeat on the inside.
3. Rinse well with water both inside and outside as described above.
4. Holes and tears are discovered by submerging the glove filled with air in the water. If there are holes the bubbles will pass up through the water.
5. Hang them to dry. When the outside is dried, turn inside out and dry.
6. When both sides are dried. They are powdered inside and outside and packed in pairs of the same size, right and left gloves in glove wrapper. A small lump of gloves powder in a gauze mesh for powdering the hands is kept in the cuff of the gloves.
7. Steam under pressure is the best method of sterilizing gloves. The pressure is kept minimum to prevent melting of the gloves.

Care of the Rubber tubes:

Catheters vary in size and quality according to the special need. Sizes of the catheters are marked on it either in French or English scales.

1. After use wash rubber tubes under running water, holding the eye end upwards and allowing the water to run through.
2. A small quantity of organic matter may be lodged at the eye end. Remove them using a swab stick.
3. Clean them with soap and warm water to remove the dirt and grease.
4. Wash them again under running water.
5. Boil the tubes for 5 min by putting them in the boiling water. Dry them by hanging.
6. When dried, powder and store them in airtight containers.
7. Reboil or autoclave them before use. Rubber tubing used for the parenteral therapy requires special attention. It must be washed by forcing detergent solution through it first then by water and finally by distilled water. Infusion solution flowing through new rubber tubing, have been found to contain products from the rubber that are toxic to the client. To correct the toxic factor, the tubing s are boiled in 10% soda bicarb solution for 30 min. It is essential that the soda bicarb should be thoroughly removed from the tubing before it is used for the client. Rubber tubing used for the blood transfusion should be rinsed immediately after use. It is recommended that the tubing which contained blood should never be used again for any kind of intravenous infusions since they cannot be cleaned properly. It is better to use disposable type of tubes which are available in the market.

Certain catheters e.g. Urinary catheters which are easily destroyed by heat and moisture are disinfected using formalin tablets.

Hard rubber tips used in cleaning and medicating the body cavities (e.g. douche nozzle) also need special care. They are moulded into special shapes. It is essential that the original shapes of the tips be maintained. Heat softens the rubber, reduces the curved up to a straight tip and roughens the polished surface. For these reasons such instruments are disinfected with chemicals.

Cleaning of the Air cushion, Rubber Beds, Hot water bottles, Ice caps and Ice collars:

To clean the air cushion and airbeds, do not pour water into them. It is sufficient to clean the outside. During cleaning it should not be filled with air, because while rubbing there is a tendency to exert pressure on the seams at the sides of the articles and they may crack. The valves of the air cushions or beds should never be immersed in water as it spoils them, and is one of the reasons why they get out of order. Cleaning and storing are done like other rubber goods except that they should be slightly inflated to prevent the two surfaces to come in contact with each other.

In case of hot water bottles, ice caps and ice collars, empty the contents immediately after use. Wash and dry as in the case of other rubber goods. Hang the bags upside down to drain the water. The ice bags, which cannot be hung, are dried with a piece of cloth. When the bags are completely dried inflate them with air.

The covers of the air cushion, ice bags and ice collars are disinfected and sent to the laundry for washing.

Care of Syringes and Needles:

Syringes make an expensive and common item of the glassware used in the hospital. Rinsing immediately after use is important to prevent the pistons sticking to the barrels, thus prolonging the life of syringes. Stuck syringes may be placed in 25% aqueous solution of glycerin and boiled for 10 minutes or soaked in weak solution

of nitric acid to separate the parts. If the needle is stuck to the hub of the syringes, immersing it in the boiling water will make the metal expand and separate them.

Some syringes are interchangeable. Others will have same number on the barrel and the piston, in order that they can be easily matched. When cleaning and sterilizing syringes, the barrels and pistons of the same number should be kept together to avoid wasting time later in matching the parts.

Sterilization by hot air is the best method of sterilization for glass syringes, if the glass has the same expansion coefficient. The syringe may be placed in the hot air sterilizer with the piston in place. Steam or chemical sterilization is with the piston in place. Steam or chemical sterilization is more effective, if the parts are separated, because the contact with the sterilizing agent is more complete. If the syringes are boiled in distilled water, silicate is taken from the glass and it results in a slow deterioration of the syringes. Never put glass in boiling water. Put the glassware in cold water and bring to the boiling point.

In sterilizing aseptosyringes, remove the rubber bulb from the glass barrel. This facilitates the penetration of the sterilizing agent and keeps the rubber from sticking to the glass, as it is very likely to do so when it is very hot. The bulb and the glass portion should be wrapped in the same package to avoid the loss of one part. No instrument requires more meticulous attention than the needles. The bore is so fine that it becomes blocked badly unless cleaned each time it is used. The points of the needles are so delicate that the slightest contact with a hard surface may bend them backwards and produce a "hook". The important points to remember are as follows:

1. After use, cold water is forced through the needle with a syringe followed by a detergent solution.
2. Again wash it with warm water.
3. Examine the point a magnifying glass or by drawing the point over the skin to discover the "hooks". If hooks are present is corrected in a sharpening device. Take care to preserve the bevel.
4. If the needles are blocked, wire stillets are used to remove them.
5. Needles are sterilized by boiling them for 10 to 20 min or by dry heat at a high temperature or by autoclaving.
6. Chemical disinfection is unsatisfactory, because it is difficult to remove the chemical from the bore of the needle completely. Suture needles are treated in the manner described for other sharp instruments.

General Instructions for Removal of Stains from Linen

1. Note the kind and the color of the material stained. The nature of the stain and select the correct stain removed and follow an appropriate method.
2. Try the simplest method first.
3. Remove stains as soon as possible.
4. Try first whether stains can be removed with cold water.
5. For colored material, always test the remover first on a small part.
6. The stains which contain protein, such as blood, excreta, milk, pus from the wound, etc., are coagulated by the application of heat. So for all stains of this nature, the articles should be soaked in cold water for sometime to remove the stains.
7. If the stains contain fatty material, hot water and soap should be used.
8. Any stains of medicine may be treated by water or methylated spirit, as many drugs are soluble in spirit and some other in plain water.
9. The application of some absorptive material, such as salt, starch or borax will prevent any liquid from spreading and thus reduce the ultimate damage to the material.
10. When the stains do not respond to the simple methods, bleaching agents may be used such as lemon juice, hydrogen peroxide and bleaching powder. When bleaching powder is used, make it into a solution

and apply a weak solution first on the stained area and then gradually increase the strength of the solution. Bleaching agents are destructive to linen and discolor the colored material.

11. When using boiling water for removal, stretch the stained part over a bowl and pour the boiling water with force until the stain disappears.
12. When using an acid, stretch the part over a bowl of boiling water and apply acid by means of a medicine dropper, applying the acid. When the stain disappears, rinse the cloth thoroughly in cold water.
13. When bleaching by the sunlight wet the stained area and lay it in the sunlight.
14. Use equal parts of hydrogen peroxide and dilute ammonia and moisten the stain until it disappears. This is particularly useful in case of woollen articles.
15. Strong chemicals are used only as a last resort because of the injurious effect caused by them.

Cleaning Blood Stains:

Soak immediately in cold water. Hot water coagulates and leaves a mark. When the stains disappear, wash them in warm soapy water. If it is an old blood stain, soak it in a mixture of hydrogen peroxide and ammonia for several hours and then wash it in cold water and then with soap and warm water.

For the thick blood stains on the mattress, apply a thick paste of starch and water, and allow standing in the sun. When the paste is dry and discoloured, brush off the stain.

Cleaning Tea and Coffee Stains:

Linen, as soon as it is stained with tea, coffee and cocoa, remove it by pouring milk over it. Washing them in cold water or washing them in hot water and sodium carbonate will remove the stain. If not completely gone, lemon juice may be rubbed or hydrogen peroxide may be applied.

Cleaning Aniline Dyes, Gention Violet, Methylene Blue Stains:

Wet the cloth and bleach them in the sunlight. Chlorine water bleaches the dyes. If chlorine water is used, rinse the bleach thoroughly with warm water after the stain disappears.

DISINFECTION OF WARDS IN A HOSPITAL

Cleaning techniques

1. **Floors:** In a busy ward, recontamination from airborne settlement or transfer from shoes and trolley wheels is very rapid. Levels of bacterial contamination on floors are usually restored to their original level within two hours of cleaning; whether disinfectants are used or not. Disinfectants should only be used on a clean surface. However, mops should be disinfected after use in the rooms of infected patients and also before use in rooms occupied by immunosuppressed patients. A neglected dry mop will redistribute microbes, which have been picked up. A neglected wet mop will grow pseudomonas on it, which will get distributed while cleaning.

2. **Carpet Care:** Usually bacteria have been found to be present in large numbers on the carpets and survive longer than on hard floors. Carpets should be first tested with the commonly used disinfectants to see their damaging capacity. Chlorine releasing agents could be used to clean blood spillage, but it damages most carpets. Therefore, peroxygen powder could be used as a substitute. In offices and administrative areas carpets could be maintained with a daily vacuuming and shampooing once a week.

3. **Walls and Ceilings**: It should be carried out sufficiently often to prevent the accumulation of visible dirt, but intervals between cleaning should not exceed 12-24 months in patient care areas or 6 months in operating theaters.

4. **Bathroom and Lavatory Cleaning**: Sufficient amount of disinfectant solution should be sprayed on to the bathroom fixtures and surfaces and be allowed to remain for a period of maximum disinfection. The cleaning and flushing of toilet is enough to keep the microbes level to the minimum. Brushes should be rinsed with water and shaken into the pan and stored dry. Baths could be a source of cross infection, therefore use of scouring powder or a liquid detergent (preferably anionic with hypochlorite solution) for thorough cleaning after use. Daily use of bowl cleaners is not needed as they are acid and need to be handled carefully by an expert. It was more cost effective and safer to use a disinfectant detergent to clean toilet on a daily basis, saving the bowel cleaners for use on mineral deposits only.

5. **Ancillary areas**: This includes offices, solaria and waiting room. In a general sense, the same rule of cleaning is applied here also but in a much rigorous way with a lesser frequency. The objective is to provide a clean and safe environment.

6. **Corridors and Stairwells** : Two important things to be obeyed while working on stairwells and corridors were- first to use wet floor signs if the floor is wet and second, to mop only one-half of a corridor or stairwell at a time to avoid accidents.

7. **Kitchen Work Surface**: All disinfectants get inactivated to some extent by food, particularly proteins. A two-step process of cleaning with a detergent and then with disinfectant obtains the best results.

GENERAL SURGICAL ASEPSIS PRACTICES

Cross Infection:

Cross infection is the infection transmitted between individuals infected with different pathogenic organisms. Cross infection occurs usually in the hospitals. It is the infection of a client with a disease other than that, for which he had been admitted. In other words, a client gets the infection from someone else during his stay in the hospital.

Method of Transmission of Infection:

The following are the methods of transmission of cross infection:

1. ***Direct contact***: The organisms can be transmitted directly from person to person through kissing, sexual contact, droplet infection and infected hands.
2. ***Indirect contact***: Contact with the secretions and excretions of the infected persons.
 - Through fomites, e.g. instruments, utensils, etc.
 - Through contaminated food and water
 - Through insects
 - Through dust
 - Through carriers

Medical Asepsis:

Medical asepsis refers to all practices used to protect the clients and his environment from the transmission of disease producing organisms (prevention of cross infection).

Surgical Asepsis:

Surgical asepsis refers to all the procedures used to keep objects or areas sterile or completely free from all microorganisms. In medical asepsis, all practices are directed to the prevention of pathogenic organisms entering into the body, but in surgical asepsis all practices are directed to the elimination of both pathogenic and non-pathogenic micro-organisms. In medical asepsis, a “clean technique” is used, but in surgical asepsis a “sterile technique” is used.

DISINFECTION OF OPERATION THEATRE

Surgical site infections (SSIs) are the second most common cause of hospital acquired infections. These complications of surgical procedures cause considerable morbidity and when these occur deep at the site of the procedure, it can lead to mortality as high as 77%. The source of SSIs may be endogenous (normal flora of the patient’s skin, mucous membranes, or viscera) or exogenous, which includes surgical personnel (especially members of the surgical team), the surgical room environment (including air, floor and wall), and tools, instrument and materials brought to the sterile field during surgery. By maintaining sterile environment in surgical theater, a major part of exogenous infections can be controlled. The following precautions help in reducing the rate of infection:

- Establish an infection control committee to monitor the events in the hospital on all matters related to the control of infections.
- The entry of unnecessary personnel should be restricted into operation theatre as everyone potentially contributes to infection.
- A thorough washing with warm water and good detergent can bring more of an overall improvement than sterilization with other chemical or fumigation.
- Frequent monitoring and training of medical and paramedical staff must carry a high priority than merely observing mechanical and chemical methods.
- Thorough washing and carbonization, if done every day after the surgeries, will greatly enhance the safety standards and reduce the repeated expenditure on fumigation. Operating Theatre Discipline
- Only people absolutely needed for an assigned task should be present in the operating theatres.
- People present in theatre should make minimal movements and curtail unnecessary movements in and out of theatres. This will greatly reduce bacterial count.
- Airborne contamination is usually affected by the type of surgery and the quality of air, which in fact depends on the rate of air exchange.
- All the persons are partners in infection control and should be careful to comply with infection control regulations.
- Prompt disposal of theatre waste is a top priority. Any spillage of body fluids, including blood on the floors, is highly hazardous and prompts the rapid multiplication of nosocomial pathogens. Surveillance of Operation Theatre
- The environment in the operating theatre is dynamic and subject to continuous change. Good infrastructure do not mean a safe environment, as people make a greater impact by making the environment safe.

- The role of microbiological surveillance is crucial, and health workers or GDAs should be aware of organisms, sites and populations.
- GDA should be familiar with the clinical techniques, as those normally used for culturing clinical specimens may not yield correct results when applied to environmental specimens. Bacterial counts in operation theatres are influenced by the number of individuals present, ventilation and air flow. The results should be interpreted taking this into consideration. Surveillance of Air Borne Pathogens
- In resource poor hospitals, settle plates with blood agar are used and can detect pathogens. Multiple plates are kept and results are based on overall assessment rather than on a single plate study in the room. Microbiologists will clarify the acceptable counts at the different physical locations in multispecialty hospitals.
- Slit sampler and air centrifuge equipment for bacterial counts are replacing settle plates. The safe level of colony counts can be calculated as per the standards created with peer reviewed studies by the manufacturers.
- Doing too frequent surveys is expensive and will not correlate the existing infection rate in the hospital, but can indicate the circumstance we operate.
- The age old tradition of detection of anaerobic spores of *Clostridium tetani*, and gas gangrene producing organisms are losing ground with the onset of more awareness on theatre sterilization. Routine testing for the anaerobes are not essential except when there are suspected cases of Tetanus or gas gangrene attributed to operating in a particular theatre.
- Ideally the operating theatre should be surveyed for anaerobes when newly constructed, or when any remodeling.

Cleaning the Operation Theatre

1. At the beginning of the day: Only remove the dust with a cloth wetted with clean water. Wipe theatre furniture lamps, sitting tables, trolley tops, operation tables, procedure tables, and Boyle's apparatus. Use chemicals/disinfectants unless contaminated with blood or body fluids.
2. Between the procedures: Clean operating tables or contaminated surfaces with disinfectant solutions. In case of spillage of blood/body fluids, decontaminate with bleaching solution/chlorine solution (10% available chlorine). Discard all waste in plastic bags. Do not discard soiled linen and gowns on the operating theatre floor.
3. At the end of the day: Clean all the table tops, sinks and door handles with detergent, followed by low level disinfectant. Clean the floors with detergents mixed with warm water. Finally, mop with disinfectant like phenol in the concentration of one in ten. Keep the operating theatre dry for the next day's work.

Training Paramedical Staff:

The short solution to controlling infection lies with trained staff. The principle and control of infection should be taught to all newcomers. Simple, repeated hand washing is the most cost effective method of reducing several infections in hospitals – in particular in operating theatres.

Fumigation Procedure:

Formaldehyde fumigation has long been an accepted method of sterilization for areas where microbiological cleanliness is required. Fumigation with formaldehyde vapour is the recognized and most commonly used method. Formaldehyde vapour is an extremely effective biocidal agent. It acts as an alkylating agent, inactivating microorganisms by reacting with carboxyl, amino, hydroxyl and sulphhydryl groups of proteins, as well as amino groups of nucleic acid bases. Fumigation is effective at above the temperature of 20°C and relative humidity of 65%. Formalin

is commercially available as 40% solution of formaldehyde in water. When formalin is heated formaldehyde vapour is generated. All workers using formaldehyde must be aware of safe handling procedures. Under certain conditions formaldehyde can react with hydrochloric acid and chlorine containing disinfectants such as hypochlorites to form chlormethyl ether, a potent lung carcinogen. So hydrochloric acid and chlorine-containing disinfectants must be removed from the room before fumigation.

Step 1: Preparation

1. Thoroughly clean windows, doors, floor, walls, surgery table and all washable equipment with detergent and water.
2. Close windows and ventilators tightly. If there are any openings, seal it with cellophane tape or other material to avoid the leak of fume.
3. Switch off all lights, A/C and other electrical and electronic items.

Step 2: Precaution

1. Adequate care must be taken by wearing cap, mask, foot cover, spectacle, etc.
2. Formaldehyde is irritant to eye and nose and it has also been recognized as a potential carcinogen.
3. So personal protective equipment (PPE) should be worn before fumigation.
4. Paste a warning notice on the front door indicating fumigation is in progress.

Step 3: Fumigation

1. Electric Boiler Fumigation Method (Recommended): For Each 1000 cubic feet, 500 ml of formaldehyde (40% solution) added in 1000 ml of distilled water (if not available uses tap water) in an electric boiler. Switch on the boiler, leave the room and seal the door. After 45 minutes (variable depending to volume present in the boiler apparatus/its heating proficiency) switch off the boiler without entering into the room.
2. Potassium Permanganate Method: Take 500 ml of formaldehyde (40% solution) in 1000 ml of distilled water (if not available use tap water) in a heat resistant bowl, preferably in a steel bucket and then add 450gm of KMnO_4 for 1000 cubic feet of theater volume. Repeat the same in separate bucket for every another 1000 cubic feet until it reaches the complete theater volume. It is important to add KMnO_4 to all buckets simultaneously to reduce the exposure to fume (i.e., need 3 or 4 persons at different location).
3. After the initiation of formaldehyde vapour, immediately leave the room and seal it for at least 12 to 24 hours.

Step 4: Neutralization

1. Before neutralization, formaldehyde fumigation system should be taken out from the surgical theater. Then the toxicity of formaldehyde vapour should be neutralized with ammonia solution.
2. Switch on the A/C, at least 2 hours before (09 a.m.) the "Sterility Test".
3. Place a cotton ball and pour 300 ml of 10% ammonia (for each 500 ml of formaldehyde used) on the floor of surgical theater, at least 4 hours before (07 a.m.) the "Sterility Test".
4. Formaldehyde gas reacts with ammonia gas and produce hexamine (synonym hexamethylenetetramine) which is considered a harmless substance.

Example: Surgical Theater Volume = $L \times B \times H = 20 \times 15 \times 10 = 3000$ cubic feet

Note: Make it into nearest 1000, if the volume is in fractions Formaldehyde required for fumigation = 500 ml for 1000 cubic feet = So, 1500 ml of formaldehyde is required (to be diluted in 3000 ml of distilled water ml of formaldehyde Ammonia required for neutralization = 300 ml of 10% ammonia for 500 So 900 ml of 10% ammonia is required.

Duties of GDA in Operation Theatre

1. The GDA is responsible for all the instruments and equipment required for the surgery.
2. He/she is responsible for sterilization of all the instruments and equipment required for the surgery.
3. He/she should scrub well from elbows to finger tips, taking care to clean under the nails and between fingers.
4. He/she should wear a mask and cover his/her head with a cap such that all his/her hair is properly covered.
5. He/she should wear a sterile gown as described under gown technique.
6. He/she should wear gloves as described under “glove technique”
7. He/she should handle only the sterile instruments and equipment required for the operation.
8. If he/she accidentally touch unsterile instruments or equipment, she should change her gown and gloves.
9. He / She should arrange the trolley by placing the following on the carbolized trolley.(a). Sterile plastic sheet(b). Sterile drapes: two one on top of the other(c). Instruments in proper order.
10. He / She should count the number of instruments, swabs and mops to be taken at the time of surgery, so that she can count them again at the end of the surgery.
11. Drums of instruments and equipment not required should not be kept open unnecessarily.
12. He / She should not handle used mops and swabs.

SURGICAL DRESSING

Dressing:

A dressing is a protective covering applied to a wound to prevent infection, absorb discharge, control bleeding, and avoid further injury.

Objectives

1. To clean the wound.
2. To prevent entries of microorganisms into the wound.
3. To give rest to the part so that the wound heals early and well.
4. To use local medications so that the wound heals early and well.
5. To remove slough from the wound.
6. To bring the edges of the wound together by pressure.

Characteristics of Efficient Dressing:

1. It should be sterile.
2. It should be soft with proper pore to allow the oozing of discharge and sweating.
3. It should be large enough to cover the area of the wound and extend about 2-5 cm beyond it.

Types of Dressing:

1. *Adhesive Dressing*

1. It is sterile.
2. Consist of pad of absorbent gauge of cellulose held in place by a layer of adhesive material.
3. It is available in different sizes and supplied in papers.

Method of application

1. Remove the outer wrapping and hold the dressing gauge side down.
2. Peel back and expose the gauge and place the pad onto the wound.
3. Press the ends and edges down.

2. *Non Adhesive Dressing*

1. Sterile ready made dressing.
2. It consists of layer of gauge covered by a pad of cotton wool with attached roller bandage to keep it in position.
3. The dressing is sealed in protective cover.
4. Available in different sizes.

Method of application

1. Remove outer and inner wrapping.
2. Unwind the bandage and open the dressing.
3. Place the dressing on the wound with gauge side down.
4. Bandage firmly until the pad is covered.
5. Secure the bandage by tying the ends over the pad or with the plaster.

3. *Gauge Dressing*

1. Gauge is commonly used in layers
2. It for large wound.
3. It helps in clothing
4. It is good absorbent, soft and pliable.

Method of application :

same as non-adhesive dressing.

4. *Improvised Dressing*

1. It is used in first aid emergency when prepared dressing is not available.
2. Any clean, dry, absorbent material can be used, such as inside of clean hand kerchief, towel, linen, clean paper pads, or cellulose tissue.
3. Such improvised dressing is placed in position by any suitable material available.
4. Do not place cotton wool, lint or fibrous material directly over the wound, otherwise the fibers can become embedded into.
5. Antiseptic Medicated Dressing.

General Rules for Application of Dressing

1. Wash hands before dressing.
2. Clean the wound and its surrounding skin if wound is not large and bleeding is under control.
3. Avoid touching the contaminated wound and dressing.
4. Never cough or sneeze over the wound.
5. If necessary cover with non-adhesive dressing, with pads of cotton wool to help control bleeding and absorb discharge.

6. Always place the dressing directly onto a wound; never slide it on from the side.
7. Do not remove dressing. Add new dressing over the top of blood soaked dressing.

Things to Remember

1. Hands should be washed well before dressing a wound.
2. If more than one dressing is to be done, hands should be washed well before and after each dressing.
3. Dressing should be started after the ward has been cleaned well.
4. Clean wounds should be dressed first and dirty wounds should be dressed afterwards.
5. Dirty wounds require frequent dressings as per the doctor's instructions.
6. Time, energy, and things should be used without wastage.
7. Dressing material should not be used wastefully.
8. Stains of sticking plaster and lotions should be removed from the patient's skin with spirit.
9. If the old dressing is adherent to the skin, it should not be pulled off with force because that is painful. It should be removed by application of ether to under surface in contact with the skin, or by moistening with saline.
10. Lotions should not be poured from a big bottle directly on the wound because it is possible that it may spill much in excess of the need.
11. Lotions like eusaoil should not be used if they are old, because the chlorine in it has gone by that time and it is no more effective.
12. Bottles containing ether and spirit should have screw caps.
13. All bottles should have labels written in a legible hand. The following information should be mentioned on the label:
 - The name of the lotion
 - The strength of the lotion.
 - The contents are for external use only. • Name of the ward.
 - The word poison, if the lotion is poisonous when taken orally.

Steps for Dressing:

1. Preparation of dressing trolley
2. Isolation of the patient with a screen around his bed.
3. Positioning the patient and placing a mackintosh under him.
4. Removal of old dressing.
5. Hand wash and wearing sterile gloves.
6. Cleaning the surrounding area of the wound.
7. Cleaning the wound.
8. Dry or wet dressing.
9. Application of bandage or adhesive plaster.

Method

1. The dressing trolley is taken to the patient when it is properly arranged.
2. The method of dressing is explained properly to the patient and his relatives.
3. A screen is placed around the patient.
4. Appropriate position is given to the patient.
5. Mackintosh is placed under the patient.
6. Only the part required is exposed.

7. The old dressing is removed and put in the bucket for waste.
8. Hands are washed.
9. Gloves are washed.
10. Sterile towel is placed around the part to be dressed so as to prevent soiling of the patient's clothes and bedclothes.
11. The skin around the wound is first cleaned with detergent solution; holding the swabs with sponge – holding forceps.
12. The swabs are moved from the centre to the periphery. Each swab is used only once.
13. Any adhesive transferred to the skin from the sticking plaster is removed with swabs soaked.
14. The wound is cleaned.
15. Dry or wet dressing is applied to the wound as per the doctor's instructions. It is covered with gauze and bandage or adhesive dressing is applied to it.
16. The used instruments are placed in a kidney tray.

DISEASES CAUSED BY MICROORGANISMS

A microorganism (from the Greek: mikrós, “small” and organismós, “organism”) or a microbe is an organism that is microscopic (too small to be seen by the naked human eye). The study of microorganisms is called microbiology, a subject that began with Anton van Leeuwenhoek's discovery of microorganisms in 1675, using a microscope. A microbe, which is another word for microorganism is a tiny individual living thing that is way too small to be seen by the human eye alone. The only way this tiny organism can be seen is by using a microscope. This is why microbes are often called “microscopic organisms.” These organisms are found almost everywhere you can think of here on Earth i.e. in air, water, soil, rock, plants, animals and the human body. Microorganisms are very diverse. They include bacteria, fungi, etc. Most micro-organisms are unicellular (single-celled), but this is not universal, since some multicellular organisms are microscopic. Some microbes are harmful, since they invade and grow within other organisms, causing diseases. Some microbes can live in very hot temperatures, and others can live in the freezing cold. Some need oxygen to grow and stay alive, while others survive without it. Some organisms found inside our body are not pathogenic in fact they maintain the gut flora. The number of microorganisms living on and in us is about ten times higher than the number of cells that make up our entire body.

What are disease causing micro-organisms?

How many times we have been told to wash our hands before sitting down at the dining table or before taking food? By washing our hands with soap and water we clean our hands and decrease number of micro organism. We take baths, cook our food and even cover our mouths when we cough and sneeze to prevent the spread of those tiny dirty particles (the disease causing microbes) that could make us sick. While some microbes play an important part in our daily lives by keeping us healthy, others are nothing but bad ones. These “bad-ones” are called disease-causing microbes and can make humans, animals and plants sick by causing infection and disease. Most microbes belong to four major groups: bacteria, viruses, protozoa or fungi. Disease-causing microbes can also be called microscopic pathogens. Bacteria (singular: bacterium) Bacteria are unicellular microorganisms. They have many shapes including curved rods, spheres, rods, and spirals. Bacteria are prokaryotic and unicellular. Bacteria have simple organization. They have an external cell wall, plasma membrane, Circular Deoxyribonucleic Acid (DNA) within the cytoplasm and ribosomes for protein synthesis. According to their necessity of oxygen, bacteria are classified into anaerobic (those that survive without oxygen) and aerobic (those that do not survive without oxygen). Obligate anaerobes are those living beings that do not survive in the presence of oxygen. For example, the bacteria *Clostridium tetani*, agent of tetanus, is an obligate anaerobe. Some human diseases caused by bacteria are tuberculosis,

pertussis, diphtheria, bacterial meningitis, gonorrhoea, syphilis, bubonic plague, leptospirosis, cholera, typhoid fever, trachoma, tetanus, anthrax. Fungi Fungi are like plants made up of many cells. They are not called plants because they cannot produce their own food from soil and water. Fungi are eukaryotic, so they possess a true nucleus. Bacteria are prokaryotic, meaning they do not possess a true nucleus. Viruses can not reproduce on their own, so they are sometimes just classified as infectious biological agents. Virus A virus (from the Latin noun virus, meaning toxin or poison) is a sub-microscopic particle (ranging in size from 20–300 nm) that can infect the cells of a biological organism. A virus may have a spiny outside layer, called the envelope. Viruses have a core of genetic material, but no way to reproduce it on their own. Viruses infect cells and take over their reproductive machinery to reproduce. The main viral diseases transmitted by respiratory secretions (sneezes, cough) and by saliva drops are flu, mumps, smallpox (variola, already considered eradicated), rubella, measles, Severe acute respiratory syndrome (SARS) COVID-19, (SARS - COVID-2) causative organism. Main viral diseases transmitted through blood or sexual contact are Acquired Immuno Deficiency Syndrome (AIDS), hepatitis B, hepatitis C, Human Papillomavirus (HPV), ebola hemorrhagic fever. Main viral diseases transmitted by animal vectors are rabies, dengue fever, yellow fever. Some viral diseases transmitted by fecal-oral route, including contaminated food, is Hepatitis A. Flu is a disease caused by the influenza virus, a highly mutant DNA virus. Due to the high mutation rate of the virus, that forms many different strains, flu always presents epidemic features in affected populations and people may have several flu episodes during life. Rabies, also known as hydrophobia, is a viral disease. It is found in dogs, cats, bats and other wild mammals. The transmission to humans occurs through the saliva of contaminated animals, mainly through bites. Bacteria, fungi and viruses are all very different from one another. A big difference is what cell coating they have surrounding their cells. Bacterial cell walls are made of peptidoglycan, fungal cell walls are made of Chitin and Viruses have a protein coat around their genetic material. Parasite A parasite is any organism which lives inside a different organism and depends on the organism for its survival. This means that a parasite basically feeds off a host and the host suffers as a result of this. Parasites can be as small as viruses, or as big as metre-long tapeworms. It is Important to Remember that:

- A pathogen is a micro-organism that has the potential to cause disease.
- An infection is the invasion and multiplication of pathogenic microbes in an individual or population.
- Disease is when the infection causes damage to the individual's vital functions or systems.
- An infection does not always result in disease.

Infectious diseases caused by disease-causing microbes are responsible for more deaths worldwide than any other single cause! Microbes can quickly develop new features that make them resistant to the drugs that were once able to kill them. The effects of infection by pathogenic bacteria are also variable and can include the following:

- Fever
- Inflammation
- Antibody response
- Shock (only in extreme cases)
- Impaired blood clotting (only in extreme cases) Some of the diseases caused by bacteria include tetanus, whooping cough, pneumonia, gonorrhoea, meningitis and some forms of tonsillitis.

The Epidemiological Triangle (Triad)

The word epidemiology comes from three Greek root words: Epi-means “on, upon, befall”, Demo- means “people”, -ology-means “the study of”. So Epidemiology is literally defined as “the study of that which befalls people.” The Epidemiologic Triangle is a model that scientists have developed for understanding infectious diseases and how they spread. There are other factors relating to the host and environment which are equally important to determine whether or not disease will occur in the exposed host. The Triangle has three corners called vertices, with agent, host and environment.

1. The Agent: The agent or microbe that causes the disease (the “what” of the Triangle) is the cause of the disease. When studying the epidemiology of most infectious diseases, the agent is a microbe.

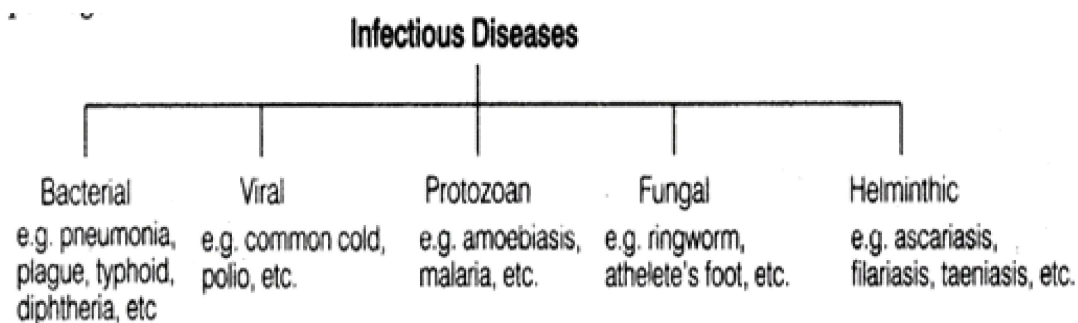
2. The Host: Hosts or organism harbouring the disease (the “who” of the Triangle) are organisms, usually humans or animals, which are exposed to and harbour a disease. The host can be the organism that gets sick, as well as any animal carrier (including insects and worms) that may or may not get sick. Although the host may or may not know that it has acquired the disease or have any outward signs of illness, the disease does take lodging from the host. The “host” heading also includes symptoms of the disease. Different people may have different reactions to the same microbe.

3. The Environment: The environment or those external factors that cause or allow disease transmission (the “where” of the Triangle) is the favourable surroundings and conditions external to the host that cause or allow the disease to be transmitted.

COMMON HUMAN DISEASES AND THEIR CAUSAL AGENTS

Disease is a state when functioning of one or more organs or systems of the body is adversely affected, characterised by various signs and symptoms. Diseases can be divided broadly into the following two categories depending on the modes of transmission

- I. **Infectious diseases** which easily transmit from one person to another, e.g. AIDS, common cold, etc.
- II. **Non-infectious diseases** which does not transmit from one person to another, e.g. cancer, diabetes, etc.
 - (i) Disease causing organisms are called pathogens, e.g. bacteria, viruses, fungi, protozoans, helminthes, etc.
 - (ii) The above described pathogens enter the body by direct contact, contaminated food and water, droplet infection, etc
 - (iii) The pathogens multiply in body cells, interfere with normal vital activities, cause morphological and functional damage.
 - (iv) Infectious diseases can be divided into certain categories, based on the type of pathogen



Some diseases are transmitted by vector, i.e. mosquitoes like dengue (*Aedes aegypti*); chikungunya (*Aedes aegypti*, *Aedes albopictus*) and malaria (*Anopheles*).

Fig 1: Types of Infectious Disease

Some of the common infectious diseases are:

I. Bacterial Diseases

Typhoid is caused by bacterium (*Salmonella typhi*).

Typhi enters the small intestine through food and water contaminated with them and migrate to other organs through blood.

Intestinal perforation and death may occur in severe cases.

Widal test is a confirmation test for typhoid.

Symptoms are high fever (39-40°C), weakness, stomach pain, constipation, headache and loss of appetite.

(ii) Pneumonia is caused by *Streptococcus pneumoniae* and *Haemophilus influenzae*. These bacteria infect alveoli of the lungs. The alveoli get filled with fluid causing decrease in respiratory efficiency of the lungs. Pneumonia spreads by inhaling droplets/aerosol from infected individuals or even by sharing glasses and utensils with patients. Symptoms of pneumonia are fever, chills, cough, headache, etc.

(iii) Dysentery, plague, diphtheria, etc., are some other examples of bacterial diseases.

II. Viral Disease

Common cold occurs due to a group of viruses called rhino viruses.

These viruses infect the nose and respiratory passage but not the lungs.

Common cold is characterised by nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness, etc., which generally last for 3-7 days.

The infection occurs due to cough or sneezes of an infected person, either inhaled directly or transmitted through contaminated objects such as pens, books, cups, computer's keyboard or mouse, etc.

III. Protozoan Diseases

(i) Malaria is caused by a protozoan, *Plasmodium* (*P. vivax*, *P. malariae* and *P. falciparum*).

Falciparum causes most serious kind of malaria, i.e. malignant malaria which can be fatal.

Female *Anopheles* mosquito is the vector of *Plasmodium*, which transfer the sporozoites (infectious form) in human body.

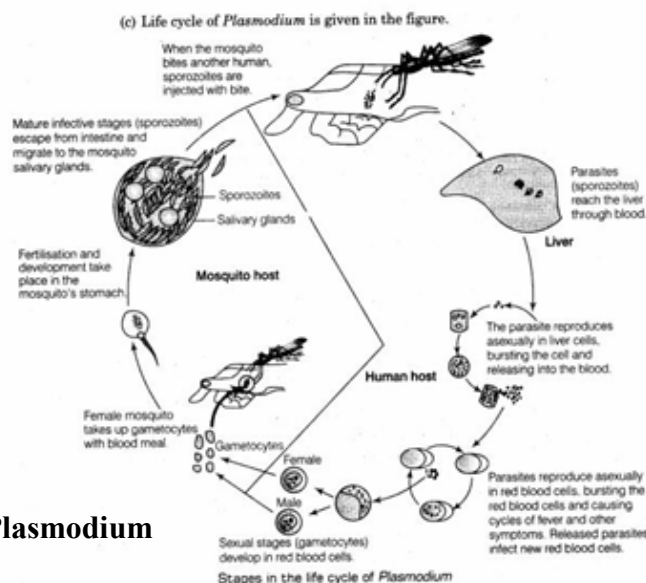


Fig2: Life cycle of *Plasmodium*

The malarial parasite requires two hosts to complete its life cycle, i.e. human and mosquito.

Plasmodium enters the human body as sporozoite, through the bite of infected female Anopheles

Parasites initially multiply within the liver cells and then attack the Red Blood Cells (RBCs) causing their rupture.

Rupture of RBCs release a toxic substance called haemozoin. Haemozoin causes chill and high fever recurring every 3-4 days.

When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and undergo further development.

The parasites multiply within them to form sporozoites that are stored in their salivary glands.

When these mosquitoes bite a human the sporozoites are introduced into his/her body, initiating the events mentioned above.

(d) Antimalarial drugs used for the treatment are quinine and chloroquin.

(e) Malaria can be prevented by killing mosquitoes by spraying DDT, BHC, etc., and using insect repellents, mosquito nets, etc.

(iii) Amoebiasis (amoebic dysentery) is caused by an intestinal endoparasite, Entamoebahistolytica, which is found in large intestine of humans.

Carrier of pathogen is housefly. It transmits the parasite from faeces of infected person to the food, thereby contaminating them.

Infection takes place mainly through the contaminated food and water.

Symptoms are abdominal pain, constipation, cramps, faeces with excess mucous and blood clots.

IV. Fungal Disease

Ringworm is caused by many fungi of genera Microsporum, Trichophyton and Epidermophyton.

(i) Infection occurs through contact with an infected person or from soil and through the use of towels, clothes, combs, etc., of an infected person.

(ii) Heat and moisture help these fungi to grow in regions like skin folds as in groin or between the toes.

(iii) Symptoms of ringworm are appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp accompanied by intense itching.

V. Helminthic Diseases

(i) Ascariasis is caused by an intestinal endoparasite of human, Ascaris lumbricoides commonly called as roundworm. Infection occurs as the eggs of parasite are excreted along with the faeces of infected person, which contaminate water, soil, plants, etc.

Infection reaches to human beings through contaminated vegetables, fruits and water, etc.

Symptoms of disease are abdominal pain, indigestion, muscular pain, fever, anaemia, nausea, headache and blockage of intestinal passage.

(ii) Filariasis/Elephantiasis is caused by filarial worms, Wuchereria bancrofti and Wuchereria malayi.

Culex mosquito (female) is the vector.

Genital organs also get affected leading to their deformation.

Symptoms are inflammation of organs in which they live for many years, normally affect lymph vessels of lower limbs resulting in swelling hence, called elephantiasis.

HOSPITAL ACQUIRED INFECTIONS

A nosocomial infection is any infection acquired while in hospital. The terms hospital infection, hospital-acquired infection or nosocomial infection (from nosocomeion, meaning hospital) are applied to infections developing in hospitalized patients, not present or in incubation at the time of their admission. Such infections may become evident during their stay in hospital or, sometimes, only after their discharge. An infection that is incubating in a patient when he or she is admitted into hospital is not a hospital infection. However, community acquired infections brought into hospital by the patient may subsequently become hospital infections for other patients and hospital staff. Incidence of Hospital Infection The incidence of hospital infection has been reported to be 21.2 percent in the advanced countries. It is much higher in the crowded hospitals in the developing countries. On average, around 10 percent of all hospital patients will develop an infection as a result of their stay in hospital. Urinary, respiratory and wound infections are the most common.

SOURCES OF INFECTIONS

Hospital infection may be exogenous or endogenous in origin.

1. **Exogenous:** Exogenous source may be another person in the hospital (crossinfection) or a contaminated item of equipment or building service (environmental infection).
 - i. Contact with other patients and staff: Patients and hospital personnel suffering from infection, or asymptomatic carriers are the most important sources.
 - ii. Environmental sources: These include inanimate objects, air, water and food in the hospital. A. Inanimate objects: Equipments, materials, such as sanitary installation (bed pans, urinals), lights, table, blankets, medical equipment (endoscopes, catheters, needles, spatula and other instruments), floors, food. And water (contaminated by kitchen or other hospital staff or visitor).
2. **Endogenous:** A high proportion of clinically apparent hospital infections are endogenous (self-infection), the infecting organism being derived from the patient's own skin, gastrointestinal or upper respiratory flora.

FACTORS INFLUENCING HOSPITAL-ASSOCIATED INFECTIONS

A large number of factors contribute towards the development of hospital associated infection. These include the following:

1. **Age:** Natural resistance to infection is lower in infants and the elderly, who often constitute the majority of hospital patients.
2. **Susceptibility to infection:** Preexisting disease, such as diabetes, or other conditions for which the patient was admitted to hospital, and the medical or surgical treatment, including immunosuppressive drugs, radiotherapy or splenectomy, may also reduce the patient's natural resistance to disease. Moreover, the natural defence mechanisms of the body surfaces may be bypassed either by injury or by procedures such as surgery, insertion of an indwelling catheter, tracheostomy or ventilatory support.
3. **Hospital environment:** The hospital environment is heavily laden with a wide variety of pathogens.

Role of Nurses and General Duty Assistants

Implementation of patient care practices for infection control is the role of the nursing staff. Nurses should be familiar with practices to prevent the occurrence and spread of infection, and maintain appropriate practices for all patients throughout the duration of their hospital stay. The Senior Nursing Administrator is responsible for the following:

1. Promoting the development and improvement of nursing techniques, and ongoing review of aseptic nursing policies, with approval by the Infection Control Committee.
2. Developing training programmes for members of the nursing staff.
3. Supervising the implementation of techniques for the prevention of infections in specialized areas, such as the operating suite, the intensive care unit, the maternity unit and newborns units. The Nurse and the GDA is responsible for the following:
 1. Strictly following universal precautions.
 2. Maintaining hygiene, consistent with hospital policies and good nursing practices in the ward.
 3. Monitoring aseptic techniques, including hand washing and use of isolation.
 4. Reporting promptly to the attending physician any evidence of infection in patients under the care.
 5. Initiating patient isolation and ordering culture specimens from any patient showing signs of a communicable disease, when the physician is not immediately available.
 6. Limiting patient exposure to infections from visitors, hospital staff, other patients, or equipment used for diagnosis or treatment.
 7. Maintaining a safe and adequate supply of ward equipment, drugs and patient care supplies.

The Nurse and GDA is a member of the infection control team and are responsible for the following:

1. Identifying nosocomial infections.
2. Participating in training of personnel.
3. Surveillance of hospital infections.
4. Educating people on proper disposal of wastes.
5. Initiating patient isolation and ordering culture specimens from any patient showing signs of a communicable disease, when the physician is not immediately available.
6. Limiting patient exposure to infections from visitors, hospital staff, other patients, or equipment used for diagnosis or treatment.
7. Maintaining a safe and adequate supply of ward equipment, drugs and patient care supplies. The Nurse and GDA is a member of the infection control team and are responsible for the following:
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DISINFECTION OF WARDS AND EQUIPMENTS

Definition

Sterilization is defined as the process where all the living microorganisms, including bacterial spores are killed. Sterilization can be achieved by physical, chemical and physiochemical means. Chemicals used as sterilizing agents are called chemosterilants.

Disinfection is the process of elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects. Disinfection can be achieved by physical or chemical methods. Chemicals used in disinfection are called disinfectants. Different disinfectants have different target ranges, not all disinfectants can kill all microorganisms. Some methods of disinfection such as filtration do not kill bacteria, they separate them out. Sterilization is an absolute condition while disinfection is not. The two are not synonymous.

PHYSICAL METHODS OF STERILIZATION:

Sunlight: The microbicidal activity of sunlight is mainly due to the presence of ultra violet rays in it. It is responsible for spontaneous sterilization in natural conditions. In tropical countries, the sunlight is more effective in killing germs due to combination of ultraviolet rays and heat. By killing bacteria suspended in water, sunlight provides natural method of disinfection of water bodies such as tanks and lakes. Sunlight is not sporicidal, hence it does not sterilize.

Heat: Heat is considered to be most reliable method of sterilization of articles that can withstand heat. Heat acts by oxidative effects as well as denaturation and coagulation of proteins. Those articles that cannot withstand high temperatures can still be sterilized at lower temperature by prolonging the duration of exposure.

Factors affecting sterilization by heat are:

- Nature of heat: Moist heat is more effective than dry heat.
- Temperature and time: temperature and time are inversely proportional. As temperature increases the time taken decreases.
- Number of microorganisms: More the number of microorganisms, higher the temperature or longer the duration required.
- Nature of microorganism: Depends on species and strain of microorganism, sensitivity to heat may vary. Spores are highly resistant to heat.
- Type of material: Articles that are heavily contaminated require higher temperature or prolonged exposure. Certain heat sensitive articles must be sterilized at lower temperature.
- Presence of organic material: Organic materials such as protein, sugars, oils and fats increase the time required.

Action of heat: Dry heat acts by protein denaturation, oxidative damage and toxic effects of elevated levels of electrolytes. The moist heat acts by coagulation and denaturation of proteins. Moist heat is superior to dry heat in action. Temperature required to kill microbe by dry heat is more than the moist heat. Thermal death time is the minimum time required to kill a suspension of organisms at a predetermined temperature in a specified environment.

Dry heat:

Red heat: Articles such as bacteriological loops, straight wires, tips of forceps and searing spatulas are sterilized by holding them in Bunsen flame till they become red hot. This is a simple method for effective sterilization of such articles, but is limited to those articles that can be heated to redness in flame.

Flaming: This is a method of passing the article over a Bunsen flame, but not heating it to redness. Articles such as scalpels, mouth of test tubes, flasks, glass slides and cover slips are passed through the flame a few times. Even though most vegetative cells are killed, there is no guarantee that spores too would die on such short exposure. This method too is limited to those articles that can be exposed to flame. Cracking of the glassware may occur.

Incineration: This is a method of destroying contaminated material by burning them in incinerator. Articles such as soiled dressings; animal carcasses, pathological material and bedding etc should be subjected to incineration. This technique results in the loss of the article, hence is suitable only for those articles that have to be disposed. Burning of polystyrene materials emits dense smoke, and hence they should not be incinerated. Hot air oven: This method was introduced by Louis Pasteur. Articles to be sterilized are exposed to high temperature (160°C) for duration of one hour in an electrically heated oven. Since air is poor conductor of heat, even distribution of heat throughout the chamber is achieved by a fan. The heat is transferred to the article by radiation, conduction and convection. The oven should be fitted with a thermostat control, temperature indicator, meshed shelves and must have adequate insulation.

Articles sterilized : Metallic instruments (like forceps, scalpels, scissors), glasswares (such as petri-dishes, pipettes, flasks, all-glass syringes), swabs, oils, grease, petroleum jelly and some pharmaceutical products.

Sterilization process :

Articles to be sterilized must be perfectly dry before placing them inside to avoid breakage. Articles must be placed at sufficient distance so as to allow free circulation of air in between. Mouths of flasks, test tubes and both ends of pipettes must be plugged with cotton wool. Articles such as petri dishes and pipettes may be arranged inside metal canisters and then placed. Individual glass articles must be wrapped in kraft paper or aluminum foils. Sterilization cycle : This takes into consideration the time taken for the articles to reach the sterilizing temperature, maintenance of the sterilizing temperature for a defined period (holding time) and the time taken for the articles to cool down. Different temperature-time relations for holding time are 60 minutes at 160°C, 40 minutes at 170°C and 20 minutes at 180°C. Increasing temperature by 10 degrees shortens the sterilizing time by 50 percent. The hot air oven must not be opened until the temperature inside has fallen below 60°C to prevent breakage of glasswares.

Sterilization control: Three methods exist to check the efficacy of sterilization process, namely physical, chemical and biological.

Physical: Temperature chart recorder and thermocouple.

Chemical: Browne's tube No.3 (green spot, color changes from red to green).

Biological: 10⁶ spores of *Bacillus subtilis* varniger or *Clostridium tetani* on paper strips are placed inside envelopes and then placed inside the hot air oven. Upon completion of sterilization cycle, the strips are removed and inoculated into thioglycollate broth or cooked meat medium and incubated at 37°C for 3-5 days. Proper sterilization should kill the spores and there should not be any growth.

Advantages :

It is an effective method of sterilization of heat stable articles.
The articles remain dry after sterilization.
This is the only method of sterilizing oils and powders.

Disadvantages:

Since air is poor conductor of heat, hot air has poor penetration.
Cotton wool and paper may get slightly charred.
Glasses may become smoky.
Takes longer time compared to autoclave.

Infra red rays: Infrared rays bring about sterilization by generation of heat. Articles to be sterilized are placed in a moving conveyer belt and passed through a tunnel that is heated by infrared radiators to a temperature of 180°C. The articles are exposed to that temperature for a period of 7.5 minutes. Articles sterilized included metallic instruments and glassware. It is mainly used in central sterile supply department. It requires special equipments, hence is not applicable in diagnostic laboratory. Efficiency can be checked using Browne's tube No.4 (blue spot).

Moist heat:

Moist heat acts by coagulation and denaturation of proteins.
At temperature below 100°C:

- **Pasteurization :** This process was originally employed by Louis Pasteur. Currently this procedure is employed in food and dairy industry. There are two methods of pasteurization, the holder method (heated at 63°C for 30 minutes) and flash method (heated at 72°C for 15 seconds) followed by quickly cooling to 13°C. Other pasteurization methods include Ultra-High Temperature (UHT), 140°C for 15 sec and 149°C for 0.5 sec. This methods suitable to destroy most milk borne pathogens like Salmonella, Mycobacteria, Streptococci, Staphylococci and Brucella, however Coxiella may survive pasteurization. Efficacy is tested by phosphatase test and methylene blue test.
- **Vaccine bath :** The contaminating bacteria in a vaccine preparation can be inactivated by heating in a water bath at 60°C for one hour. Only vegetative bacteria are killed and spores survive. Serum bath: The contaminating bacteria in a serum preparation can be inactivated by heating in a water bath at 56°C for one hour on several successive days. Proteins in the serum will coagulate at higher temperature. Only vegetative bacteria are killed and spores survive.
- **Inspissation :** This is a technique to solidify as well as disinfect egg and serum containing media. The medium containing serum or egg are placed in the slopes of an inspissator and heated at 80-85°C for 30 minutes on three successive days. On the first day, the vegetative bacteria would die and those spores that germinate by next day are then killed the following day. The process depends on germination of spores in between inspissation. If the spores fail to germinate then this technique cannot be considered sterilization.

At temperature 100°C:

- **Boiling :** Boiling water (100°C) kills most vegetative bacteria and viruses immediately. Certain bacterial toxins such as Staphylococcal enterotoxin are also heat resistant. Some bacterial spores are resistant to boiling and survive; hence this is not a substitute for sterilization. The killing activity can be enhanced

by addition of 2% sodium bicarbonate. When absolute sterility is not required, certain metal articles and glasswares can be disinfected by placing them in boiling water for 10-20 minutes. The lid of the boiler must not be opened during the period.

- Steam at 100!: Instead of keeping the articles in boiling water, they are subjected to free steam at 100°C. Traditionally Arnold's and Koch's steamers were used. An autoclave (with discharge tap open) can also serve the same purpose. A steamer is a metal cabinet with perforated trays to hold the articles and a conical lid. The bottom of steamer is filled with water and heated. The steam that is generated sterilizes the articles when exposed for a period of 90 minutes. Media such as TCBS, DCA and selenite broth are sterilized by steaming. Sugar and gelatin in medium may get decomposed on autoclaving, hence they are exposed to free steaming for 20 minutes for three successive days. This process is known as tyndallisation (after John Tyndall) or fractional sterilization or intermittent sterilization. The vegetative bacteria are killed in the first exposure and the spores that germinate by next day are killed in subsequent days. The success of process depends on the germination of spores.

At temperature above 100°C:

- Autoclave : Sterilization can be effectively achieved at a temperature above 100°C using an autoclave. Water boils at 100°C at atmospheric pressure, but if pressure is raised, the temperature at which the water boils also increases. In an autoclave the water is boiled in a closed chamber. As the pressure rises, the boiling point of water also raises. At a pressure of 15 lbs inside the autoclave, the temperature is said to be 121°C. Exposure of articles to this temperature for 15 minutes sterilizes them. To destroy the infective agents associated with spongiform encephalopathies (prions), higher temperatures or longer times are used; 135°C or 121°C for at least one hour are recommended.

RADIATION:

Two types of radiation are used, ionizing and non-ionizing.

Non-ionizing rays are low energy rays with poor penetrative power while ionizing rays are high-energy rays with good penetrative power. Since radiation does not generate heat, it is termed "cold sterilization". In some parts of Europe, fruits and vegetables are irradiated to increase their shelf life up to 500 percent. Non-ionizing rays : Rays of wavelength longer than the visible light are non-ionizing. Microbicidal wavelength of UV rays lie in the range of 200-280 nm, with 260 nm being most effective. UV rays are generated using a high-pressure mercury vapor lamp. It is at this wavelength that the absorption by the microorganisms is at its maximum, which results in the germicidal effect. UV rays induce formation of thymine-thymine dimers, which ultimately inhibits DNA replication. UV readily induces mutations in cells irradiated with a non-lethal dose. Microorganisms such as bacteria, viruses, yeast, etc. that are exposed to the effective UV radiation are inactivated within seconds. Since UV rays don't kill spores, they are considered to be of use in surface disinfection. UV rays are employed to disinfect hospital wards, operation theatres, virus laboratories, corridors, etc. Disadvantages of using uv rays include low penetrative power, limited life of the uv bulb, some bacteria have DNA repair enzymes that can overcome damage caused by uv rays, organic matter and dust prevents its reach, rays are harmful to skin and eyes. It doesn't penetrate glass, paper or plastic.

Ionizing rays : Ionizing rays are of two types, particulate and electromagnetic rays.

- Electron beams are particulate in nature while gamma rays are electromagnetic in nature. Highspeed electrons are produced by a linear accelerator from a heated cathode. Electron beams are employed to sterilize articles like syringes, gloves, dressing packs, foods and pharmaceuticals. Sterilization is accomplished in few seconds. Unlike electromagnetic rays, the instruments can be switched off. Disadvantage includes poor penetrative power and requirement of sophisticated equipment.

- Electromagnetic rays such as gamma rays emanate from nuclear disintegration of certain radioactive isotopes (Co60, Cs137). They have more penetrative power than electron beam but require longer time of exposure. These high-energy radiations damage the nucleic acid of the microorganism. A dosage of 2.5 megarads kills all bacteria, fungi, viruses and spores. It is used commercially to sterilize disposable petri dishes, plastic syringes, antibiotics, vitamins, hormones, glasswares and fabrics. Disadvantages include; unlike electron beams, they can't be switched off, glasswares tend to become brownish, loss of tensile strength in fabric. Gamma irradiation impairs the flavour of certain foods. *Bacillus pumilus* E601 is used to evaluate sterilization process.

FILTRATION:

Filtration does not kill microbes, it separates them out. Membrane filters with pore sizes between 0.2-0.45 μm are commonly used to remove particles from solutions that can't be autoclaved. It is used to remove microbes from heat labile liquids such as serum, antibiotic solutions, sugar solutions, urea solution. Various applications of filtration include removing bacteria from ingredients of culture media, preparing suspensions of viruses and phages free of bacteria, measuring sizes of viruses, separating toxins from culture filtrates, counting bacteria, clarifying fluids and purifying hydatid fluid. Filtration is aided by using either positive or negative pressure using vacuum pumps. The older filters made of earthenware or asbestos are called depth filters.

Different types of filters are:

1. **Earthenware filters:** These filters are made up of diatomaceous earth or porcelain. They are usually baked into the shape of candle. Different types of earthenware filters are:
 - a. Pasteur-Chamberland filter : These candle filters are from France and are made up of porcelain (sand and kaolin). Similar filter from Britain is Doulton. Chamberland filters are made with various porosities, which are graded as L1, L1a, L2, L3, L5, L7, L9 and L11. Doulton filters are P2, P5 and P11.
 - b. Berkefeld filter : These are made of Kieselguhr, a fossilized diatomaceous earth found in Germany. They are available in three grades depending on their porosity (pore size); they are V (veil), N (normal) and W (wenig). Quality of V grade filter is checked using culture suspension of *Serratiamarcescens* (0.75 μm).
 - c. Mandler filter : This filter from America is made of kieselguhr, asbestos and plaster of Paris. Asbestos filters: These filters are made from chrysotile type of asbestos, chemically composed of magnesium silicate. They are pressed to form disc, which are to be used only once. The disc is held inside a metal mount, which is sterilized by autoclaving. They are available in following grades; HP/PYR (for removal of pyrogens), HP/EKS (for absolute sterility) and HP/EK (for clarifying). Sintered glass filters: These are made from finely ground glass that are fused sufficiently to make small particles adhere to each other. They are usually available in the form of disc fused into a glass funnel. Filters of Grade 5 have average pore diameter of 1-1.5 μm . They are washed in running water in reverse direction and cleaned with warm concentrated H_2SO_4 and sterilized by autoclaving.
4. **Membrane filters:** These filters are made from a variety of polymeric materials such as cellulose nitrate, cellulose diacetate, polycarbonate and polyester. The older type of membrane, called gradocol (graded colloiddion) membrane was composed of cellulose nitrate. Gradocol membranes have average pore diameter of 3-10 μm . The newer ones are composed of cellulose diacetate. These membranes have a pore diameter ranging from 0.015 μm to 12 μm . These filters are sterilized by autoclaving. Membrane filters are made in two ways, the capillary pore membranes have pores produced by radiation while the labyrinthine pore membranes are produced by forced evaporation of solvents from cellulose esters.

The disadvantages of depth filters are migration of filter material into the filtrate, absorption or retention of certain volume of liquid by the filters, pore sizes are not definite and viruses and mycoplasma could pass through. The advantages of membrane filters are known porosity, no retention of fluids, reusable after autoclaving and compatible with many chemicals. However, membrane filters have little loading capacity and are fragile.

Air Filters: Air can be filtered using HEPA (High Efficiency Particle Air) filters. They are usually used in biological safety cabinets. HEPA filters are at least 99.97% efficient for removing particles $>0.3\ \mu\text{m}$ in diameter. Examples of areas where HEPA filters are used include rooms housing severely neutropenic patients and those operating rooms designated for orthopedic implant procedures. HEPA filter efficiency is monitored with the dioctylphthalate (DOP) particle test using particles that are $0.3\ \mu\text{m}$ in diameter.

SONIC AND ULTRASONIC VIBRATIONS:

Sound waves of frequency $>20,000$ cycle/second kills bacteria and some viruses on exposing for one hour. Microwaves are not particularly antimicrobial in themselves, rather the killing effect of microwaves are largely due to the heat that they generate. High frequency sound waves disrupt cells. They are used to clean and disinfect instruments as well as to reduce microbial load. This method is not reliable since many viruses and phages are not affected by these waves.

CHEMICAL METHODS OF DISINFECTION:

Disinfectants are those chemicals that destroy pathogenic bacteria from inanimate surfaces. Some chemical have very narrow spectrum of activity and some have very wide. Those chemicals that can sterilize are called chemisterilants. Those chemicals that can be safely applied over skin and mucus membranes are called antiseptics. An ideal antiseptic or disinfectant should have following properties:

- Should have wide spectrum of activity.
- Should be able to destroy microbes within practical period of time.
- Should be active in the presence of organic matter.
- Should make effective contact and be wettable.
- Should be active in any pH.
- Should be stable.
- Should have long shelf life.
- Should be speedy.
- Should have high penetrating power.
- Should be non-toxic, non-allergenic, non-irritative or non-corrosive.
- Should not have bad odour.
- Should not leave non-volatile residue or stain.
- Efficacy should not be lost on reasonable dilution.
- Should not be expensive and must be available easily.

Such an ideal disinfectant is not yet available. The level of disinfection achieved depends on contact time, temperature, type and concentration of the active ingredient, the presence of organic matter, the type and quantum of microbial load. The chemical disinfectants at working concentrations rapidly lose their strength on standing.

Classification of disinfectants:

1. Based on consistency
 - a. Liquid (E.g., Alcohols, Phenols)
 - b. Gaseous (Formaldehyde vapor, Ethylene oxide).
2. Based on spectrum of activity
 - a. High level
 - b. Intermediate level
 - c. Low level
3. Based on mechanism of action
 - a. Action on membrane (E.g., Alcohol, detergent)
 - b. Denaturation of cellular proteins (E.g., Alcohol, Phenol)
 - c. Oxidation of essential sulphhydryl groups of enzymes (E.g., H₂O₂, Halogens)
 - d. Alkylation of amino-, carboxyl- and hydroxyl group (E.g., Ethylene Oxide, Formaldehyde)
 - e. Damage to nucleic acids (Ethylene Oxide, Formaldehyde)

ALCOHOLS:

Mode of action:

Alcohols dehydrate cells, disrupt membranes and cause coagulation of protein. *Examples:* Ethyl alcohol, isopropyl alcohol and methyl alcohol.

Application: A 70% aqueous solution is more effective at killing microbes than absolute alcohols. 70% ethyl alcohol (spirit) is used as antiseptic on skin. Isopropyl alcohol is preferred to ethanol. It can also be used to disinfect surfaces. It is used to disinfect clinical thermometers. Methyl alcohol kills fungal spores, hence is useful in disinfecting inoculation hoods. Disadvantages: Skin irritant, volatile (evaporates rapidly), inflammable.

ALDEHYDES:

Mode of action:

Acts through alkylation of amino-, carboxyl- or hydroxyl group, and probably damages nucleic acids. It kills all microorganisms, including spores.

Examples: Formaldehyde, Gluteraldehyde

Application: 40% Formaldehyde (formalin) is used for surface disinfection and fumigation of rooms, chambers, operation theatres, biological safety cabinets, wards, sick rooms etc. Fumigation is achieved by boiling formalin, heating paraformaldehyde or treating formalin with potassium permanganate. It also sterilizes bedding, furniture and books. 10% formalin with 0.5% tetraborate sterilizes clean metal instruments. 2% gluteraldehyde is used to sterilize thermometers, cystoscopes, bronchoscopes, centrifuges, anesthetic equipments etc. An exposure of at least 3 hours at alkaline pH is required for action by gluteraldehyde. 2% formaldehyde at 40°C for 20 minutes is used to disinfect wool and 0.25% at 60°C for six hours to disinfect animal hair and bristles. Disadvantages: Vapors are irritating (must be neutralized by ammonia), has poor penetration, leaves non-volatile residue, activity is reduced in the presence of protein. Gluteraldehyde requires alkaline pH and only those articles that are wettable can be sterilized.

PHENOL:

Mode of action: Act by disruption of membranes, precipitation of proteins and inactivation of enzymes.

Examples: 5% phenol, 1-5% Cresol, 5% Lysol (a saponified cresol), hexachlorophene, chlorhexidine, chloroxylenol (Dettol)

Applications: Joseph Lister used it to prevent infection of surgical wounds. Phenols are coal-tar derivatives. They act as disinfectants at high concentration and as antiseptics at low concentrations. They are bactericidal, fungicidal, mycobactericidal but are inactive against spores and most viruses. They are not readily inactivated by organic matter. The corrosive phenolics are used for disinfection of ward floors, in discarding jars in laboratories and disinfection of bedpans. Chlorhexidine can be used in an isopropanol solution for skin disinfection, or as an aqueous solution for wound irrigation. It is often used as an antiseptic hand wash. 20% Chlorhexidine gluconate solution is used for pre-operative hand and skin preparation and for general skin disinfection. Chlorhexidine gluconate is also mixed with quaternary ammonium compounds such as cetrimide to get stronger and broader antimicrobial effects (eg. Savlon). Chloroxylenols are less irritant and can be used for topical purposes and are more effective against gram positive bacteria than gram negative bacteria. Hexachlorophene is chlorinated diphenyl and is much less irritant. It has marked effect over gram positive bacteria but poor effect over gram negative bacteria, mycobacteria, fungi and viruses. Triclosan is an organic phenyl ether with good activity against gram positive bacteria and effective to some extent against many gram negative bacteria including Pseudomonas. It also has fair activity on fungi and viruses.

Disadvantages: It is toxic, corrosive and skin irritant. Chlorhexidine is inactivated by anionic soaps. Chloroxylenol is inactivated by hard water.

HALOGENS:

Mode of action: They are oxidizing agents and cause damage by oxidation of essential sulfhydryl groups of enzymes. Chlorine reacts with water to form hypochlorous acid, which is microbicidal.

Examples: Chlorine compounds (chlorine, bleach, hypochlorite) and iodine compounds (tincture iodine, iodophores)

Applications: Tincture of iodine (2% iodine in 70% alcohol) is an antiseptic. Iodine can be combined with neutral carrier polymers such as polyvinylpyrrolidone to prepare iodophores such as povidone-iodine. Iodophores permit slow release and reduce the irritation of the antiseptic. For hand washing iodophores are diluted in 50% alcohol. 10% Povidone Iodine is used undiluted in pre and postoperative skin disinfection. Chlorine gas is used to bleach water. Household bleach can be used to disinfect floors. Household bleach used in a stock dilution of 1:10. In higher concentrations chlorine is used to disinfect swimming pools. 0.5% sodium hypochlorite is used in serology and virology. Used at a dilution of 1:10 in decontamination of spillage of infectious material. Mercuric chloride is used as a disinfectant.

Disadvantages: They are rapidly inactivated in the presence of organic matter. Iodine is corrosive and staining. Bleach solution is corrosive and will corrode stainless steel surfaces.

HEAVY METALS:

Mode of action: Act by precipitation of proteins and oxidation of sulfhydryl groups. They are bacteriostatic.

Examples: Mercuric chloride, silver nitrate, copper sulfate, organic mercury salts (e.g., mercurochrome, merthiolate)

Applications: 1% silver nitrate solution can be applied on eyes as treatment for ophthalmia neonatorum (Crede's method). This procedure is no longer followed. Silver sulphadiazine is used topically to help to prevent colonization and infection of burn tissues. Mercurials are active against viruses at dilution of 1:500 to 1:1000. Merthiolate at a concentration of 1:10000 is used in preservation of serum. Copper salts are used as a fungicide. Disadvantages: Mercuric chloride is highly toxic, are readily inactivated by organic matter.

SURFACE ACTIVE AGENTS:

Mode of actions: They have the property of concentrating at interfaces between lipid containing membrane of bacterial cell and surrounding aqueous medium. These compounds have long chain hydrocarbons that are fat soluble and charged ions that are water-soluble. Since they contain both of these, they concentrate on the surface of membranes. They disrupt membrane resulting in leakage of cell constituents.

Examples: These are soaps or detergents. Detergents can be anionic or cationic. Detergents containing negatively charged long chain hydrocarbon are called anionic detergents. These include soaps and bile salts. If the fat-soluble part is made to have a positive charge by combining with a quaternary nitrogen atom, it is called cationic detergents. Cationic detergents are known as quaternary ammonium compounds (or quat). Cetrimide and benzalkonium chloride act as cationic detergents.

Application: They are active against vegetative cells, Mycobacteria and enveloped viruses. They are widely used as disinfectants at dilution of 1-2% for domestic use and in hospitals.

Disadvantages: Their activity is reduced by hard water, anionic detergents and organic matter. Pseudomonas can metabolise cetrimide, using them as a carbon, nitrogen and energy source.

DYES:

Mode of action: Acridine dyes are bactericidal because of their interaction with bacterial nucleic acids.

Examples: Aniline dyes such as crystal violet, malachite green and brilliant green. Acridine dyes such as Carillion and aminacrine. Acriflavine is a mixture of proflavine and euflavine. Only euflavine has effective antimicrobial properties. A related dye, ethidium bromide, is also germicidal. It intercalates between base pairs in DNA. They are more effective against gram positive bacteria than gram negative bacteria and are more bacteriostatic in action.

Applications: They may be used topically as antiseptics to treat mild burns. They are used as paint on the skin to treat bacterial skin infections. The dyes are used as selective agents in certain selective media.

HYDROGEN PEROXIDE:

Mode of action: It acts on the microorganisms through its release of nascent oxygen. Hydrogen peroxide produces hydroxyl-free radical that damages proteins and DNA.

Application: It is used at 6% concentration to decontaminate the instruments, equipments such as ventilators. 3% Hydrogen Peroxide Solution is used for skin disinfection and deodorising wounds and ulcers. Strong solutions are sporicidal.

Disadvantages: Decomposes in light, broken down by catalase, proteinaceous organic matter drastically reduces its activity.

ETHYLENE OXIDE (EO):

Mode of action: It is an alkylating agent. It acts by alkylating sulfhydryl-, amino-, carboxyl- and hydroxyl-groups.

Properties: It is a cyclic molecule, which is a colorless liquid at room temperature. It has a sweet ethereal odor, readily polymerizes and is flammable.

Application: It is a highly effective chemosterilant, capable of killing spores rapidly. Since it is highly flammable, it is usually combined with CO₂ (10% CO₂+ 90% EO) or dichlorodifluoromethane. It requires presence of humidity. It has good penetration and is well absorbed by porous material. It is used to sterilize heat labile articles such as bedding, textiles, rubber, plastics, syringes, disposable petri dishes, complex apparatus like heart-lung machine, respiratory and dental equipments. Efficiency testing is done using *Bacillus subtilis* varniger. Disadvantages: It is highly toxic, irritating to eyes, skin, highly flammable, mutagenic and carcinogenic.

BETA-PROPIOLACTONE (BPL):

Mode of action: It is an alkylating agent and acts through alkylation of carboxyl- and hydroxyl- groups. Properties: It is a colorless liquid with pungent to slightly sweetish smell. It is a condensation product of ketane with formaldehyde.

Application: It is an effective sporicidal agent, and has broad-spectrum activity. 0.2% is used to sterilize biological products. It is more efficient in fumigation than formaldehyde. It is used to sterilize vaccines, tissue grafts, surgical instruments and enzymes.

Disadvantages: It has poor penetrating power and is a carcinogen.

INTERNAL ASSESSMENT

- **What is the difference between concurrent and terminal disinfection?**
- **Explain the procedure of removing different kinds of stains.**
- **Describe the various cleaning techniques used in hospital.**
- **What do you mean by asepsis? Mention its types.**
- **Describe the fumigation procedure in OT.**
- **What are the types and general rules of application of surgical dressing?**
- **Describe the three vertices of the epidemiological triad.**
- **Mention the human diseases caused by pathogens.**
- **What do you mean by hospital acquired infections?**
- **Describe the chemical and physical agents used in sterilization and disinfection.**

UNIT-III

INTRODUCTION TO MEDICATION

Unit at a glance

- Introduction to Drug delivery system
- Patient's safety and effectiveness in drug delivery system
- Routes of administering drugs in patients's body
- Drug dosage forms
- Novel drug delivery system
- Controlled drug delivery system
- Drug administration
- Forms and routes of drug administration
- Classification of drugs



LEARNING OUTCOMES OF THE UNIT

- Demonstrate the knowledge of different types of drugs delivery system operated in the hospital
- Maintain patient's safety and effectiveness in drug delivery
- Administer the drug in the patient's body through correct route
- Demonstrate the knowledge of virus drug dosage forms
- Demonstrate the knowledge of novel drug delivery system
- Demonstrate the knowledge of control drug delivery system
- Demonstrate the knowledge of basic principles of drug administration
- Demonstrate the knowledge of forms and routes of medication
- Classify the drugs
- Demonstrate the knowledge of drugs of cardiovascular system
- Demonstrate the knowledge of storage and administration of medicine

DEFINITION

According to WHO, **Drug is any substance or product that is used or intended to be used to modify or explore the physiological system or pathological state in the benefit of the recipient.**

INTRAVENOUS DRUG

Intravenous (IV) means into a vein. Intravenous (IV) medications are a solutions administered directly into the venous circulation via a syringe or intravenous catheter (tube).

TYPES OF INTRAVENOUS DRUG DELIVERY METHOD

IV push

An IV “push” or “bolus” is a rapid injection of medication. A syringe is insert edin to the catheter to quickly send a one-time dose of a drug into the bloodstream.

IV infusion

An IV infusion is a controlled administration of medication into the bloodstream over time. The two main methods of IV infusion use either gravity or a pump to send medication into the catheter:

Pump infusion

A pump infusion is the most common method used. The pump is attached to IV line and sends medication and a solution, such as sterile saline, into the catheter in a slow, steady manner. Pumps may be used when the medication dosage must be precise and controlled.

Drip infusion

This method uses gravity to deliver a constant amount of medication over a set period of time. With a drip, the medication and solution drip from a bag through a tube and into the catheter.

CONVENTIONAL DRUG DELIVERY SYSTEM

Conventional drug delivery system is the classical method of the delivery of drugs into the body. The Examples of these systems includes: **Oral Delivery, Buccal / Sublingual Delivery, Rectal Delivery, Intravenous Delivery, Sub Cutaneous Delivery, Intramuscular Delivery.**

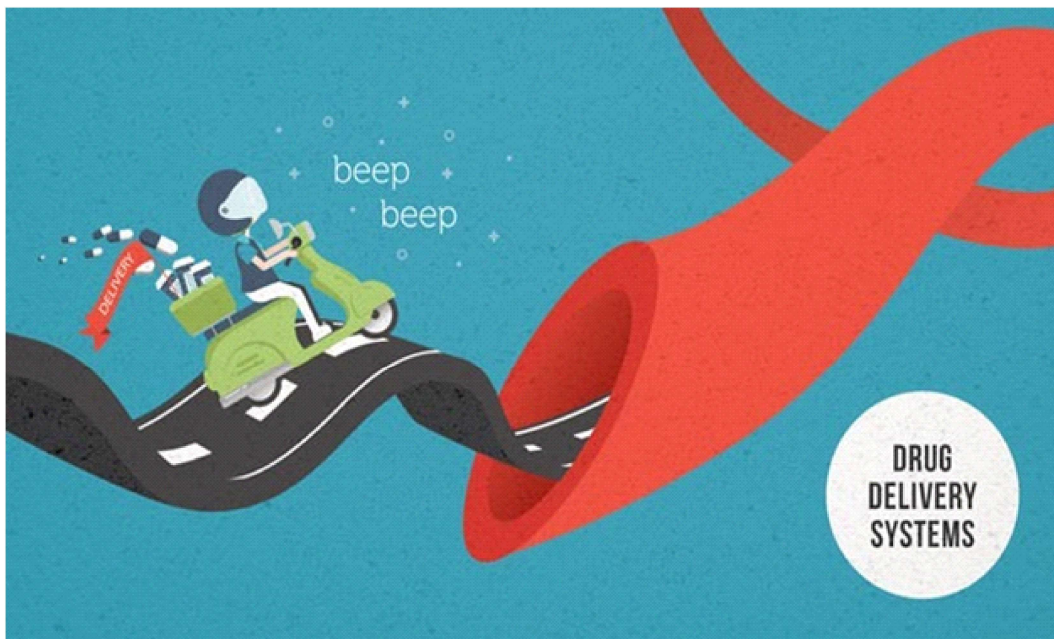


Fig 1: Drug Delivery System

1. **Oral Delivery:** It includes tablets, capsules, syrups etc. Taken directly through mouth and travels through GIT.

Advantages of Oral Delivery:

- Convenience in Administration
- Noninvasive
- Accurate and measured dose
- Unit Dosage form
- Higher compliance
- Cheap to the patient

Disadvantages of Oral delivery:

- Unconscious patients cannot take dose
- Low permeability
- Degradation by Gastro-Intestinal enzymes
- First pass metabolism
- Irregular absorption

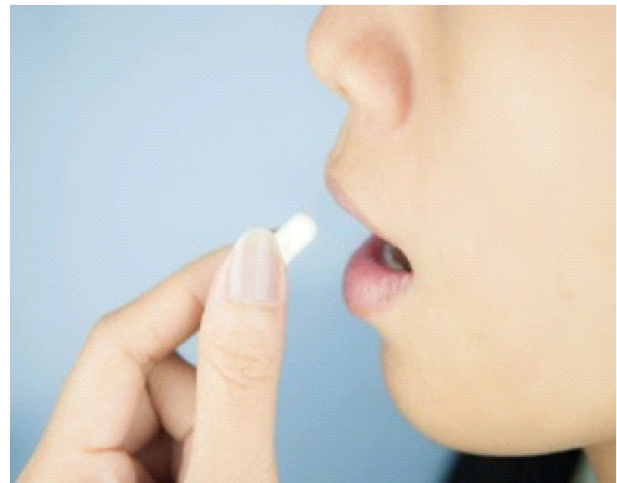


Fig 2: Oral Medicine

2. **Buccal/Sublingual Delivery:** Here tablets or chewing gums are placed under tongue (sublingual) and between cheeks (buccal).

Advantages:

- By-pass First pass metabolism
- Rapid absorption
- Low enzymatic activity

Disadvantages:

- Discomfort during dissolution
- Probability of swallowing- lost of effect
- Small doses

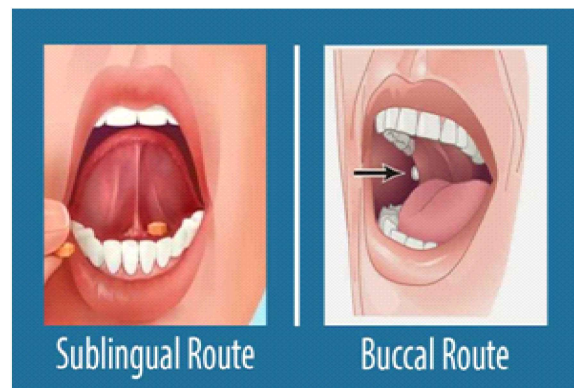


Fig 3 : Sublingual & Buccal Route

3. **Rectal Delivery:** Here suppositories are placed inside rectum and it melts at body temperature to give quick effect.

Advantages

- By-pass first pass metabolism
- Useful for children

Disadvantages

- Absorption depends on disease state
- Degradation by bacterial flora
- Uncomfortable

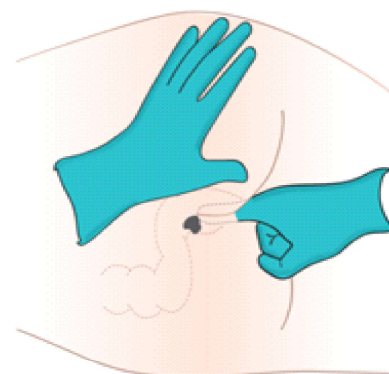


Fig 4: Rectal delivery of the drug

4. **Intravenous Delivery:** Drug in liquid form is administered directly into blood by injecting in vein with the help of sterile injector.

Advantages

- Drug 100% bioavailable
- Rapid response
- Can administer drugs degradable in stomach
- By-passes First Pass Metabolism

Disadvantages

- Invasive
- Trained personnel
- Possible toxicity due to incorrect dosing
- Sterility



Fig 5: Intravenous route

5. **Subcutaneous Delivery:** Here liquid drug is administered in subcutaneous tissue by injecting with injector.

Advantages

- Patient self-administration
- Slow, complete absorption
- By-pass FPM when placed at lower part of rectum.

Disadvantages

- Invasive
- Irritation
- Inflammation
- Maximum dose volume – 2mL



Fig 6: Subcutaneous route

6. **Intramuscular Delivery:** The liquid drug is administered in the muscle tissue by injecting with injector.

Advantages

- Drug is absorbed slowly, so prolonged effect
- Larger volume than subcutaneous
- By-pass first pass metabolism

Disadvantages

- Invasive – patient discomfort
- Irritation
- Inflammation
- May require some training

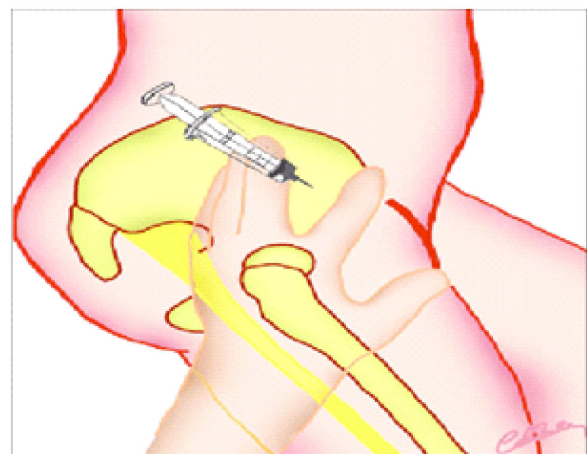


Fig 6: Intramuscular route

PATIENT SAFETY AND EFFECTIVENESS IN DRUG DELIVERY SYSTEM

Healthcare Errors and System Failures

Even though the extent of adverse events in the health system has long been recognized, the degree to which they are acknowledged and managed varies greatly across health systems and across health professions. Poor information and understanding about the extent of harm, and the fact that most errors do not cause any harm at all, may explain why it has taken so long to make patient safety a priority. In addition, mistakes affect one patient at a time and staff working in one area may only experience or observe an adverse event infrequently. Errors and system failures do not all happen at the same time or place, which can mask the extent of errors in the system.

Patient's Safety

The urgency of patient safety was raised over a decade ago when the US Institute of Medicine convened the National Roundtable on Healthcare Quality. All of this knowledge has strengthened the place of the safety sciences in the context of medical practice and health-care services. The need to improve healthcare through redesigning processes of care has been acknowledged by WHO and its representative countries as well as by most health professions.

Plan medication administration to avoid disruption:

- Dispense medication in a quiet area.
- Avoid conversation with others.
- Follow agency's no-interruption zone policy.
- Prepare medications for ONE patient at a time.
- Follow the SEVEN RIGHTS of medication preparation
- Check that the medication has not expired.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth) AND check against MAR.
- Check allergy band for any allergies, and ask patient about type and severity of reaction.
- Complete necessary focused assessments, lab values, and/or vital signs, and document on MAR.
- Provide patient education as necessary.
- If a patient questions or expresses concern regarding a medication, stop and do not administer.

Sources of Hazards to Patient's Safety in Hospitals

- Electronic devices
- Invasive devices
- Miscommunication
- Electrical Devices
- Pharmaceutical Incompatibilities

ROUTES FOR ADMINISTERING DRUGS IN THE PATIENT'S BODY

A route of administration is the path by which a drug, fluid, poison or other substance is brought into contact with the body. The route of administration that is chosen may have a profound effect upon the speed and efficiency with which the drug acts.

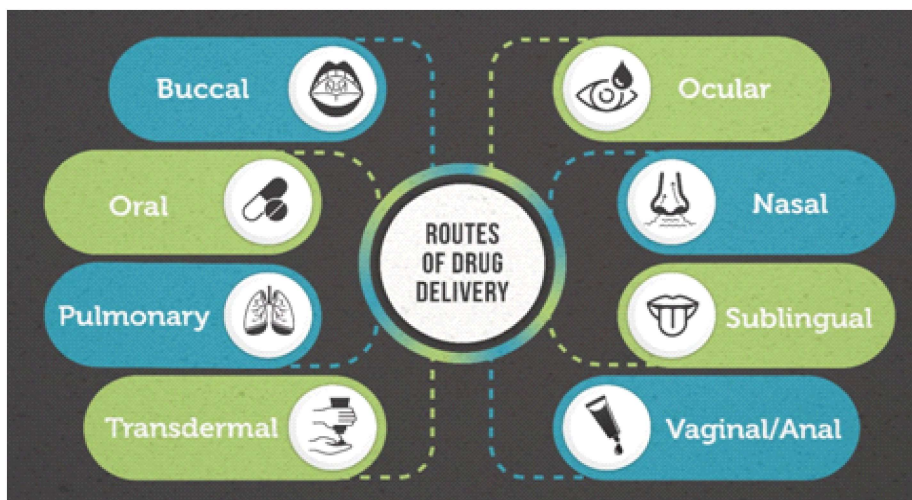


Fig 7: Different routes of drug administration

The possible routes of drug entry into the body may be divided into:

Gastrointestinal / Enteral

Administration through the gastrointestinal tract is sometimes termed enteral or enteric administration (literally meaning 'through the intestines'). Enteral/enteric administration usually includes oral (through the mouth) and rectal (into the rectum) administration, in the sense that these are taken up by the intestines. However, uptake of drugs administered orally may also occur already in the stomach, and as such gastrointestinal (along the gastrointestinal tract) may be a more fitting term for this route of administration. Furthermore, some application locations often classified as enteral, such as sublingual (under the tongue) and sublabial or buccal (between the cheek and gums/gingiva), are taken up in the proximal part of the gastrointestinal tract without reaching the intestines. Strictly enteral administration (directly into the intestines) can be used for systemic administration, as well as local (sometimes termed topical), such as in a contrast enema, whereby contrast media is infused into the intestines for imaging. However, for the purposes of classification based on location of effects, the term enteral is reserved for substances with systemic effects.

Other locations

- **Epicutaneous/topical(application onto the skin):** It can be used both for local effect as in allergy testing and typical local anesthesia, as well as systemic effects when the active substance diffuses through skin in a transdermal route.
- **Nasal administration(through the nose):** It can be used for topically acting substances, as well as for insufflation e.g. decongestant nasal sprays to be taken up along the respiratory tract. Such substances are also called in halational, e.g. in halational anesthetics.
- **Intraarticular(into joint space):** It is used in treating osteoarthritis
- **Intracranial (into the brain)**
- **Intramuscular(into muscle):** e.g. many vaccines, antibiotics, and long-term psychoactive agents.

- **Intravenous (into a vein):** e.g. many drugs, total parenteral nutrition
- **Subcutaneous (under the skin):** e.g. insulin.
- **Transdermal (diffusion through the intact skin for systemic rather than topical distribution):** e.g. transdermal patches such as fentanyl in pain therapy, nicotine patches for treatment of addiction and nitroglycerine for treatment of angina pectoris.

DRUG DOSAGE FORMS

These are the various dosage forms that are administered to the patients for the optimum delivery of the drug in the body.

Tablet

A tablet or caplet is a pharmaceutical dosage form. It comprises a mixture of active substances and excipients, usually in powder form, pressed or compacted from a powder into a solid dose. The compressed tablet is the most popular dosage form in use today. About two-thirds of all prescriptions are dispensed as solid dosage forms, and half of these are compressed tablets. A tablet can be formulated to deliver an accurate dosage to a specific site; it is usually taken orally, but can be administered sublingually, buccally, rectally or intravaginally. The tablet is just one of the many forms that an oral drug can take such as syrups, elixirs, suspensions, and emulsions. Medicinal tablets were originally made in the shape of a disk of whatever colour their components determined, but are now made in many shapes and colours to help distinguish different medicines

Capsule

In the manufacture of pharmaceuticals, encapsulation refers to a range of techniques used to enclose medicines in a relatively stable shell known as a capsule, allowing them to, for example, be taken orally or be used as suppositories. The two main types of capsules are:

- Hard-shelled capsules, which are typically made using gelatin and contain dry, powdered ingredients or miniature pellets. These are made in two halves: a lower-diameter "body" that is filled and then sealed using a higher-diameter cap.
- Soft-shelled capsules are primarily used for oils and for active ingredients that are dissolved or suspended in oil.

Parenteral Formulations

- These are also called injectable formulations and are used for intravenous, subcutaneous, intramuscular, and intra-articular administration. The drug is stored in liquid or if unstable, it is stored in lyophilized form.
- Many parenteral formulations are unstable at higher temperatures and require storage at refrigerated or sometimes frozen conditions.

Topical Formulations

- Cream – Emulsion of oil and water in approximately equal proportions.
- Ointment – Combines oil (80%) and water (20%).
- Gel – Liquefies upon contact with the skin.
- Paste – Combines three agents – oil, water, and powder; an ointment in which a powder is suspended.
- Powder – A finely subdivided solid substance.

NOVEL DRUG DELIVERY SYSTEM

It is a combination of advance technique and new dosage forms which are far better than conventional dosage forms and involves medicinal devices. It improves drug potency, control drug release to give a sustained therapeutic effect, provide greater safety and target a drug specifically to a desired tissue. Advantage of NDDS over conventional

- The conventional dosage forms provide drug release immediately and it causes fluctuation of drug level in blood depending upon dosage form.
- Therefore to maintain the drug concentration within the therapeutically effective range need novel drug delivery system
- It provide optimum dose at the right time and right location.
- Efficient use of expensive drugs, excipients and reduction in production cost.
- Beneficial to patients, better therapy, improved comfort and standard of living.

There are various types of novel drug delivery systems that have been developed. Let us now try to understand some of them.

Aerosols

- Aerosol preparations are stable dispersions or suspensions of solid material and liquid droplets in a gaseous medium.
- The drugs, delivery by aerosols is deposited in the air ways by:
 - Gravitational sedimentation
 - Inertial impaction
 - Diffusion

Mostly larger drug particles are deposited by first two mechanisms in the air ways, while the smaller particles get their way in to the peripheral region of the lungs by following diffusion. There are three commonly used clinical aerosols:

- Nebulizers
- Metered-dose Inhaler (MDI)
- Dry-powder inhaler (DPI)

The basic function of these three completely different devices is to generate a drug-containing aerosol cloud that contains the highest possible fraction of particles in the desired size range.

Nebulizers

- Nebulizers are widely used as aerosolized drug solutions or suspensions for drug delivery to the respiratory tract and are particularly useful for the treatment of hospitalized patients.
- Delivered the drug in the form of mist.

There are two basic types

- Airjet
- Ultrasonic nebulizers

Dry Powder Inhaler

Dry Powder Inhalers (DPI) are bolus drug delivery devices that contain solid drug in a dry powder mix that is fluidized when the patient inhales.

- Dry powder formulations either contain the active drug alone or have a carrier powder (e.g. lactose) mixed with the drug to increase flow properties of drug.
- DPIs are widely accepted inhaled delivery dosage forms, particularly in Europe, where they are currently used by approximately 40% of asthma patients.

Metered Dose Inhalers

Metered Dose Inhalers (MDI) is used for treatment of respiratory diseases such as asthma and COPD. They can be given in the form of suspension or solution. Particle size of less than 5 microns. It is used to minimize the number of administration errors. It can deliver a measured amount of medication accurately.

Transdermal Drug Delivery System

Transdermal drug delivery system can deliver the drugs through the skin portal to systemic circulation at a predetermined rate and maintain clinically effective concentrations over a prolonged period of time.

Advantages of Transdermal Drug Delivery System

- These are painless, non-adhesive ways to deliver drugs directly into the body.
- They are useful where drugs that are broken down by the stomach acid or extensively degraded by the liver.
- Useful in controlled and steady delivery of medication over a long period of time.

CONTROLLED DRUG DELIVERY SYSTEM

A controlled drug delivery system is aimed at releasing the correct dose of a therapeutic directly in the desired zone and during the required period of time. This allows maximizing the efficacy of the therapeutic and minimizing the possible side effects.

Classification of Controlled Drug Delivery System on the Basis of Mechanism of Release:

Control drug release has been achieved by following classes of control drug delivery system:

- 1. Diffusion**
 - Matrix
 - Reservoir
- 2. Dissolution**
 - Matrix
 - Encapsulation
- 3. Combination of both dissolution and diffusion**
- 4. Osmotic pressure control system**

Diffusion Control Release Drug Delivery System

- Diffusion process shows the movement of drug molecules from a region of higher concentration to one of lower concentration across the membrane.
- Commonly when a water insoluble membrane encloses a core of drug, it must diffuse through the membrane.

Reservoir System

- Also called as laminated matrix device.
- In this system, a water insoluble polymeric material encases a core of drug. Drug will partition into the membrane and exchange with the fluid surrounding the particle or tablet.
- Additional drug will enter the polymer, diffuse to the periphery and exchange with the surrounding media.
- Drug core surrounded by polymer membrane which controls release rate

Dissolution Control Release Drug Delivery System

- These systems are most commonly employed for production of enteric coated dosage forms.
- To protect the stomach from the effects of drugs such as aspirin, a coating that dissolves in alkaline media is used.
- This inhibits release of drug from the device unless it reaches the higher pH in the intestine.

Matrix Type

- Also called as Monolith dissolution controlled system.
- It can be either a drug impregnated sphere or tablet which will be subjected to slower dissolution. Dissolution is controlled by:
 - Altering porosity of tablet.
 - Dissolving at slow rate.
 - Drug release determined by dissolution rate of polymer.

Encapsulation/Reservoir type

- Also called as Coating Dissolution Controlled System.
- Drug is coated with a given thickness coating, which is slowly dissolved in the content of gastrointestinal tract.
- An alternative method is to administer the drug as a group of beads that have coating of different thickness.
- Since the beads have different coating thickness, their release occurs in a progressive manner.

Osmotic Pressure Control System

- A semi permeable membrane is placed around a tablet, particle or drug solution that allows transport of water into the tablet with eventual pumping of drug solution out of the tablet through a small delivery aperture in tablet coating.
- Two types of osmotically sustained systems are as follows:-
 - Type A contains an osmotic core with drug
 - Type B contains the drug in a flexible bag with osmotic cores surrounding.

DRUG ADMINISTRATION

Drug administration is the process of giving out medication to the patient in order to treat or prevent disease or complication. A drug is any substance that alters physiologic function with the potential for affecting health.

Classifications of Medicine Groups

Medicines can be grouped according to their use or function, or the system that they treat or their chemical makeup. For example, they can be grouped according to a body system like this:

- Respiratory medicines
- Cardiac medicines
- Nervous system medicines

They can also be grouped according to their function or use:

- Nonsteroidal anti-inflammatory medicines (NSAID)
- Narcotic analgesics
- Antidepressants

Lastly they can be grouped according to their chemical makeup:

- Aminoglycosides
- Estrogens
- Opioids

Most of the medicines within a group are quite alike but they are not identical. Grouping helps us to see the things that are the same and the things that are different. One of the best ways to learn about a large number of medicines is to learn about groups first. You will learn about some common groups later in this class.

The Seven “Rights”

When helping a person you must check and double check that you are dealing with

1. The right medicine
2. The right patient
3. The right time
4. The right dose
5. The right route
6. The right form
7. The right documentation

The Right Medicine

Do NOT use any medicine that has a label that you cannot read. Do NOT use any medicine unless it has a complete label. Read and double check the label against the medicine record at least three times and tell the person the name of the medicine before you help them. If the person says they do not get this medicine, STOP. Do not help. Report this to your supervisor/doctor. If a patient takes the wrong medicine, it must be reported to the Doctor immediately.

The Right Patient

You must check the identity of the person before you help them with the medicines.

The Right Time

The right time is 30 minutes before and up to 30 minutes after the time on the bottle and the order. For example, a person can take medicine anytime between 9:30 am and 10:30 am if the medicine is to be given once a day. It is an error if it is taken at 9 am or at 11 am. This, too, must be reported. PRN medicines are not taken at a special time of the day. They are taken only when they are needed but not more often than the order states. For example, the doctor may order aspirin q 4 h prn for pain. This aspirin can be given when the person has pain but there must be a duration of at least 4 hours between doses.

The Right Dose

Check and double check the dose. Scored tablets must be cut in half if the label says ½ tablet. It is an error when the person takes more or less than he/she should. This error must also be reported.

The Right Route

Check the label to find out the right route. A buccal medication should not be swallowed (oral route). It is an error when a person takes a medicine with the wrong route. This error must be reported.

The Right Form

Check the label against the order to make sure that you have the right form. A pill cannot be given if the order says a liquid. It is an error when a person takes the wrong form. This too must be reported.

The Right Documentation

All documentation must be complete and accurate.

Refused Medicines

A person has the right to refuse a medicine. This refusal must be reported and documented.

Forgotten Medicines

Report and document if the person forgets to take medicine or you forget to remind him/her it is time to take medicine

Observing & Record Keeping

You must observe for a person's response to medicine. Again, some of these responses are wanted and others are not. For example, you must take a person's blood pressure to make sure that the medicine is making it lower when the person is taking a blood pressure medicine. This is a wanted effect. However, if that person becomes dizzy and their blood pressure is too low, this is NOT a wanted response. You must observe and record both the wanted and the unwanted responses to the person's medicine(s).

A medication that is taken, forgotten, held or refused by the patient must be written on the patient's medicine record. Other information like vital signs and apical pulse rate must also be recorded when it is needed. For example, the apical rate for a full minute must be taken and recorded before a person takes digoxin. If the rate is 54 or more, the person can take it. The dose must be held and the supervisor must be notified if the rate is less than 54. This must also be written in the person's record.

Complete medication records must include the following details of a patient:

- **Fullname**
- **Room and bednumber**
- **Age**
- **Name of Doctor**
- **Description about allergies**
- **Medicine(s) to be taken**
- **Dose for each medicine**
- **Route for each medicine**
- **Form for each medicine**
- **Date and the time that the order was written**
- **Date(s) and time(s) that the medicine is to be taken/given**
- **Start and end dates of the order**
- **Initials/signatures of all who have helped with the medicine(s).**

Some of the legal rules for record keeping are:

- Do NOT use white fluid if you make a mistake. If you make a mistake, cross it off with one thin line. Do NOT cover the mistake with scribble. Write "error", sign your name and date
- Write so that other people can read what you write.
- Do NOT scribble.
- Use dark ink on records.

FORMS AND ROUTES OF DRUG ADMINISTRATION

Medicines are made in many forms and for many routes. Some medicines come in more than one form. Some can be given with more than one route. Complete medicine orders must state the route and the form that the patient must take.

Forms

Medicines can come in these forms:

- Tablets
- Capsules (regular and sustained release)
- Elixirs
- Suppositories (vaginal and rectal)
- Oral suspensions
- Syrups
- Tinctures
- Ointments
- Pastes
- Creams
- Drops (eye)
- IV suspensions and solutions
- Metered dose inhalers

Routes

Routes can be:

- Oral
- Buccal (insidecheek)
- Sublingual (under thetongue)
- Topical (on theskin)
- Ophthalmic(eye)
- Otic(ear)
- Vaginal
- Rectal
- Nasal
- Viaanasogastricorgastrostomytube
- Inhalation
- Subcutaneous (underskin)
- Intramuscular (in themuscle)
- Intradermal (in theskin)
- Transdermal (through theskin)
- Intravenous (into thevein)

Precautions and Contraindications

Some medicines are contraindicated or not allowed to be used for some patients. For example, a medicine can be prohibited for patients that have severe kidney or liver disease and those that are pregnant or breast feeding. Other medicines may only be used with some people when they are used with caution. For example, a medicine can sometimes be used, but only with caution, for an older person. It is very important to close lyobserveandreport the patient'sresponsestothemedicinewhen it is being used with caution. The most common contraindication is an allergy or sensitivity tothemedicine. Thepatient'sallergiesmustbeknownbeforeyouassisttheperson. IfyouseeNKAonthe patient'schart, thismeansthatthepersonhasNoKnownAllergies.

Allergies

A rash and even a life threatening reaction can happen if a medicine is taken by a person that has an allergy to it. Anaphylaxis is a very severe allergic reaction that can happen if a person is allergic to a food,likepeanutsorshellfish,asubstance,likelatex,or amedicineliikepenicillinorcephalosporin. Itisa medical emergency that needs immediateattention.

The signs are:

- Itching
- Hives
- Swelling of thethroat
- Trouble breathing(dyspnea)
- Shortness ofbreat
- Adropinbloodpressure
- Irregular heartrhythm
- Nausea
- Vomiting
- Abdominalcramping
- Loss ofconsciousness
- Death

Side Effects and Adverse Reactions

All medicines have side effects. Nausea and vomiting are the most common side effects. Some side effects are troublesome; others can be life threatening. Adverse drug reactions are serious and they can also lead to death.

Some medicines also have toxic effects. For example, tinnitus is a sign of toxicity with aspirin.

You must know about the side effects, adverse drug reactions and the toxic effects of all medicines that the patient is taking. You must observe such allergic reactions and report them.

Abbreviations

Abbreviations save time, but, they can also lead to deadly effects. Some of the abbreviations that we have been using for many, years are now being stopped because they have led to serious errors.

The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) has issued guidelines and rules for using abbreviations, acronyms and symbols.

Hospitals, nursing homes, assisted living facilities, and all other healthcare settings must now standardize abbreviations, acronyms and symbols that they are using. They must also make a list of all that they will not use

Standard abbreviation used in medication chart

| ABBREVIATIONS | MEANING |
|--------------------|----------------------------|
| <i>Frequencies</i> | |
| OD | Once daily |
| BID | Twice daily |
| TID | Thrice daily |
| QID | Four times a day |
| QHS | Before bedtime |
| Q4H | Every four hour |
| Stat | Immediately |
| PRN | As needed |
| AC | Before meal |
| PC | After meal |
| <i>Routes</i> | |
| PO | By mouth |
| IM | Intramuscular |
| IV | Intravenous |
| SC | Sub cutaneous |
| PR | Rectal |
| ID | Intradermal |
| TPN | Total Parenteral Nutrition |
| NPO | Nothing by mouth |

CLASSIFICATION OF DRUGS

Drugs may be classified according to their chemical composition, clinical actions, therapeutic effect on body systems, their purpose and uses.

Classification of Drugs

The following are the major categories of drugs:

1. Antacids

Uses: Gastritis, peptic ulcer, hiatal hernia and reflux esophagitis.

Adverse Reactions and Side Effects: Constipation, diarrhea, flatus, abdominal distention, alkaluria (urine that is not normal and has a high base pH).

Contraindications: Allergy and sensitivity

Implications: Check for stomach pain, GI symptoms and kidney problems.

Examples of Medicines in this Group:

- aluminumcarbonate
- calciumcarbonate

2. Anticoagulants

Uses: Heart attack (MI), pulmonary embolus (lung clots), deep vein thrombosis, disseminated intravascular clotting syndrome (DIC), and atrial fibrillation. It is also used with kidney dialysis.

Adverse Reactions and Side Effects: Hemorrhage, diarrhoea, fever, rash and blood disorders depending on the drug.

Contraindications: Bleeding disorders, (hemophilia and leukemia), ulcers, blood problems, nephritis

Implications: Observe for bleeding (like blood in the mouth, blood when the person shaves, black stools, stool occult blood, ecchymosis (black and blue marks), etc. Check the BP. It could be too high.

Examples of Medicines in this Group:

- warfarinsodium
- heparin

3. Anticonvulsants

Uses: They prevent seizures.

Adverse Reactions and Side Effects: Depressed bone marrow, which can be life-threatening, GI problems, confusion, lack of balance and slurring of speech.

Contraindications: Allergy

Implications: Observe liver and kidney function, blood, mental state, and for toxicity (ataxia, bone marrow depression, nausea, vomiting, cardiovascular problems, Stevens-Johnson syndrome)

Examples of Medicines in this Group:

- phenytoin
- diazepam

4. Antidepressants

Uses: Depression, Bed wetting for children.

Adverse Reactions and Side Effects: Orthostatic hypotension, mouth dryness, dizziness, drowsiness, urine retention, high blood pressure, kidney failure and paralytic ileus.

Contraindications: Large prostate, seizures, kidney, liver and heart disease.

Implications: Take the BP both standing and lying. Check the mental state. Observe for unusual facial symptoms and urine retention.

Examples of Medicines in this Group:

- sertraline
- amitriptyline
- bupropion
- phenelzine

5. Antidiabetic Medicines

Uses: Diabetes and ketoacidosis

Adverse Reactions and Side Effects: Hypoglycemia (low blood pressure) and liver damage.

Contraindications: Oral agents are contraindicated for juvenile diabetes and ketoacidosis.

Implications: Check the blood glucose and check for signs of high and low blood sugar.

Examples of Medicines in this Group:

- insulin
- glyburide

6. Antidiarrheals

Uses: Diarrhea

Adverse Reactions and Side Effects: Constipation, paralytic ileus, and stomach pain.

Contraindications: Colitis

Implications: Used for short term therapy (48 hours or less). Check the bowel response.

Examples of Medicines in this Group:

- bismuth subgallate
- kaolin and pectin mixtures

7. Antifungals

Uses: Fungus infections

Adverse Reactions and Side Effects: Kidney, liver damage, GI problems, hypokalemia (low potassium), anorexia (lack of appetite), nausea and vomiting.

Contraindications: Depressed bone marrow.

Implications: Check the vital signs, I & O, blood, weight, hearing, kidney and liver function.

Examples of Medicines in this Group:

- nystatin
- amphotericin B

8. Antihistamines

Uses: Allergies.

Adverse Reactions and Side Effects: Most can cause drowsiness, headache, urinary retention, blood problems, thick bronchial secretions and GI effects

Contraindications: Asthma, peptic ulcer, narrow angle glaucoma.

Implications: Check the urinary, respiratory and cardiac status Examples of in this Group:

- diphenhydraminehydrochloride
- chlorpheniraminemaleate

9. Anti-Infectives

Uses: Infections

Adverse Reactions and Side Effects: Diarrhea, nausea, vomiting, bone marrow depression and anaphylaxis (life threatening)

Contraindications: Most people allergic to penicillin are also allergic to the cephalosporins.

Implications: Observe bowel pattern and urinary output. Check the kidney function, and for signs of another infection and bleeding.

Examples of Medicines in this Group:

- penicillin
- tetracycline

10. Antineoplastics

Uses: Cancer

Adverse Reactions and Side Effects: Nausea, vomiting, hair loss, liver damage, and heart damage.

Contraindications: Liver and kidney damage.

Implications: Check kidney and liver function, I & O. Observe for bleeding, jaundice (yellow skin and yellow eyes), dependent edema, and breaks in the skin.

Examples of Medicines in this Group:

- fluorouracil
- cisplatin

11. AntiparkinsonAgents

Uses: Parkinson's disease

Adverse Reactions and Side Effects: Involuntary movement, insomnia, nausea, vomiting, orthostatic hypotension, dry mouth, numbness and headache

Contraindications: Narrow angle glaucoma

Implications: Check the respirations, blood pressure and changes in mental and behavioral states.

Examples of Medicines in this Group:

- levodopa
- entacapone

12. Antipsychotic and Neuroleptic Agents

Uses: Psychosis and anxiety. They are also sometimes used for unrelieved hiccups, nausea, vomiting, and pediatric behavior problems as well as relaxation before surgery.

Adverse Reactions and Side Effects: Some symptoms with antiparkinsonian medicines. Some side effects include dry mouth, photosensitivity (sensitive to light), hypotension (low blood pressure) and life threatening cardiac problems and breathing problems (laryngospasm).

Contraindications: Heart disease, high blood pressure, severe bone marrow depression, blood disorders, Parkinson's disease, narrow angle glaucoma and children less than 12 years of age. Caution use with the elderly.

Implications: Check the I & O, blood pressure lying and standing (orthostatic hypotension), EPS (antiparkinsonian agents should be used for this). Observe for dizziness, palpitations, tachycardia (fast heart rate), changes in emotion, level of consciousness, as well as for any walking and sleep problems.

Examples of Medicines in this Group:

- haloperidol
- chlorpromazine

13. Antitubercular Medicine

Uses: Tuberculosis

Adverse Reactions and Side Effects: Anorexia, nausea, vomiting, rash, kidney, liver and hearing effects, which could be severe.

Contraindications: Kidney disease. Caution with liver disease, pregnancy and lactation

Implications: Check kidney and liver status and for signs of anemia.

Examples of Medicines in this Group:

- isoniazid
- rifampin

14. Cough Medicines & Expectorants

Uses: The expectorants are used for a cough from bronchitis, TB, pneumonia, cystic fibrosis and COPD. Antitussives are used for coughs that are not producing mucus.

Adverse reactions and side effects: Dizziness, drowsiness and nausea

Contraindications: Iodine sensitivity, pregnancy, lactation and an over active thyroid. Caution with the old people and those with asthma

Implications: Check the cough and the sputum. Increase fluid intake and humidity to keep the mucus thin.

Examples of Medicines in this Group:

- guaifenesin
- codeine

15. Antivirals

Uses: Infections caused by a virus like HIV, herpes and varicella.

Adverse Reactions and Side Effects: Nausea, vomiting, diarrhea, headache, lack of appetite, blood problems, and kidney failure

Contraindications: People with an abnormal immune system, like AIDS, and those with herpes. Caution with pregnancy, lactation, kidney and liver disease and dehydration

Implications: Check for kidney and liver problems. Observe for signs of infection and allergic reactions (itching, rash).

Examples of Medicines in this Group:

- acyclovirsodium
- cidofovir

16. Barbiturates

Uses: Epilepsy, sedation, insomnia, anesthesia, and gall stones

Adverse Reactions and Side Effects: Drowsiness, nausea, blood problems and StevensJohnson syndrome

Contraindications: Allergy, poor liver function and pregnancy. Caution with the elderly and those that have kidney or liver disease

Implications: Observe seizure control and for signs of toxicity (insomnia, hallucinations, hypotension, pulmonary constriction; cold, clammy skin; blue or gray lips, vomiting, delirium, weakness)

Examples of Medicines in this Group:

- phenobarbital
- secobarbital

17. Benzodiazepines

Uses: Anxiety, acute alcohol withdrawal and pre-operative relaxation.

Adverse Reactions and Side Effects: Physical dependence and abuse, dizziness, drowsiness, orthostatic hypotension, and blurred vision

Contraindications: Narrow angle glaucoma, infants less than 6 months old. Caution with the elderly as well as with those that have kidney and/or liver disease

Implications: Check the lying and standing blood pressure (report it if it drops 20 mm Hg or more), pulse, liver and kidney function and signs of dependency. Give the person milk or food to prevent GI symptoms.

Examples of Medicines in this Group:

- diazepam
- clonazepam

18. Bronchodilators

Uses: Asthma, spasm of the bronchi, COPD, and Cheyne-Stokes respirations

Adverse Reactions and Side Effects: Dyspnea (trouble breathing), bronchospasm, anxiety, tremors, throat irritation, nausea and vomiting.

Contraindications: Narrow angle glaucoma, severe heart disease, and a fast heart rate. Cautious use with hypertension, seizures, pregnancy and lactation, an over active thyroid and a large prostate

Implications: Check for response (absence of dyspnea and/or wheezing)

Examples of Medicines in this Group:

- albuterol
- aminophylline

19. Diuretics

Uses: High blood pressure (hypertension) and edema

Adverse Reactions and Side Effects: Low potassium (hypokalemia), high blood glucose (hyperglycemia) blood problems, like anemia, and dehydration

Contraindications: Electrolyte imbalances, poor urine output and dehydration. Caution among the elderly as well as when the person has a kidney or liver disease

Implications: Potassium in the form of a tablet or liquid may be needed. A banana also gives the person potassium. Check the lying and standing blood pressures. This medicine should be given in the morning so that the person does not have to get up in the middle of the night to void.

Examples of Medicines in this Group:

- furosemide
- hydrochlorothiazide

20. Histamine H2 Antagonists

Uses: Ulcers and GI reflux disease

Adverse Reactions and Side Effects: Blood problems, diarrhea and headache.

Contraindications: Cautious use with children less than 16 years of age, and with those people that have liver or kidney disease, and organic brain syndrome. Caution is also indicated during pregnancy and if the person is breast feeding a baby.

Implications: Check the I & O. Give it to the person during their meal so that it will take its full effect.

Examples of Medicines in this Group:

- cimetidine
- ranitidine

21. Immunosuppressants

Uses: Prevention of organ transplant rejection

Adverse Reactions and Side Effects: Protein, blood and albumin in the urine, Kidney failure, liver damage, oral thrush, sore gums, fever and headache.

Contraindications: Caution with severe liver or kidney disease and pregnancy

Implications: Check for liver and kidney function. Signs of liver damage are itching, light colored stools, jaundice and dark urine. Give the person this medicine with a meal.

Examples of Medicines in this Group:

- cyclosporine
- azathioprine

22. Laxatives

Uses: Constipation, as bowel prep and a stool softener

Adverse Reactions and Side Effects: Cramping, diarrhea, and nausea

Contraindications: Large colon, stomach pain, nausea, vomiting, impaction, GI obstruction, gastric retention and colitis. Caution must be used if the person has hemorrhoids and/or rectal bleeding

Implications: Check the I & O. The person must take this with water only. The person should not take it within one hour after taking milk, a meal or an antacid.

Examples of Medicines in this Group:

- psyllium
- docusate sodium

23. Non steroidal inflammatory drugs(NSAIDS)

Uses: Mild to moderate pain, arthritis and dysmenorrhea

Adverse Reactions and Side Effects: Blood problems, kidney problems, blood in the urine, painful urination, stomach pain, lack of appetite, anorexia, dizziness and drowsiness.

Contraindications: Asthma, severe liver and/or kidney disease. Cautions use with the elderly, children, lactation, pregnancy and for patients with GI, cardiac and/or bleeding problems.

Implications: Check the blood, kidney and liver function. Baseline hearing and eye exams are recommended so that changes can be seen. Toxicity can lead to tinnitus (ringing in the ears) and/or blurred vision.

Examples of Medicines in this Group:

- ibuprofen
- naproxen

24. Opioid Analgesics

Uses: Moderate to severe pain

Adverse Reactions and Side Effects: GI problems (constipation, nausea, vomiting, anorexia, cramps), sedation, slow breathing, circulatory depression and increased pressure in the head

Contraindications: Upper airway obstruction, bronchial asthma, and addiction. Cautious use with kidney, liver, respiratory and heart disease.

Implications: Check the respiratory, urinary and mental status, including the person's level of consciousness. An antiemetic can be used for nausea and vomiting. Continue to check the level of pain

Examples of Medicines in this Group:

- Codeine

25. Salicylates

Uses: Mild to moderate pain, inflammation (arthritis), and for a fever

Adverse Reactions and Side Effects: Rash, GI symptoms, liver and blood problems, and hearing problems (tinnitus- a sign of possible toxicity)

Contraindications: Frequently occurring contraindicated with a vitamin K deficiency, GI bleeding, a bleeding disorder, and children with Reye's syndrome. Caution with Hodgkin's disease, liver and kidney failure, anemia

Implications: Look for signs of a liver problem (clay colored stool, dark urine, diarrhea, yellow sclera and skin, itching, fever, abdominal pain) and ototoxicity (ringing or roaring in the ears, tinnitus)

Examples of Medicines in this Group:

- aspirin
- salsalate

26. Thyroid Medicines

Uses: Under active thyroid gland

Adverse Reactions and Side Effects: Palpitations, tachycardia, insomnia, tremors, angina, weight loss, irregular heartbeat, and thyroid storm.

Contraindications: Heart attack, and poor adrenal function. Cautious use with the elderly, pregnant and breast feeding women, and for patients with diabetes, high blood pressure, angina, and other heart disease

Implications: The person should take it at the same time every day. Check the blood pressure before each dose. Check the I & O, weight, and for irritability and nervousness

Examples of Medicines in this Group:

- thyroid
- levothyroxine

DRUGS OF CARDIOVASCULAR SYSTEM

1. Alpha-Adrenergic Blockers

Uses: Hypertension (high blood pressure)
Adverse Reactions and Side Effects: Hypotension (low blood pressure), a stuffed nose, tachycardia (fast heart rate over 100), diarrhea, nausea, and vomiting.

Contraindications: Myocardial infarction (MI) and coronary artery disease, including angina (chest pain).

Implications: Check daily weights, I&O, and the blood pressure (BP) standing and lying.

Examples of Medicines in this Group:

- dihydroergotaminemesylate
- phentolaminemesylate

2. Beta-Adrenergic Blockers

Uses: High blood pressure, angina and irregular heartbeats coming from the heart's ventricles.

Adverse Reactions and Side Effects: Orthostatic hypotension, diarrhea, nausea, vomiting, slow heart rate, blood problems, congestive heart failure (CHF) and spasms in the bronchus.

Contraindications: Heart block, shock and CHF. Cautions use with the elderly and those patients with COPD, coronary artery disease, asthma, kidney disease, thyroid disease, and pregnancy.

Implications: Check the blood pressure, I&O, daily weights, and pulse. Observe for edema and take the apical and radial pulse.

Examples of Medicines in this Group:

- metoprolol
- propranolol

3. **Antianginal Medicines**

Uses: Angina, hypertension (high blood pressure) and irregular heartbeats.

Adverse Reactions and Side Effects: Postural hypotension, fatigue, irregular heartbeats, headache, edema, dizziness.

Contraindications: Increased pressure in the brain and a bleed in the brain.

Implications: Observe for side effects and orthostatic hypotension. Check for angina (chest) pain.

Examples of Medicines in this Group:

- propranolol
- verapamilhydrochloride
- nitroglycerine

4. **Anticholinergics**

Uses: Some slow down the GI, urinary and gallbladder movement. Others lower GI secretions, decrease involuntary movement, and relieve nausea, and vomiting.

Adverse Reactions and Side Effects: Dryness of the mouth, paralytic ileus, constipation, urinary problems (retention and hesitancy) dizziness and headache.

Contraindications: GI or urinary obstruction, narrow-angle glaucoma, and myasthenia gravis.

Implications: Observe urine and bowel function as well as vital signs.

Examples of Medicines in this Group:

- atropinesulfate
- scopolamine

5. **Antidysrhythmias**

Uses: Fast heart rate, irregular heartbeat, high blood pressure and angina.

Adverse Reactions and Side Effects: Low blood pressure, a pulse less than 60 (bradycardia) and irregular heartbeats.

Contraindications: Various. Check each medicine.

Implications: Check the rate and rhythm of the pulse. Check the blood pressure, and I &O. Look for swelling (edema).

Examples of Medicines in this Group:

- digoxin
- quinidine

6. **Antihypertensives**

Uses: Hypertension (high blood pressure), heart failure, angina and some irregular heart beats.

Adverse Reactions and Side Effects: Hypotension (high blood pressure), tachycardia (fast pulse), bradycardia (slow pulse), nausea, vomiting and headache.

- propranololhydrochloride

Contraindications:

Heartblock

Implications: Check for edema of the feet and legs, check kidney function, blood pressure and breathing.

Examples of Medicines in this Group:

- captopril

7. Calcium Channel Blockers

Uses: Angina, high blood pressure and irregular heartbeats.

Adverse Reactions and Side Effects: Irregular heartbeats, edema, fatigue, headache, and drowsiness.

Contraindications: Systolic blood pressure of less than 90 mm HG, Wolff-Parkinson- White syndrome, heart block, and cardiogenic shock. CHF may get worse in the presence of edema. Cautions use with liver and kidney disease.

Implications: Check the blood pressure, pulse and respirations. Administer at bedtime and before meals.

Examples of Medicines in this Group:

- verapamil
- felodipine

8. Cardiac Glycosides

Uses: CHF and rapid heart rate

Adverse Reactions and Side Effects: Cardiac changes, hypotension, GI problems, blurred vision, yellowish-green halos and headache.

Contraindications: Some irregular heartbeats, current heart attack, severe respiratory problems, and a rapid heartbeat. Caution with people that do NOT have the right amount of potassium, magnesium and/or calcium, kidney or liver disease, an under active thyroid and the elderly.

Implications: Check vital signs, check the apical heart rate for one full minute before giving it to the person to take (if less than 60, hold the dose and notify the MD). Check the I & O.

Examples of Medicines in this Group:

- digitoxin
- digoxin

9. Cholinergics

Uses: Myasthenia gravis, bladder distention, and a paralytic ileus

Adverse Reactions and Side Effects: Spasms of the bronchi and larynx, slow breathing, a convulsion, paralysis, respiratory arrest, nausea, vomiting and diarrhea

Contraindications: Kidney or intestinal obstruction. Cautious use with children, lactation, slow pulse, low blood pressure, seizures, asthma and an over active thyroid

Implications: Check the vital signs, I & O. Check for urine retention, brady cardia (slow pulse), spasms of the bronchi, low blood pressure and slowing of the person's breathing.

Examples of Medicines in this Group:

- neostigmine
- bethanechol

10. Cholinergic Blockers

Uses: To control secretions during surgery, and to slow down the urinary, biliary and GI tracts. Some are used for Parkinson like symptoms that result from the use of a neuroleptic medicine

Adverse Reactions and Side Effects: Constipation and dryness of the mouth.

Contraindications: GI or urinary obstruction, angle closure glaucoma, and myasthenia gravis. Cautious use with the elderly and with patients who have an enlarged prostate or a rapid heart rate.

Complications: Check the urinary status and I & O. Check for any dysuria (pain while urinating), frequency or retention. The medicine may be discontinued with these signs. Observe mental status and for constipation. Administer oral doses with milk or food

Examples of Medicines in this Group:

- atropine
- scopolamine

11. Corticosteroids

Uses: Some stop inflammation. Others are used for allergies, adrenal gland problems and brain swelling (edema)

Adverse Reactions and Side Effects: Insomnia, changes in behavior, an elevated mood (euphoria), an ulcer, GI irritation, sodium and fluid retention, hypokalemia (low potassium), hyperglycemia (high blood glucose), and a lack of tolerance for carbohydrates

Contraindications: Fungus infections, amebiasis, and lactation. Caution with the elderly, children and pregnant women, as well as those with diabetes, seizures, ulcers, glaucoma, CHF, hypertension, poor kidney function, myasthenia gravis and ulcerative colitis

Implications: Give the person milk or food with the medicine to prevent GI upset. Check the blood sugar, weight, I&O, and for any signs of infection. Observe for mood changes, like depression.

Examples of Medicines in this Group:

- cortisone
- hydrocortisone

12. Vasodilators

Uses: High blood pressure and angina.

Adverse Reactions and Side Effects: Hypotension (low blood pressure), hypertension (high blood pressure), ECG changes, nausea, headache

Contraindications: Tachycardia (rapid heart rate) and acute MI. Cautious use with ulcers and some heart disease

Implications: They should be taken with meals to prevent any GI problems.

Examples of Medicines in This Group:

- amyl nitrate
- hydralazine

STORAGE AND ADMINISTRATION OF MEDICINE

All medicines must be secure at all times. This gives safety to children, confused people, and those at risk for taking medications that are not theirs. Some medicines must be kept out of light. Others have to be put in the refrigerator. Others have to be kept at room temperature.

Disposing Medicines

These medicines must be thrown out:

- Those that have expired
- Those that are in a bottle without a label
- Those that are in a bottle with a label that you cannot read
- Those that have been stopped or discontinued by the Doctor

Medicine should be thrown away in the sink under running water. They should not be thrown away in the trash can. The GDA must document all medicine(s) that are thrown away.

Preventing Mistakes and Errors

Patient identification is Vital. Many mistakes happen when the person is not identified properly. When you help with medicine, you must use at least two ways of identifying the person. A bed or room number cannot be one of these. Some examples of two identifiers include the person's:

- First, middle and last name
- A code number given to that person
- Social security number
- Birthday in terms of month, day and year
- Photograph
- A bar code containing two or more unique identifiers.

Infection Control during Drug Administration

Standard precautions in healthcare greatly lower the risk of exposures to HIV and other blood borne pathogens. Other infection control measures that help to prevent the spread of infection are:

- Handwashing
- Engineering controls, such as "needleless" systems
- Work practice controls
- The use of personal protective equipment, such as gowns, goggles, gloves and masks
- The proper handling of sharps and regulated biohazardous waste.

The following routine infection control measures must be taken when helping a person with their medicine

- ALWAYS wash your hands before and after each patient contact.
- Wear gloves whenever you may have contact with blood and other bodily fluids, as well as when touching skin that is not intact. Wash your hands before you put on gloves and wash your hands after you take them off. Gloves are not a substitute for handwashing.
- Wear a water-proof gown, goggles and a surgical mask if you may come in contact with bodily fluids, splashes and spills

INTERNAL ASSESSMENT

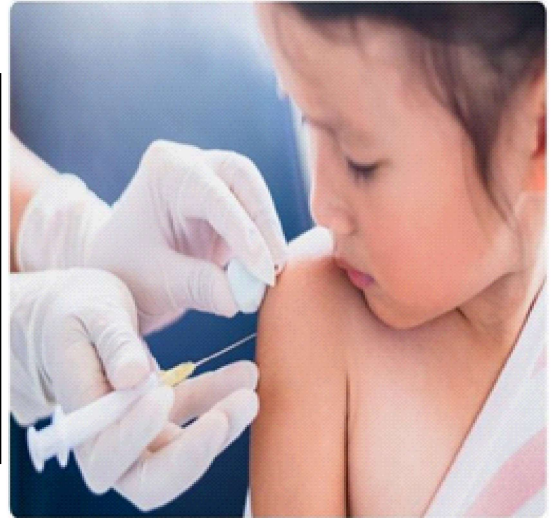
1. What is drug delivery? List the various types of conventional drug delivery system.
2. Write various routes of administering the drugs in the body of the patient.
3. Explain two main types of capsule.
4. What is transdermal drug delivery system? Write its advantage.
5. Classify the controlled drug delivery system on the basis of mechanism of release.
6. What are the seven rights in drug administration?
7. List the different forms of medicine.
8. What is vasodilation?
9. How to control infection during drug administration?
10. What are the common side-effects of antidepressant?

UNIT-IV

Immunization

Learning outcomes

- ✓ Differentiate between various types of immunity.
- ✓ Prepare immunization scheduled chart.
- ✓ Identify the key components of Universal Immunization Program.
- ✓ Prepare a list of national health programs.
- ✓ Identify the key components of Pulse Polio Immunization program.



Unit at a glance

- ❖ **IMMUNITY**
 - Types of Immunity
 - Difference between various types of immunity
- ❖ **IMMUNIZATION**
 - Importance of Immunization
 - Side effects of Immunization
 - Immunization Scheduled chart
- ❖ **UNIVERSAL IMMUNIZATION PROGRAMMES**
 - Key components of UIP
- ❖ **NATIONAL HEALTH PROGRAMMES**
- ❖ **PULSE POLIO IMMUNIZATION PROGRAMME**
 - Key components of Pulse Polio Immunization Program
- ❖ **PRACTICAL**

IMMUNITY

The Latin term “**immunis**” means the state of protection from infectious disease.

It is the ability of an organism to resist a particular infection or toxin by the action of specific antibodies or sensitized white blood cells.

Types of immunity

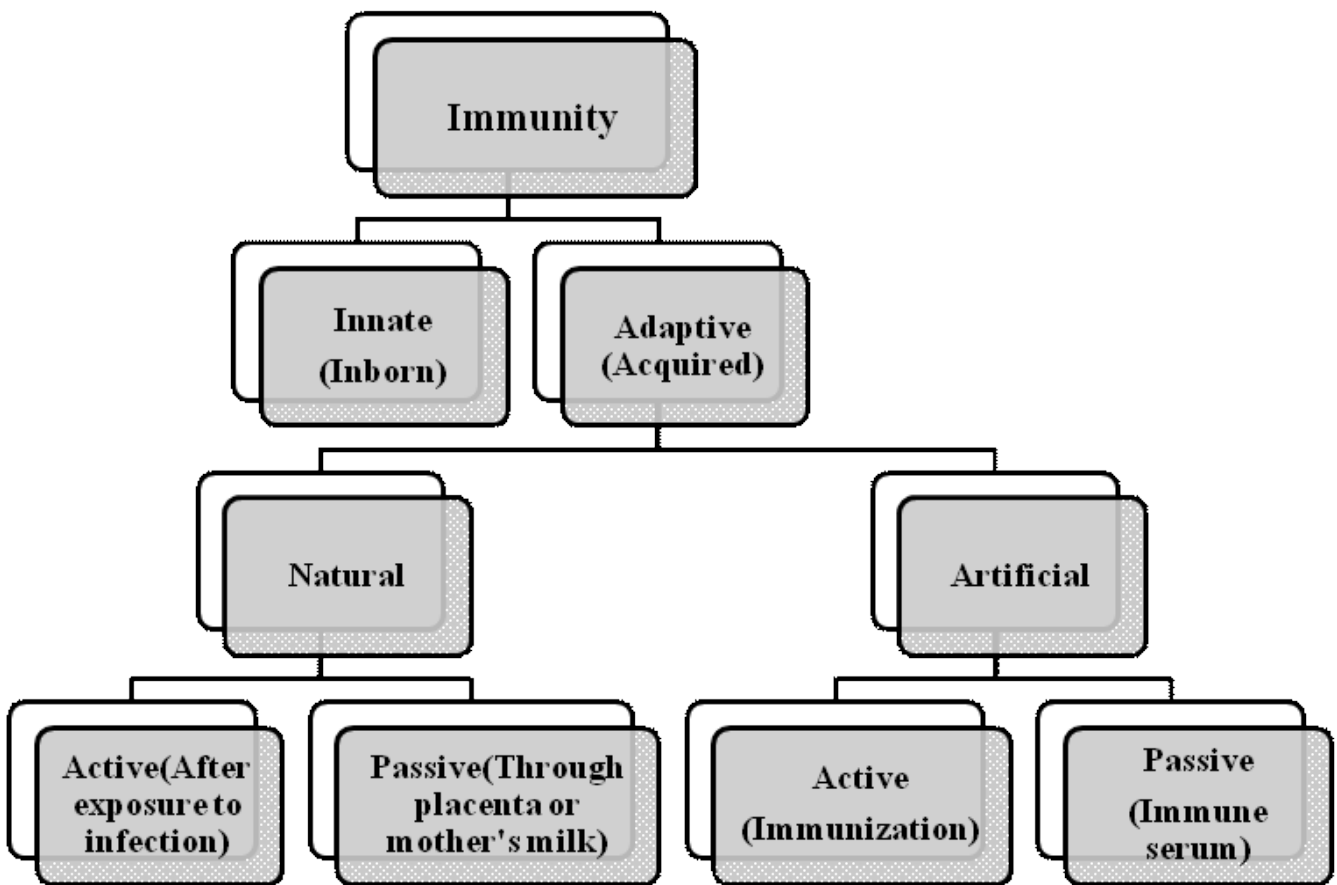


Fig 1: Flow Chart : Types of Immunity

Difference between innate and adaptive immunity

| Innate Immunity | Adaptive Immunity |
|--|---|
| Innate Immunity refers to a naturally occurring immunity by the genetic constituents and the physiology of a person. | Adaptive Immunity refers to an acquired immunity, mediated by T cells and B cells and characterized by an immunological memory. |
| Known as natural immunity | Known as acquired immunity |
| Generates a non-specific immune response | Generates a specific immune response |
| Always present in the body | Generated in response to exposure to an external factor |
| Generates a rapid response | Delayed 5-6 days |
| Plasma proteins, phagocytes, physical and chemical barriers are the components | <u>Humoral</u> and cell mediated immunity are the components |
| Temperature, pH, skin and mucous membranes are the barriers | Lymph nodes, spleen and lymphoid tissues are the barriers |
| Does not develop memory cells | Develops memory cells |
| Possesses a less diversity | Possesses a higher diversity |
| Less potent | Exhibits a higher potency |
| Does not produce allergic reactions | Develops allergic reactions, immediate and delayed <u>hypercreativity</u> |

Table 1: Difference between innate and adaptive immunity

Difference between passive and active immunity

| Active Immunity | Passive Immunity |
|---|---|
| Active immunity refers to immunity, which results from the production of antibodies by the person's own immune system in response to a direct contact of an antigen | Passive immunity refers to a short-term immunity which results from the introduction of antibodies from the outside |
| It includes both cell mediated and <u>humoral</u> immunity | Already produced antibodies are transferred in the body |
| Mediated by the antibodies produced by the person's own cells | Mediated by the antibodies produced outside the body |
| The pathogen has direct contact with the body | The pathogen doesn't have direct contact with the body |
| Does not generate a rapid response | Generates a rapid response |
| May last for a long time | May not last for a long time |
| Generates an immunological memory | Does not generate an immunological memory |
| More effective | Less effective |
| Not applicable in <u>immunodeficient</u> | Applicable even in <u>immunodeficient</u> |
| Negative phase may occur | No negative phase |

Table 1: Difference between innate and adaptive immunity

IMMUNIZATION

Immunization is the process of protecting an individual from a disease through introduction of live or killed attenuated organisms in the individual system to create immunity.

Importance of Immunization

- It involves Immunization has helped reduce the impact of communicable disease on health and wellbeing.
- It involves Immunization helps protect future generations by eradicating diseases.
- It involves Immunization protects a large number of people through mass vaccination.
- It involves Immunization reduces mortality, morbidity and also reduces direct and indirect medical costs.
- It involves Immunization protects children from serious illness and complications of vaccine preventable diseases.
- It involves Immunization is the only solution that eradicated Polio in infants.
- It involves Immunization is safe and effective. All vaccines undergo long and careful trial before being administered.
- It involves Immunizations are cheap, cost-effective, and easily administered.
- It involves Immunization also protects those around you who cannot get immunized.
- It involves Immunization helps you protect from diseases you may encounter in other countries.

Side-effects of Immunization

The most common mild side effects are:

- ❖ Fatigue
- ❖ Headache
- ❖ Tenderness, redness, pain or swelling at the site of injection
- ❖ Nausea
- ❖ Fever
- ❖ Mild rash
- ❖ Dizziness

Unusual severe side effects are:

- ❖ Anaphylaxis-severe immediate allergic reaction
- ❖ Sepsis
- ❖ Seizures
- ❖ Severe local reaction
- ❖ Toxic Shock Syndrome (TSS)-abrupt onset of fever, vomiting and watery diarrhea within a few hours of immunization.

Various aspects of Immunization scheduled chart

| Vaccine Name | Due age | Dose | Route |
|---|----------------|---------|---------------------|
| <i>For Infants</i> | | | |
| BCG | At birth | 0.05ml | Intra dermal (ID) |
| Hep B-0 | | 0.5ml | Intra muscular (IM) |
| bOPV-0 | | 2 drops | Oral |
| bOPV-1 | At 6 weeks | 2 drops | Oral |
| Pentavalent-1 | | 0.5ml | Intra muscular |
| Fractional IPV | | 0.1ml | Intra dermal |
| Rotavirus | | 5 drops | Oral |
| Pneumococcal Conjugate Vaccine (PCV) | | 0.5ml | Intra muscular |
| bOPV-2 | At 10 weeks | 2 drops | Oral |
| Pentavalent-2 | | 0.5ml | Intra muscular |
| Rotavirus | | 5 drops | Oral |
| bOPV-3 | At 14 weeks | 2 drops | Oral |
| Pentavalent-2 | | 0.5ml | Intra muscular |
| Rotavirus | | 5 drops | Oral |
| Fractional IPV | | 0.1ml | Intra dermal |
| Pneumococcal Conjugate Vaccine (PCV) | | 0.5 ml | Intra muscular |
| Pneumococcal Conjugate Vaccine Booster (PCV-B) (Given at 9 completed months) | At 9-12 months | 0.5ml | Intra muscular |
| Measles/Rubella 1 st dose | | 0.5ml | Sub-cutaneous |
| Japanese Encephalitis 1 st dose | | 0.5ml | Sub-cutaneous |
| Vitamin A 1 st dose (Given at 9 completed months) | | 1ml | Oral |
| <i>For Children</i> | | | |

| | | | |
|--|---|---------|----------------|
| DPT booster-1 | At 16-24 months | 0.5ml | Intra-muscular |
| Measles/Rubella 2 nd dose | | 0.5ml | Sub-cutaneous |
| bOPV Booster | | 2 drops | Oral |
| Japanese Encephalitis 2 nd dose | | 0.5ml | Sub-cutaneous |
| Vitamin A (2 nd dose to 9 th dose) | At 16 months, then one dose every 6 months | 2ml | Oral |
| DPT Booster-2 | At 5-6 years | 0.5ml | Intra-muscular |
| Td | At 10 years & 16 years | 0.5ml | Intra-muscular |
| <i>For Pregnant Women</i> | | | |
| Td-1 | Early in pregnancy | 0.5ml | Intra muscular |
| Td-2 | 4 weeks after Td-1 | 0.5ml | Intra muscular |
| Td Booster | If received Td doses in a pregnancy within the last 3 years | 0.5ml | Intra muscular |

Table 3: Immunization Schedule

UNIVERSAL IMMUNIZATION PROGRAMME

Universal Immunization program is a vaccination program launched by the government of India on **November 19, 1985** and was dedicated to the memory of Smt. Indira Gandhi.

Vaccines under UIP

- Under UIP, following vaccines are provided:
 1. BCG (Bacillus Calmette Guerin)
 2. DPT (Diphtheria, Pertussis and Tetanus Toxoid)
 3. OPV (Oral Polio Vaccine)
 4. Measles
 5. Hepatitis B
 6. TT (Tetanus Toxoid)
 7. JE vaccination (in selected high disease burden districts)
 8. Hib containing Pentavalent vaccine (DPT+HepB+Hib) (In selected states)

Diseases Protected by Vaccination under UIP

1. Diphtheria
2. Pertussis.
3. Tetanus
4. Polio
5. Tuberculosis
6. Measles

7. 7. Hepatitis B
8. 8. Japanese Encephalitis (commonly known as brain fever)
9. 9. Meningitis and Pneumonia caused by Haemophiles Influenzae type b

VPD surveillance

- Vaccine Preventable Diseases (VPD) surveillance system is needed to create evidence base to enable planning and deployment of effective interventions.
- India has different surveillance models. Integrated Disease Surveillance Project (IDSP) is one of those surveillance systems.
- IDSP is a case-based surveillance system for detection of early warning signals of outbreaks. There are other sentinel surveillance systems which falls under different vertical national health programs for diseases targeted for control, elimination or eradication.
- Another source is the National Polio Surveillance Project (NPSP), which has done extremely well in acute flaccid paralysis (AFP) and measles surveillance in India.
- WHO/NPSP provides needed technical and training support for AFP and measles surveillance.

New vaccines to be introduced as per National Technical Advisory Group on Immunization (NTAGI) recommendation

- Injectable Polio Vaccine (IPV): National Technical Advisory Group on Immunization (NTAGI) recommended Injectable Polio Vaccine (IPV) introduction as an additional dose along with 3rd dose of DPT in the entire country in the first quarter of 2016.
- Rota virus vaccine: NTAGI recommended the introduction of rotavirus vaccine in Universal Immunization Programme in a phased manner.
- Rubella vaccine is to be introduced as MR vaccine replacing the measles containing vaccine first dose (MCV1) at 9 months and second dose (MCV2) at 16-24 months.

Key components of Universal Immunization program (UIP)

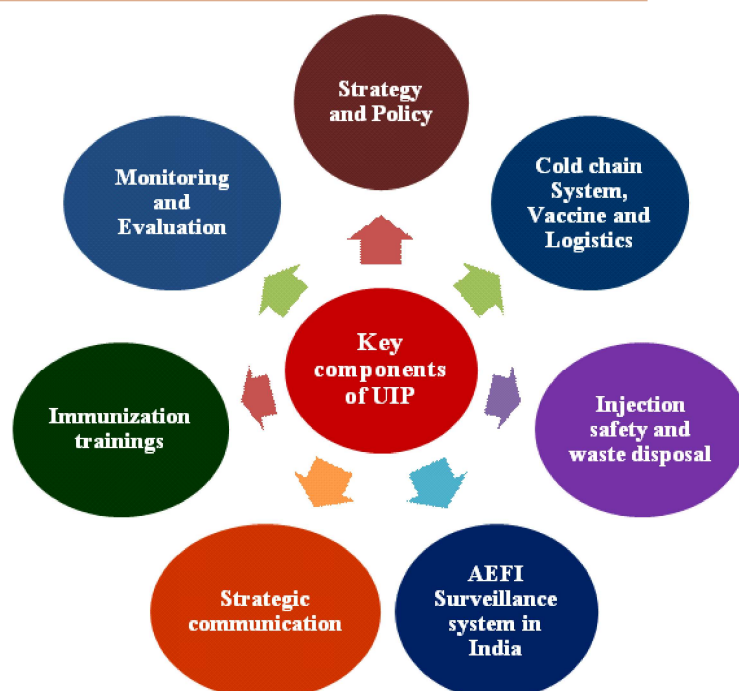


Fig 2: Key components of Universal Immunization program (UIP)

1. Strategy and policy

- Directed towards achieving an acceptable, affordable and sustainable standard of health through an appropriate health system.
- Provision of universal immunization of children against vaccine preventable disease is one of the major goals under this policy.
- Country developed a comprehensive Multi Year strategic plan for immunization in 2005 with an addendum in 2010 to achieve these targets of improving access and utilization of immunization in the country.
- Ministry of Health and Family Welfare also revised the National Vaccine Policy in 2011.

2. Cold Chain System, Vaccines and Logistics

- Cold chain is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use.
- To track the cold chain equipment inventory, availability and functionality.
- The vaccines are supplied directly to four Government Medical Store Depots (at Karnal, Mumbai, Chennai and Kolkata) and state and regional vaccine stores.
- Transportation of vaccines from States/Regional stores to divisions and district is done in cold boxes using insulated vaccine vans.
- Vaccines carriers with icepacks are used to transport vaccines from PHCs to the outreach sessions in the village.
- At the PHCs and CHCs, cold chain handlers, who are health personnel have been tasked with the proper storage and handling of vaccines and daily upkeep of Ice Lined Refrigerators (ILRs) and Deep Freezers (DFs) including temperature charting.
- The performance and efficiency of the cold chain system at different levels is monitored continuously, through supervisory visits, review meeting.

3. Injection safety and waste disposal

- To ensure safe injection practices, Government of India endeavors to ensure continuous supply of injection safety equipment's (AD syringes, hub cutters and waste disposal bags)
- Disposal of immunization waste is strictly as per Central Population Control Board (CPCB) guidelines for biomedical waste disposal.

4. AEFI Surveillance System in India

- The WHO defines AEFI as a “medical incident that takes place after an immunization, causes concern, and believed to be caused by immunization.
- AEFI surveillance in country monitors immunization safety, detects and responds to adverse events following immunization, corrects unsafe immunization practices, reduces the negative impact of the event on health and contributes to the quality of immunization activities.

5. Strategic communication

- Strategic communication refers to policy-making and guidance for consistent information activity through coherent messaging.
- The issue of media advocacy, proactive planning and effective media response is emerging as one of the key elements of strategic communication support to achieving full Routine Immunization coverage in the country.

Development of RI Logo

The new logo of the baby holding the syringe, indicating RI as his right, has been developed in purple color. This will give RI a distinct identity.

6. Immunization Trainings

- The Immunization Program runs due to the coordinated efforts of different cadres of health staff working in the states at different levels (states, districts, PHCs and CHCs)
- In the year of intensification of Routine Immunization (2012-2013), the government of India has supported the training of approximately 12,50,000 frontline workers in 9 high priority states-UP, MP, Rajasthan, Bihar, Chhattisgarh, Jharkhand, Haryana, Gujarat and West Bengal.
- The objective is to motivate and strengthen the capacity of frontline workers to reduce dropouts and left outs and improve the quality of services.

7. Monitoring and Evaluation

- UIP performs monitoring and evaluation at three levels.
 - ✓ There is regular reporting system from the health sub-centre to PHC, district, state and national level.
 - ✓ To evaluate immunization coverage, country conducts period population-based surveys. These include National Family Health Survey (NFHS), District Level Health Survey (DLHS), Annual Health Survey (AHS) and UNICEF Coverage Evaluation Survey (CES)
 - ✓ In between periodic surveys and administrative reporting, country also plans targeted studies and surveys to evaluate the performance of various components under UIP.

Schemes:

Routine Immunization:

- Objectives: The stated objectives of UIP are:
 - ✓ To rapidly increase immunization coverage.
 - ✓ To improve the quality of services.
 - ✓ To establish a reliable cold chain system to the health facility level.
 - ✓ Monitoring of performance.
 - ✓ To achieve self-sufficiency in vaccine production.
- Scope and eligibility:
 - ✓ India has one of the largest Universal Immunization Programs (UIP) in the world in terms of the quantities of vaccines used, number of beneficiaries covered, geographical spread and human resources involved.
 - ✓ Under the UIP, all vaccines are given free of cost to the beneficiaries as per the National Immunization Schedule.
 - ✓ All beneficiaries' namely pregnant women and children can get themselves vaccinated at the nearest Government/Private health facility or at an immunization post (Anganwadi centers/ other identified sites) near to their village/urban locality on fixed days.
 - ✓ The UIP covers all sections of the society across the country with the same high-quality vaccines.

- Achievements:
 - ✓ The biggest achievement of the immunization program is the eradication of small pox.
 - ✓ One more significant milestone is that India is free of Poliomyelitis caused by Wild Polio Virus (WPV) for more than 33 months.
 - ✓ Besides, vaccination has contributed significantly to the decline in the cases and deaths due to the Vaccine Preventable Diseases (VPDs).

NATIONAL HEALTH PROGRAMS

The National Health Program has been launched by the Central government for the control or eradication of communicable diseases, improvement of environmental sanitation, raising the standard of nutrition, control of population and improving rural health.

Enumerate national health program

- **Program related to communicable diseases**
 - ✓ National Vector Borne Diseases Control Program (NVBDCP)
 - ✓ Revised National Tuberculosis Control Program (RNTCP)
 - ✓ National Leprosy Eradication Program
 - ✓ National AIDS Control Program
 - ✓ Universal Immunization Program
 - ✓ National Guinea worm Eradication Program
- **Program related to non-communicable diseases**
 - ✓ National Cancer Control Program
 - ✓ National Iodine Deficiency Control Program
 - ✓ National Blindness Control Program
 - ✓ National Diabetes Control Program
 - ✓ National Mental Health Program
- **Nutritional Program**
 - ✓ Vitamin A Prophylaxis Program
 - ✓ Prophylaxis Against Nutritional Anemia
 - ✓ IDD's Program
 - ✓ Special Nutritional Program
 - ✓ Balwadi Nutritional Programme
 - ✓ ICDS Programme
 - ✓ Mid-Day Meal Program
- **Other Welfare Programme**
 - ✓ National Family Welfare Programme
 - ✓ Reproductive and Child Health Programme
 - ✓ National Water supply and Sanitation Programme
- **Social Welfare Programme**
 - ✓ Integrated Rural Development Programme (IRDP)
 - ✓ National Rural Employment Programme (NREP)
 - ✓ Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)
 - ✓ Special Employment Programme

PULSE POLIO IMMUNIZATION PROGRAMME

Pulse Polio Immunization program was launched in India in **1995**. It is an immunization campaign established by government of India to eliminate poliomyelitis (polio) in India by vaccinating all children under the age of five years against the polio virus. The last polio case in the country was reported from Howrah district of West Bengal with the date of onset from **13th January 2011**. WHO on **24th February 2012** removed India from the list of countries with active endemic wild polio virus transmission.

Polio has been eradicated from most of the world using several key strategies. Each of the following strategies is important components in the National Polio Eradication Programme:

- **Routine Immunization:** Sustaining high levels of coverage with 3 doses of oral polio vaccine in the 0–1-year age group.
- **Supplementary Immunization Activities (SIAs):** Simultaneous administration of oral polio vaccine to all children in the age group of 0-5 years, 4-6 weeks apart to interrupt wild poliovirus transmission and to increase immunity amongst children. SIAs include:
 - ✓ National Immunization Days (NIDs) when the entire country is covered.
 - ✓ Sub National Immunization Days (SNIDs) where some states or parts are covered.
 - ✓ Mop-ups are conducted, as soon as possible after identification of the virus as an end game strategy to interrupt transmission.
- **Surveillance and investigation of cases of Acute Flaccid Paralysis (AFP)**
 - ✓ Surveillance data is used to identify areas of wild poliovirus transmission and to guide immunization activities.

PRACTICAL

DIFFERENTIATE BETWEEN BACTERIA AND VIRUS

| Bacteria | Virus |
|---|--|
| Bacteria is considered as living organism | Virus is not considered as living organism |
| Bacteria do not need host organism for reproduction | Viruses replicate only inside the host |
| Bacteria is larger and visible under light microscope | Virus is smaller and visible under the electron microscope |
| Bacteria contain a Peptidoglycan/Lipopolysaccharide cell wall | Virus contain a protein coat instead of a cell wall |
| Bacteria is unicellular | Virus do not have cells |
| Bacteria is single, circular and chromosome is present | DNA/RNA strand is present |
| Caused localized infections | Caused systemic infection |
| Can be treated with antibiotics | Cannot be treated with antibiotics |

PREPARE A SAMPLE OF IMMUNIZATION

| Vaccine Name | Due age | Dose | Route |
|--------------------------------------|-------------|---------|---------------------|
| <i>For Infants</i> | | | |
| BCG | At birth | 0.05ml | Intra dermal (ID) |
| Hep B-0 | | 0.5ml | Intra muscular (IM) |
| bOPV-0 | | 2 drops | Oral |
| bOPV-1 | At 6 weeks | 2 drops | Oral |
| Pentavalent-1 | | 0.5ml | Intra muscular |
| Fractional IPV | | 0.1ml | Intra dermal |
| Rotavirus | | 5 drops | Oral |
| Pneumococcal Conjugate Vaccine (PCV) | | 0.5ml | Intra muscular |
| bOPV-2 | At 10 weeks | 2 drops | Oral |
| Pentavalent-2 | | 0.5ml | Intra muscular |
| Rotavirus | | 5 drops | Oral |
| bOPV-3 | At 14 weeks | 2 drops | Oral |
| Pentavalent-2 | | 0.5ml | Intra muscular |
| Rotavirus | | 5 drops | Oral |
| Fractional IPV | | 0.1ml | Intra dermal |
| Pneumococcal | | 0.5 ml | Intra muscular |

| | | | |
|--|---|---------|----------------|
| Conjugate vaccine (PCV) | | | |
| Pneumococcal Conjugate Vaccine Booster (PCV-B) (Given at 9 completed months) | At 9-12 months | 0.5ml | Intra muscular |
| Measles/Rubella 1 st dose | | 0.5ml | Sub-cutaneous |
| Japanese Encephalitis 1 st dose | | 0.5ml | Sub-cutaneous |
| Vitamin A 1 st dose (Given at 9 completed months) | | 1ml | Oral |
| For Children | | | |
| DPT booster-1 | At 16-24 months | 0.5ml | Intra-muscular |
| Measles/Rubella 2 nd dose | | 0.5ml | Sub-cutaneous |
| OPV Booster | | 2 drops | Oral |
| Japanese Encephalitis 2 nd dose | | 0.5ml | Sub-cutaneous |
| Vitamin A (2 nd dose to 9 th dose) | At 16 months, then one dose every 6 months | 2ml | Oral |
| DPT Booster-2 | At 5-6 years | 0.5ml | Intra-muscular |
| Td | At 10 years & 16 years | 0.5ml | Intra-muscular |
| For Pregnant Women | | | |
| Td-1 | Early in pregnancy | 0.5ml | Intra muscular |
| Td-2 | 4 weeks after Td-1 | 0.5ml | Intra muscular |
| Td Booster | If received Td doses in a pregnancy within the last 3 years | 0.5ml | Intra muscular |

IMMUNIZATION (CARD) CALENDAR FOR AN INFANT BASED ON DATE OF BIRTH



ENLIST THE DISEASES COVERED UNDER UIP

The program now consists of vaccination for **12** diseases. Those 12 diseases are:

- Tuberculosis
- Diphtheria
- Pertussis (Whooping cough)
- Tetanus
- Poliomyelitis
- Measles
- Hepatitis B
- Diarrhea
- Japanese Encephalitis
- Rubella
- Pneumonia (Haemophiles Influenza Type B)
- Pneumococcal diseases (Pneumococcal Pneumonia and Meningitis)

(Refer theory portion for the following)

KEY COMPONENTS OF A UNIVERSAL IMMUNIZATION PROGRAMME

LIST THE NATIONAL HEALTH PROGRAMMES

KEY COMPONENTS OF PULSE POLIO IMMUNIZATION PROGRAMME

INTERNAL ASSESSMENT

- a) Differentiate between Active and Passive Immunity
- b) What is the importance of Immunization?
- c) What are the key components of UIP?
- d) What are the key components of Pulse Polio Immunization Programme?
- e) Differentiate between bacteria and virus.
- f) Prepare a sample of Immunization scheduled chart.

Unit 5

DRUG ADMINISTRATION AND PHYSIOTHERAPY

DRUG ADMINISTRATION

INTRODUCTION-

The administration of a medicine is a common but important clinical procedure. It is the manner in which a medicine is administered that will determine to some extent whether or not the patient gains any clinical benefit, and whether they suffer any adverse effect from their medicines.

DEFINITION-

This is the process of giving out medication to the patients in order to treat or prevent disease or complication.

CLASSIFICATION OF MEDICATION GROUP-

Classifications drugs

- Drugs can be categorized in a number of ways. In pharmacology, a drug can be classified by its chemical activity or by the condition that it treats.
- In general, drugs are classified based on
 - Therapeutic classification
 - Pharmacologic classification (based on mechanism of action and mode of action)
 - Chemical classification
 - Amalgamated classification
 - Legal classification (Controlled Substances, Drug Schedules, and Teratogenic Risks)

Table 1 : Classification of drugs

USP Drug Classification

- a) Analgesics, including opioids and non-opioid –Analgesic also called pain killers are the medication that relieves different type of pain.
- b) Anesthetics -These are the drugs that can be used intravenously to produce anesthesia or sedation.
- c) Antibacterials –These are the drugs that able to destroy or to inhibit the development / growth of bacteria.
- d) Anticonvulsants-A drug or other substance used to prevent or stop seizures or convulsion.
- e) Antidementia agents –These are the pharmaceutical agent that are used not only to improve cognitive function but also to treat behavioural symptoms .
- f) Antidepressants –These are drugs used to treat the major depressive disorder.
- g) Antidotes and antitoxins.-Antidote is a substance that can counteract a form of poisoning and antitoxins is an antibody that counteracts a toxins.
- h) Antiemetics - It is the group of drug that is effective against vomiting and nausea

LEGAL ASPECT OF RECORD KEEPING AND DOCUMENTATION

DEFINITION: The legal health record is the documentation of healthcare services provided to an individual during any aspect of health care delivery in any type of healthcare organization. It is consumer or patient-centric. The legal health record contains individually identifiable data, stored on any medium and collected and directly used in documenting healthcare or health status.

LEGAL ASPECTS:

- Police authorities and court can summon medical records under the due process of law.
- Limitation period for filing a case paper is maximum up to 3 years under limitation Act
- According to the consumer protection act it is up to 2 years.

Legal aspects of medical record in India-

- Confidentiality
 - A. Identification data
 - B. Clinical data
- Ownership and recording
- Students focus on legal ethics
- Property law
- Employment law
- Environmental law
- Avoid negligence

SEVEN RIGHTS DURING ASSISTING THE DRUG ADMINISTRATION-

7 Rights of Medication Administration

- Right Medication. ...
- Right Child. ...
- Right Dose. ...
- Right Time. ...
- Right Route. ...
- Right Reason. ...
- Right Documentation.

DIFFERENT FORMS OF MEDICINE-

- Liquid- The active part of the medicine is combined with a liquid to make it easier to take or better absorbed.
- Tablet.-The active ingredient is combined with another substance and pressed into a round or oval solid shape.
- Capsules.- it includes medication that's enclosed in an outer shell.
- Topical medicines.- It's a medication that is applied to a particular place on or in the body.
- Suppositories - These are solid medication that enter the body through the rectum, vagina or urethra.
- Drops.
- Inhalers.- An inhaler is a device that gets medicine directly into a person's lungs.
- Injections- An injection is the act of administering a liquid, specially a drug, into a person's body using needle and a syringe .

IMPORTANCE OF FORMS V/S ROUTE IN DRUG ADMINISTRATION-

1. To provide drug products that bypass the first-pass metabolism e.g., injections, topical dosage forms etc.
2. To protect the drug substance from the destructive influence of atmospheric oxygen or humidity e.g., coated tablets.
3. To protect the active pharmaceutical ingredients (APIs) from the destructive influence of gastric acid following oral administration of the dosage form e.g., enteric-coated tablets.
4. To mask the bitter, salty, or undesirable taste or odor of drug substances e.g., capsules, coated tablets, taste-masked suspensions, and flavored syrup.
5. To provide useful dosage form for administering substances that are either insoluble or unstable in the desired vehicle e.g., suspensions.
6. To provide rate-controlled drug action e.g., various controlled-release tablets, capsules, and suspensions.
7. To provide drug products that are stable, effective, and safe for consumption under specified suitable storage conditions e.g., powders for reconstitution.
8. To provide optimal drug action from topical administration sites g., creams, transdermal patches, ointments, and ophthalmic, ear, and nasal preparations.
9. To provide sterile, clear, and particulate-free liquid dosage forms of substances e.g., injections and eye drops.

10. To provide site-specific and local drug delivery e.g., rectal and vaginal suppositories.
11. To target the drug at the desired site of action e.g., , liposomes, etc.
12. To achieve rapid onset of action through inhalation therapy e.g., inhalants and inhalation aerosols.

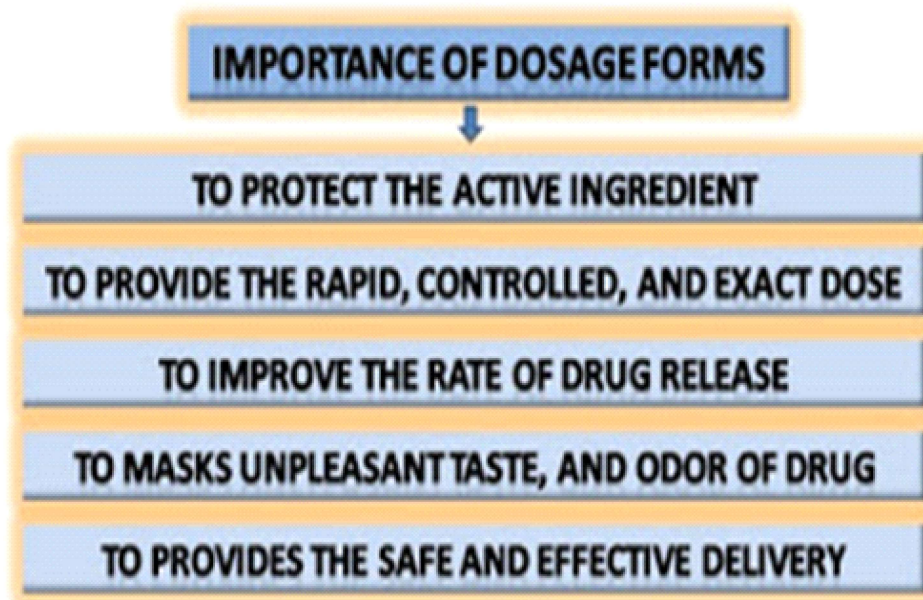


Fig 2: Importance of dosage forms

What are the most important routes of drug administration?

- Oral administration. This is the most frequently used route of drug administration and is the most convenient and economic.
- Sublingual.
- Rectal administration.
- Topical administration.
- Parenteral administration.
- Intravenous injection.

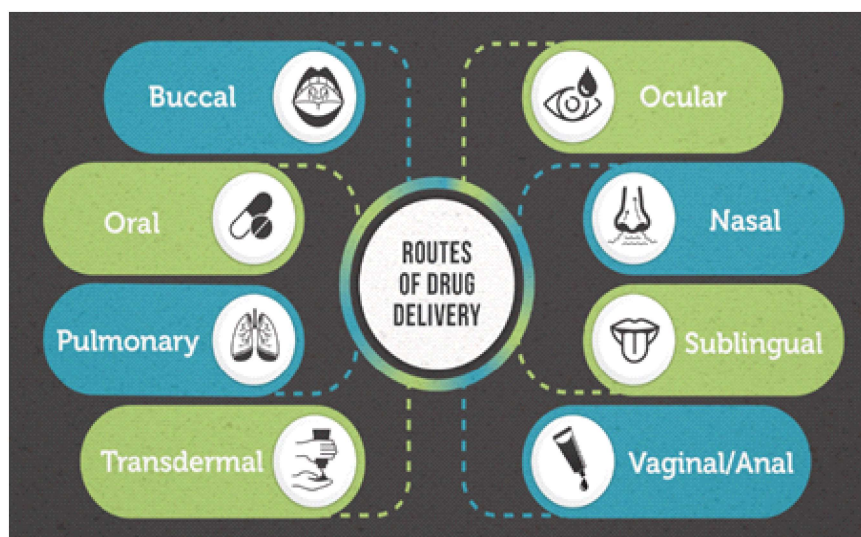


Fig 3: Routes of Drug Delivery to our body

READ INSTRUCTION OF MEDICATION

There's a lot of important information that comes with the medicine you buy at a pharmacy. The Drug Facts panel on an over-the-counter med lets you know how to take it, what's in it, and how it might make you feel. But the way that info is written can make it tricky to understand. Here's how to make sense of drug labels so you can avoid common, possibly dangerous mistakes.

How to read a medicine label (and why you always should)

1. Purpose. All over-the-counter medicines will clearly state what they're meant to do on the packet. ...
2. Directions. ...
3. Warnings. ...
4. Expiry date. ...
5. AUST R and L numbers. ...
6. Storage conditions. ...
7. Batch number and supplier's name.

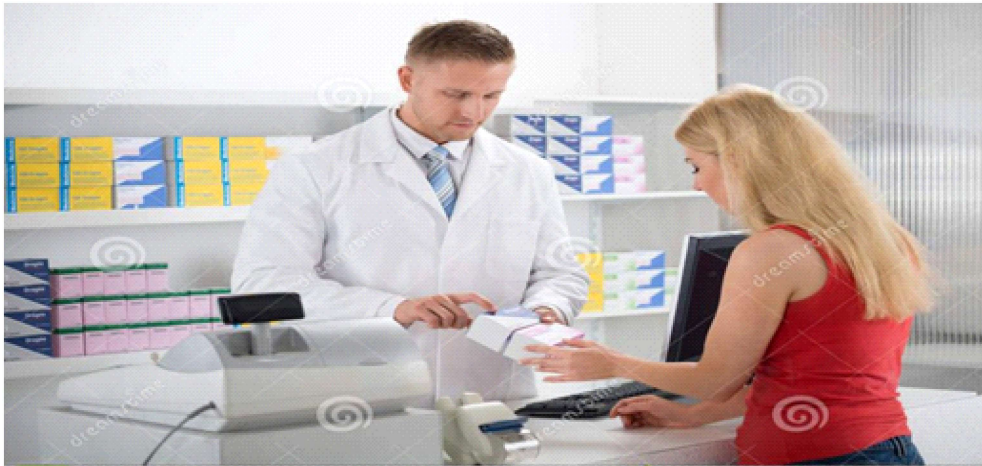


Fig 4: Purchasing of medicine from Pharmacy.

VAROIOUS SIGNS OF ALLERGY-

Drug allergy signs and symptoms may include:

- Skin rash.
- Hives.
- Itching.
- Fever.
- Swelling.
- Shortness of breath.
- Wheezing.
- Runny nose.

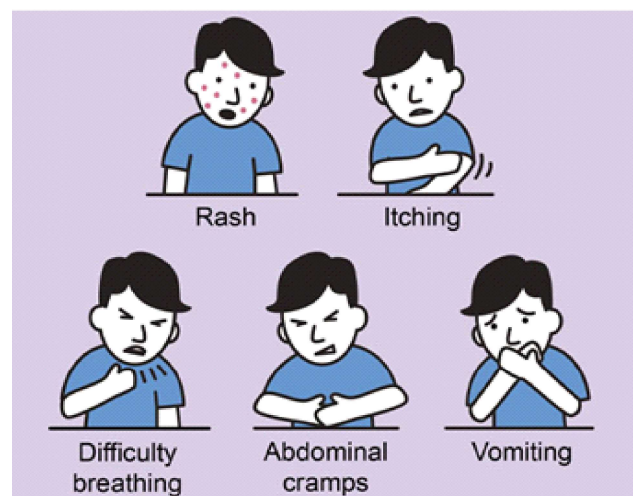


Fig 5: Signs of drug allergy

STANDARD ABBREVIATION USED IN MEDICATION CHART-

FREQUENCIES-

- OD- once daily
- BID- twice daily
- TID- thrice daily
- QID- four times a day
- QHS- before bed time
- Q4H- every 4 hours
- STAT- immediately
- PRN- as needed
- AC-before meals
- PC- after meals

ROUTES-

- PO- by mouth
- IM-intramuscular
- IV- intravenous
- IVP-intravenous push
- SC-subcutaneous
- PR-rectal
- ID-intradermal
- TPN-total parenteral nutrition
- NPO-nothing by mouth

❖ INDICATION , CONTRAINDICATION AND SIDE EFFECT OF DRUG ADMINISTRATION –

- ✓ In medical terminology, an “indication” for a drug refers **to the use of that drug for treating a particular disease**. For example, diabetes is an indication for insulin. Another way of stating this relationship is that insulin is indicated for the treatment of diabetes.
- ✓ A contraindication is a **specific situation in which a drug, procedure, or surgery should not be used because it may be harmful to the person**. There are two types of contraindications: Relative contraindication means that caution should be used when two drugs or procedures are used together.
- ✓ Side effects are **unwanted effects of a medicine**. All medicines can cause side effects

Some common examples mild adverse/ side effects related to drugs include:

- Constipation.
- Skin rash or dermatitis.
- Diarrhea.
- Dizziness.
- Drowsiness.
- Dry mouth.
- Headache.

CLASSIFICATION OF DRUGS -

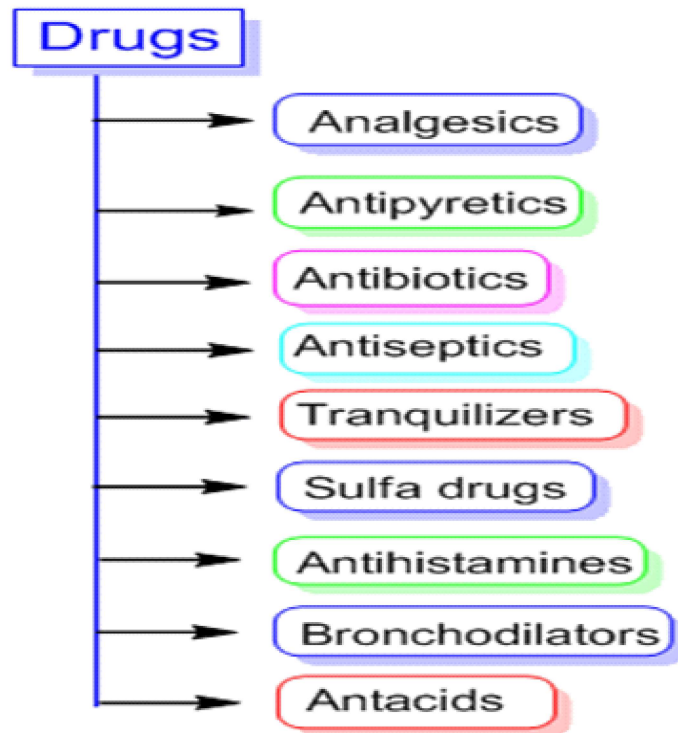


Fig 6: Classification of drugs

DRUGS OF DIFFERENT CATEGORY-

- Depressants. Some of the most commonly found types of drugs in society are depressants. ...
- Stimulants. Stimulants, such as caffeine or nicotine, work in the opposite manner. ...
- Opioids. The opioid addiction crisis has affected our society to a grave degree. ...

COMMON- SIDE OF ANTIDEPRESSANT-

- feeling agitated, shaky .
- feeling and being sick.
- indigestion and stomach aches.
- diarrhoea or constipation.
- loss of appetite.
- dizziness.
- not sleeping well (insomnia), or feeling very sleepy.
- headaches.

TECHNIQUE OF DISPOSING MEDICINE-

Apart from incineration (used for pathological and pharmaceutical waste disposal), there are other biomedical waste disposal methods, like autoclave chambers (sharps and infectious waste disposal), or the use of a medical wasteshredder. Here at Celitron, you can find autoclaves in different sizes. And follow the bio-medical waste management process.

Disposal of Unwanted Medicines

In some cases, medicines are not entirely consumed due to:

- Change in prescription
- Patient's health improves before finishing medicine
- Patient death
- Patient non-compliance
- Expiration date reached
- Bulk "economy size" containers of over-the-counter medicines contain more than is needed




Fig 7: Disposal of Unwanted Medicine

METHODS OF DISPOSING MEDICINE-

Tablets and capsules can be destroyed disposing them in a bucket of water. Using landfill procedure as per medical waste disposal method. Pouring the liquids into the sink and washing away with sufficient water. Keeping a record of all such disposal with full details of medicines destroyed.

How to Safely Dispose Medicine

- Mix medicines (do not crush tablets or capsules) with an unpalatable substance such as kitty litter or used coffee grounds.
- Place the mixture in a container such as a sealed plastic bag.
- Throw the container in your household trash.

Follow these simple steps to dispose of medicines in the household trash

MIX
Mix medicines (do not crush tablets or capsules) with an unpalatable substance such as dirt, cat litter, or used coffee grounds;



PLACE
Place the mixture in a container such as a sealed plastic bag;



THROW
Throw the container in your household trash;



SCRATCH OUT
Scratch out all personal information on the prescription label of your empty pill bottle or empty medicine packaging to make it unreadable, then dispose of the container.



Fig 8: Disposal of medicine in household trash

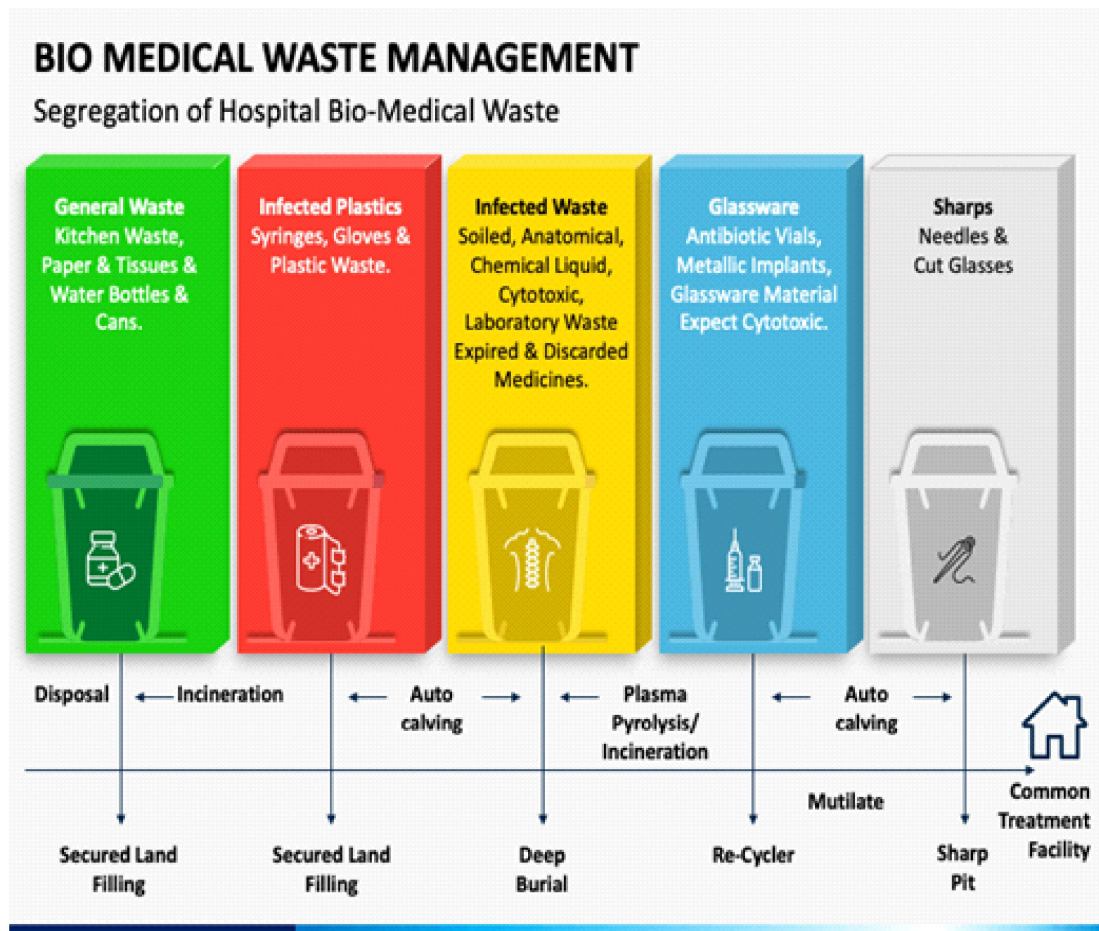


Fig 9: Biomedical Waste Management showing the disposal of used medicine packets and vials

PREVENTIVE MEASURES TO CONTROL THE MISTAKE IN DRUG ADMINISTRATION-

One of the recommendations to reduce medication errors and harm is to use the “five rights”: **the right patient, the right drug, the right dose, the right route, and the right time.**

Here are some drug safety tips:

1. Know the various risks and causes for medication errors. ...
2. Find out what drug you’re taking and what it is for. ...
3. Find out how to take the drug and make sure you understand the directions. ...
4. Check the container’s label every time you take a drug. ...
5. Keep drugs stored in their original containers.

TABLE 2 HOW TO REDUCE MEDICATION ERRORS

Here are 12 tips to help avoid hazardous missteps when prescribing medications for children:

- 1** Confirm that the patient's weight is correct, write weight on each order written, and make sure that weight-based dose does not exceed the adult dose.
- 2** Ensure that calculations are correct.
- 3** Induce dose and volume of medication when appropriate and specify the exact dosage strength to be used.
- 4** Write intravenous fluid orders clearly, ensuring that additives are quantified per liter and rates noted per hour.
- 5** Write out all instructions rather than using abbreviations, and make instructions specific.
- 6** Avoid use of a terminal zero to the right of the decimal point to minimize 10-fold dosing errors (ie, use 5 milliliters rather than 5.0 milliliters).
- 7** Use a zero to the left of a dose less than 1 to avoid 10-fold dosing errors (ie, use 0.1 milliliters rather than .1 milliliters).
- 8** Do not abbreviate drug names, use generic medication names rather than trade names, and spell out dosage units rather than using abbreviations.
- 9** Use computerized order entry systems and standing order sets when available.
- 10** When prescribing outpatient medications, always ask the pharmacist to dispense an appropriate measuring device.
- 11** Avoid use of verbal orders when possible.
- 12** Recommend that nurses and pharmacists always check medication calculations.

From Stucky ER, et al.⁶

Table 2: Steps to reduce the medication errors

MEDICAL ERROR IN DRUG ADMINISTRATION

Types of Medication Errors

- Prescribing Errors
- Omission Errors
- Wrong Time Errors
- Unauthorized Drug Errors
- Improper Dose Errors
- Wrong Dosage Form Errors
- Wrong Drug Preparation Errors
- Wrong Administration Technique Errors
- Deteriorated Drug Errors
- Monitoring Errors
- Compliance Errors

Table 3: Types of medication error

PHYSIOTHERAPY

INTRODUCTION-

“Physiotherapy is a dynamic profession, which uses a range of treatment techniques to restore movement and function within the body.” The aim of physiotherapy is to **optimize someone’s range of movement and function** whilst at the same time reducing pain and preventing recurrence.

DEFINITION-

The treatment of disease, injury, or deformity by physical methods such as massage, heat treatment, and exercise rather than by drugs or surgery.

HOLISTIC APPROACH USED IN PHYSIOTHERAPY-

A holistic approach utilizes the traditional methods of injury recovery and combines them with other techniques such as chiropractic care, massage, nutrition and a structured fitness routine.

BASIC PRINCIPLE OF PHYSIOTHERAPY-

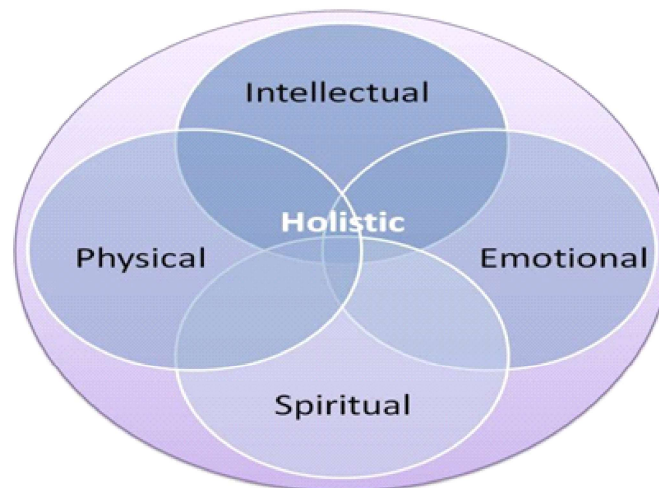


Fig 10 (a): Holistic Approach used in Physiotherapy



Fig 10 (b): Holistic Approach used in Physiotherapy

BASIC PRINCIPLE OF PHYSIOTHERAPY-

The basic principle of physical therapy-

Physical therapist practice is guided by a set of seven core values: accountability, compassion/caring, excellence, integrity, professional duty, and social responsibility. Throughout the document the primary core values that support specific principles are indicated in parentheses.

| <u>PRINCIPLES OF PHYSIOTHERAPY</u> |
|--|
| • Decrease pain & facilitates healing of inflamed & injured neurological & musculoskeletal tissues. |
| • Maintain normal range of motion in affected joints, i.e. hind & fore limb. |
| • Prevent soft tissue contracture & fibrosis in weak or paralyzed limbs. |
| • Prevent further disuse atrophy of affected musculature of hind limb/fore limb during the healing process. |
| • Improve strength & function of weak or paralyzed limbs. |
| • Maximize post-surgical recovery & function of the patient. |
| • Provide +ve psychological effects for the patient & owner. |

Table 4: Principles of Physiotherapy

DIFFERENT TECHNIQUE OF PHYSIOTHERAPY-

Our range of physiotherapy treatments (provided in the clinic or during a home visit) includes:

- Massage + Lymphatic drainage.
- TENS.
- Magnetic Therapy.
- Dry Needling & Acupuncture.
- Taping.
- Kinesiology and Kinetic Link Training.
- Exercise Physiology.
- Soft Tissue Treatment.



Fig 11(a) : Techniques of physiotherapy



Fig 11(b) : Techniques of physiotherapy

SCOPE OF PHYSIOTHERAPY IN DIFFERENT CONDITION OF PATIENT-

Physiotherapy is treatment to restore, maintain, and make the most of a patient’s mobility, function, and well-being. Physiotherapy helps through physical rehabilitation, injury prevention, and health and fitness. Physiotherapists get you involved in your own recovery.



Fig 12 : Scopes of Physiotherapy

❖ BODY MECHANISM-

INTRODUCTION-

Body mechanics is a term used to describe the ways we move as we go about our daily lives. It includes how we hold our bodies when we sit, stand, lift, carry, bend, and sleep. Poor body mechanics are often the cause of back problems.

DEFINITION-

Body mechanics refers to the way you hold your body when you move around. Proper body mechanics help you avoid muscle fatigue and injuries as you walk, bend over, lift objects, or perform other activities of daily living.

MOVING AND POSITION OF THE PATIENTS-

- **MOVING OF PATIENTS-** Moving or repositioning patients within their beds, from bed to bed, bed to chair, or otherwise from one posture or surface to another.

Technique of moving of patients-

Put one of your arms under the patient's shoulders and one behind the knees. Bend your knees. Swing the patient's feet off the edge of the bed and use the momentum to help the patient into a sitting position. Move the patient to the edge of the bed and lower the bed so the patient's feet are touching the ground.eg-

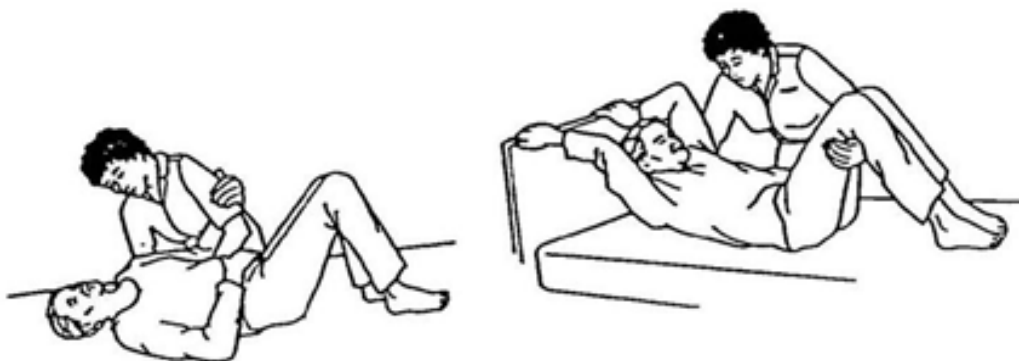


Fig 13 : Techniques of moving a patient

- **POSITIONING OF PATIENTS-**

Patient positioning involves properly maintaining a patient's neutral body alignment by preventing hyperextension and extreme lateral rotation to prevent complications of immobility and injury.eg-

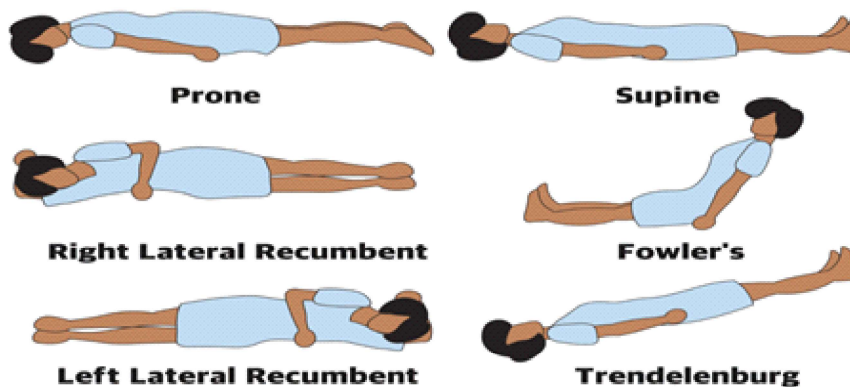


Fig 14(a): Types of position

DIFFERENT POSITION OF PATIENTS MEDICAL TREATMENT-

Common Patient Positions-

- Fowler's Position. Fowler's position, also known as sitting position, is typically used for neurosurgery and shoulder surgeries.
- Supine Position.
- Prone Position.
- Lithotomy Position.
- Sim's Position.
- Lateral Position.



Fig 14(b): Types of position

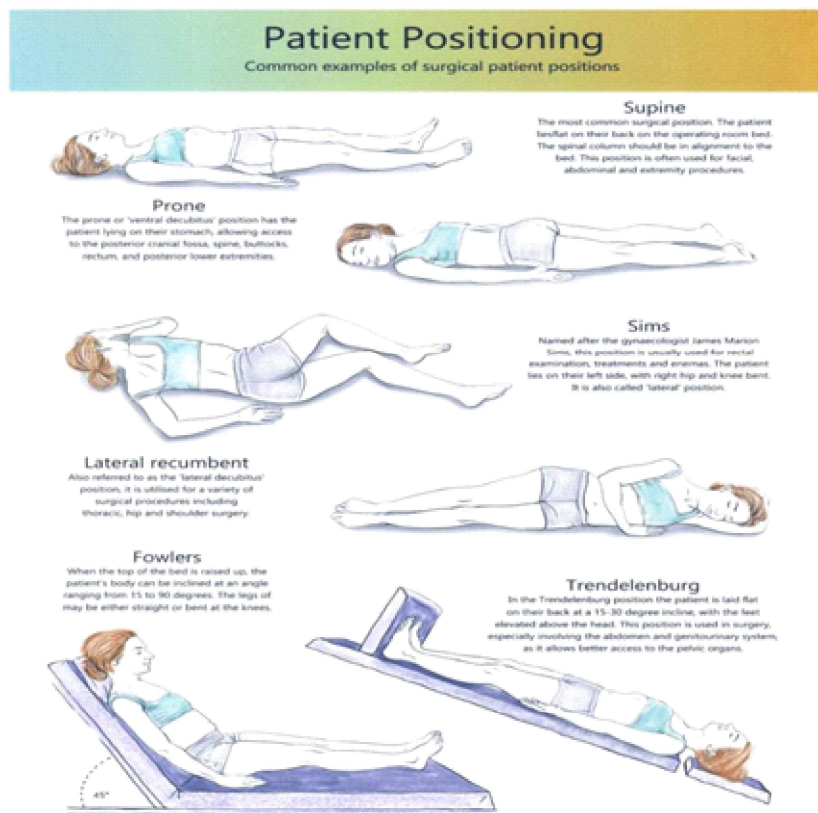


Fig 14(c): Types of position

TECHNIQUES OF BODY MECHANICS

LIFTING:

1. Use the stronger leg muscles for lifting.
2. Bend at the knees and hips; keep your back straight.
3. Lift straight upward, in one smooth motion.

REACHING:

1. Stand directly in front of and close to the object.
2. Avoid twisting
3. Overstretching.
4. Use a stool or ladder for high objects.
5. Maintain a good balance and a firm base of support.
6. Before moving the object, be
7. Ensure that it is not too large or too heavy.

PIVOTING:

1. Place one foot slightly ahead of the other.
2. Turn both feet at the same time, pivoting on the heel of one foot and the toe of the other.
3. Maintain a good center of gravity while holding or carrying the object.

AVOID STOOPING:

1. Squat (bending at the hips and knees).
2. Avoid stooping (bending at the waist).
3. Use your leg muscles to return to an upright position

GENERAL CONSIDERATIONS FOR PERFORMING PHYSICAL TASKS

1. It is easier to pull, push, or roll an object than it is to lift it.
2. Movements should be smooth and coordinated rather than jerky.
3. Less energy or force is required to keep an object moving than it is to start and stop it.
4. Use the arm and leg muscles as much as possible, the back muscles as little as possible.
5. Keep the work as close as possible to your body. It puts less of a strain on your back, legs, and arms.
6. Rock backward or forward on your feet to use your body weight as a pushing or pulling force.
7. Keep the work at a comfortable height to avoid excessive bending at the waist.
8. Keep your body in good physical condition to reduce the chance of injury.

REASONS FOR THE USE OF PROPER BODY MECHANICS

Use proper body mechanics in order to avoid the following:

1. Excessive fatigue.
2. Muscle strains or tears.
3. Skeletal injuries.
4. Injury to the patient.
5. Injury to assisting staff members.

Steps Involved in Properly Moving an Object to a New Location

- i) Identify the object to be moved.
- ii) Adopt a stable base of support.
 1. Your feet are separated.
 2. One foot is behind the other.
 3. Your back is straight
- iii) Grasp the object at its approximate center of gravity.
- iv) Pull the object toward your body's center of gravity using your arm and leg muscles.
- v) Re-establish your base of support and appropriate body alignment.
 1. Your back is straight.
 2. You have a stable base of support.
 3. You are holding the object approximately at waist height and close to your body
- vi) Pivot toward the desired direction of travel.
 1. Turn on both feet at the same time.
 2. Maintain a stable balance.
- vii) Re-establish a stable base of support and appropriate body alignment.
 1. Your back is straight.
 2. Your feet are apart, one slightly behind the other.
 3. The object is at hip level, close to your body.
- viii) Squat and place the object onto the lower area.
 1. Bend at the knees and hips.
 2. Maintain a straight back.
 3. Maintain a stable base of support.
 4. Use your arm and leg muscles (as needed) for guidance.
- ix) Use your leg muscles to resume an upright position

EXERCISE

Definition

Exercise is physical activity that is planned, structured, and repetitive for the purpose of conditioning any part of the body. Exercise is used to improve health, maintain fitness and is important as a means of physical rehabilitation.

Purpose

Exercise is useful in preventing or treating coronary heart disease, osteoporosis, weakness, diabetes, obesity, and depression. Range of motion is one aspect of exercise important for increasing or maintaining joint function. Strengthening exercises provide appropriate resistance to the muscles to increase endurance and strength. Cardiac rehabilitation exercises are developed and individualized to improve the cardiovascular system for prevention and rehabilitation of cardiac disorders and diseases. A well-balanced exercise programme can improve general health, build endurance, and slow many of the effects of aging. The benefits of exercise not only improve physical health, but also enhance emotional well-being.

Precautions

Before beginning any exercise programme, an evaluation by a physician is recommended to rule out potential health risks. Once health and fitness level are determined and any physical restrictions identified, their individual's exercise programme should begin under the supervision of a healthcare or other trained professional. This is particularly true when exercise is used as a form of rehabilitation. If symptoms of dizziness, nausea, excessive shortness of breath

Or chest pain are present during exercise, the individual should stop the activity and inform physician about these symptoms before resuming activity. Exercise equipment must be checked to determine if it can bear the weight of people of all sizes and shapes. Individuals must be instructed in the proper use of exercise equipment in order to prevent injury.

Range of Motion Exercise

Range of motion exercise refers to activity aimed at improving movement of a specific joint. This motion is influenced by several structures: configuration of bone surfaces within the joint, joint capsule, ligaments, tendons, and muscles acting on the joint. There are three types of range of motion exercises: passive, active, and active assists.

Passive range of motion is movement applied to a joint solely by another person or persons or a passive motion machine. When passive range of motion is applied, the joint of an individual receiving exercise is completely relaxed while the outside force moves the body part, such as a leg or arm, throughout the available range. Injury, surgery, or immobilization of a joint may affect the normal joint range of motion.

Active range of motion is movement of a joint provided entirely by the individual performing the exercise. In this case, there is no outside force aiding in the movement. Active assist range of motion is described as a joint receiving partial assistance from an outside force. This range of motion may result from the majority of motion applied by an exerciser or by the person or persons assisting the individual. It also may be a half-and-half effort on the joint from each source.

Preparation

A physical examination by a physician is important to determine if strenuous exercise is appropriate or detrimental for an individual, especially when the exercise programme is designed for rehabilitation. Before exercising, proper stretching is important to prevent the possibility of soft tissue injury resulting from tight muscles, tendons, ligaments, and other joint-related structures. It is still a need for further studies to identify potential risks.

Aftercare

Proper cool down after exercise is important in reducing the occurrence of painful muscle spasms. Proper cool down stretching also may decrease frequency and intensity of muscle stiffness the day following any exercise program.

Risks

Improper warm up can lead to muscle strains. Overexertion without enough time between exercise sessions to recuperate also can lead to muscle strains, resulting in inactivity due to pain. Stress fractures also are a possibility if activities are strenuous over long periods without proper rest. Although exercise is safe for the majority of children and adults, there

Normal Results

Significant health benefits are obtained by including a moderate amount of physical exercise in the form of an exercise prescription. This is much like a drug prescription in that it also helps enhance the health of those who take it in the proper dosage. Physical activity plays a positive role in preventing disease and improving overall health status. People of all ages, both male and female, benefit from regular physical activity. Regular exercise also provides significant psychological benefits and improves quality of life.

Abnormal Results

Exercise burn out may occur if an exercise programme is not varied and adequate rest periods are not taken between exercise sessions. Muscle, joint, and cardiac disorders have been noted among people who exercise. However, they often have had preexisting or underlying illnesses

Range of Motion Exercises

Different types of range of motion exercises will be more effective for different patients. With the goal of developing full and normal function of patient's joints, doctor may recommend that patient utilize active ROM exercises, active-assisted ROM exercises, or passive ROM exercises. Patients living with arthritis, sports-related injuries, or healing after joint surgery will likely begin the healing process with passive ROM exercises when he cannot perform the exercise alone, then move to active assisted ROM exercises that include the assistance of a therapist or trainer, and finally to active ROM exercises as he gains strength and can perform the exercises alone.

Active Range of Motion Exercise

Range of motion (ROM) refers to how far a joint moves during exercise and physical therapy. Muscle strength and flexibility are the key components to movement. Lack of activity due to injury or disease lead to a decline in these two vital functions. Range of motion helps maintain movement by stretching the muscles and moving the joints. The terms active and passive define the energy behind the movement.

Active range of motion is exercises patient do on their own. Active ranges of motion exercises are for people trying to increase or maintain flexibility on their own. They require no assistance to perform simple movements, such as arm circles or flexing of fingers. Passive range of motion refers to someone physically moving a part of patient's body. This requires no effort on the part of the patient. For instance, a therapist may grasp patient's arm gently and move it in a circular motion. For active, patient move the arm; for passive, someone else moves it.

ROM exercises are vital-whether passive or active Range of motion helps maintain mobility. Without ROM, some patients lose the flexibility in their joints. For those able to move on their own, active range of motion keeps muscles supple and functioning as well as increasing joint flexibility. Passive ROM prevents bed-ridden or immobile people from developing muscle atrophy, or shortening. Without any ROM, joints eventually lock.

Selection of Active or Passive Range of Motion

The decision to use active or passive range of motion is dependent on a number of factors. Some people are incapacitated by injury or illness. For these people, passive is the only form of exercise available. Passive ROM is sometimes a testing tool to determine how far a joint can flex. Joints often have better range of motion passively than actively. A person suffering from muscle or nerve damage may benefit from passive ROM even if he can move on his own, because joints can flex further.

Active exercise is necessary to build up muscles

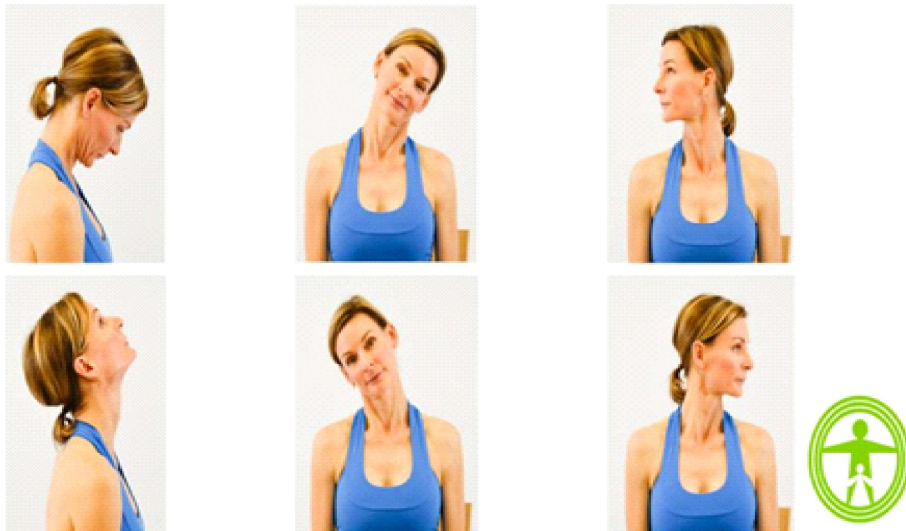
Active range of motion helps build muscle strength. This means improving the fitness of the muscles and joints at the same time. If a person is able to fully move the limb, active exercises are better to improve toning and strength. Passive ROM only keeps joints flexible. Passive exercise provides just enough movement to maintain joint flexibility.

Neck exercises:

Starting position: Patient may sit or stand with face forward. Patient's shoulders should be straight and relaxed.

- Head tilts, forward and back: Gently bow head and try to touch chin to chest. Raise chin back to the starting position. Tilt head back as far as possible so patient is looking up at the ceiling. Return head to the starting position.
- Head tilts, side to side: Tilt head to the side, bringing ear toward shoulder. Return head to the starting position.
- Head turns: Turn head to look over shoulder. Tilt chin down and try to touch it to shoulder. Do not raise shoulder to chin.

Neck Range of Motion Exercises



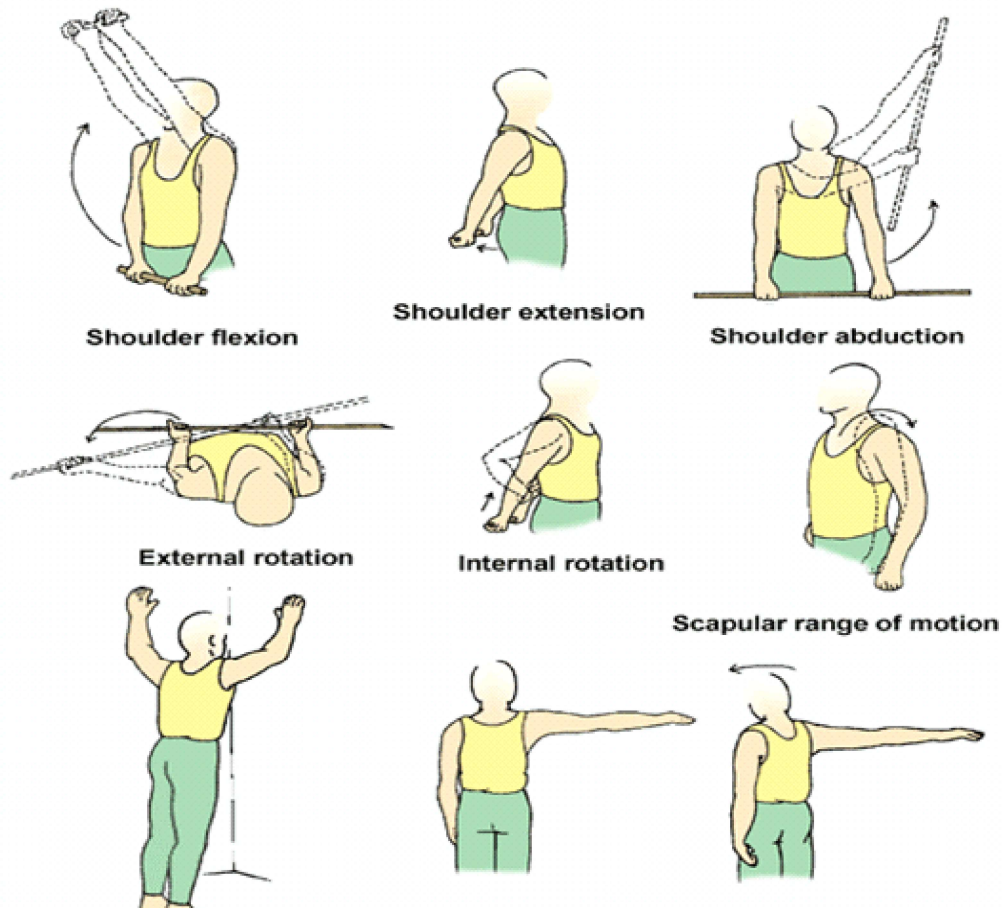
Shoulder and elbow exercises:

Starting position: Stand or sit. Hold arm straight down at side. Face palms in toward body. It is best to use a chair without arms if patient is in a sitting position.

- Shoulder movement, up and down: Raise arm forward and then up over head. Try to raise it so that inner arm touches ear. Bring arm back down to side. Bring it back as far as possible behind body. Return arm to the starting position.
- Shoulder movement, side to side: Raise arm to the side and then up over head as far as possible. Return arm to side. Bring arm across the front of body and reach for the opposite shoulder. Return arm to the starting position.

- Shoulder rotation: Raise both shoulders up toward ears, as if patient were trying to shrug. Lower them to the starting position, and relax shoulders. Pull shoulders back. Then relax them again. Roll shoulders in a smooth circle. Then roll shoulders in a smooth circle in the other direction.
- Elbow bends: With palm facing forward, bend elbow. Try to touch shoulder with fingertips.

Frozen Shoulder Exercises



Arm and wrist exercises:

Starting position: Sit down. Bend elbow and rest forearm on a flat surface, such as a table or lap. Make sure wrist hangs loosely over the side.

- Wrist bends: Bend hand back toward wrist so that fingers point toward the ceiling. Then bend hand down so that fingers point toward the floor.
- Wrist rotation: Move hand from side to side. Then roll hand in circles in one direction. Roll and in circles in the other direction.
- Palm up, palm down: Stay in the same position, but tuck bent elbow against side. Face palm down. Turn palm so that it faces up toward the ceiling. Then turn palm so it faces down.

Hand and finger exercises: Starting position: Sit or stand. Place hand out in front of patient.

- Finger bends: Make a tight fist. Then open and relax hand.
- Finger spreads: Open hand and stretch the fingers as far apart as possible. Bring fingers together again.
- Finger-to-thumb touches: One at a time, touch each fingertip to the pad of thumb.
- Thumb-to-palm stretches: Move thumb and rest it across palm. Move it out to the side again.

Hip and knee exercises: Starting position: If patient have had a hip injury or surgery, hip exercises directed by caregiver only. Lie flat on the bed with legs flat and straight.

- Hip and knee bends: Point toes. Slowly bend knee up as close to chest as possible. Straighten leg and return it to a flat position on the bed.
- Leg lifts: Raise leg so that foot is 6 to 12 inches (15 to 31 centimeters) off the bed. Hold it in the air. Return leg to the bed.
- Leg movement, side to side: Flex foot so that toes point up toward the ceiling. Move leg out to the side as far as possible. Bring leg back to the middle.
- Leg rotation, in and out: Put leg flat on the bed. Roll leg toward the middle so that big toe touches the bed. Then roll leg out and try to make smallest to touch the bed.
- Knee rotation, in and out: Lie on back on the bed. Bend knee so the bottom of that foot is flat on the bed. Slide heel towards buttocks. Return foot to the starting position.
- Spread toes apart. Bring them together again.

Ankle and foot exercises: Starting position: Sit in a chair with both feet flat on the floor.

- Ankle bends: Keep toes on the floor and raise heel as high as patient can. Lower heel. Then keep heel on the floor and raise toes as high as patient can.
- Ankle rotation: Raise foot slightly off the floor. Roll ankle in circles. Then roll ankle in circles in the other direction.
- Toe bends: Curl toes down toward the sole (bottom) of foot. Straighten them. Curl them up toward the ceiling. Then straighten them again.
- Toe spreads: Spread toes apart. Bring them together again.

PASSIVE RANGE OF MOTION

Passive range of motion exercises helps keep a person's joints flexible, even if he cannot move by himself/herself. Range of motion is how far the person's joints can be moved in different directions.

The exercises help patient move all the person's joints through their full range of motion. The following are some important points to be kept in mind while giving passive exercises:

- Regular movement helps prevent contractures (permanent shortening of a muscle or joint). Contractures are severely tightened joints and muscles. It develops when the stretchy (elastic) tissues are replaced by non-stretchy (inelastic) fibre-like tissues.
- Patient may do the exercises in any order. Patient may spread the exercises out over the course of the day. All the exercises may be done while the person lies in bed.
- Move the person slowly, gently, and smoothly. Avoid fast or jerky motions.
- Support the area near the joint as shown by the person's caregiver. Move the person's body part with your other hand.
- Each joint should be moved as far it will go. Move each joint to the point where patient feel some resistance. The person may feel discomfort, but do not push to where it hurts. Hold the position a few seconds, and then return the person to a resting position.
- Perform the exercises on both sides. Perform each group of exercises on one side, and then do the same exercises on the other side.

Neck Exercises

Support the person's head with your hands. Gently return the person's head to the middle, facing forward, after each exercise.

- **Head turns:** Turn the person's head to the side. Then turn his head to the other side.
- **Head tilts:** Tilt the person's head, bringing his ear toward his shoulder. Then tilt his head toward the other shoulder
- **Chin-to-chest:** Gently bow the person's head toward his chest.

Shoulder and Elbow Exercises

Support the person's elbow with one hand. Hold his wrist with your other hand.

- **Shoulder movement, up and down:** Raise the person's arm forward and then up over his head. Bring his arm back down to his side.
- **Shoulder movement, side to side:** Raise the person's arm to the side as far as it will go. Bring his arm back down to his side.
- **Elbow bends:** Place the person's arm at his side with his palm facing up. Bend and straighten his arm.



Forearm and Wrist Exercises

Support the person's wrist with one hand. Hold his fingers with your other hand.

- **Wrist bends:** Bend the person's hand back toward his
- **Wrist rotation:** Rock the person's hand back and forth
- **Palm up, palm down:** Tuck the person's elbow against



Hand and Finger Exercises

Hold the person's hand with both of your hands. Hold his hand out toward yourself, with his fingers long.

- **Finger bends:** Curl the fingers into a fist. Straighten the fingers again. Curl and straighten each finger one at a time. Curl and straighten the thumb.
- **Fingerspreads:** Spread the thumb and first finger apart, and then bring them back together. Spread the first finger and middle finger apart, and then bring them back together. Perform the same with the rest of the fingers.
- **Finger-to-thumb touches:** Touch the person's fingertips to the pad of his thumb, one finger at time.
- **Finger rotations:** Roll each finger in a circle in one direction. Roll each finger in the other direction. Roll the thumb in each direction.
- **Hip and Knee Exercises:** Start with person's legs. Put one hand under his knee. Hold his ankle with your other hand.
- **Hip and knee bends:** Slowly bend the person's knee up as close to his chest as possible. Then gently straighten the leg.

- **Leg movement, side to side:** Move one leg out to the side, away from the other leg. Bring the leg back to the middle and cross it over the other leg.
- **Leg rotation, in and out:** Roll one of the person's legs toward the other leg so his toes point in. Then roll his leg out toward the side so his toes point out.

Ankle and Foot Exercises

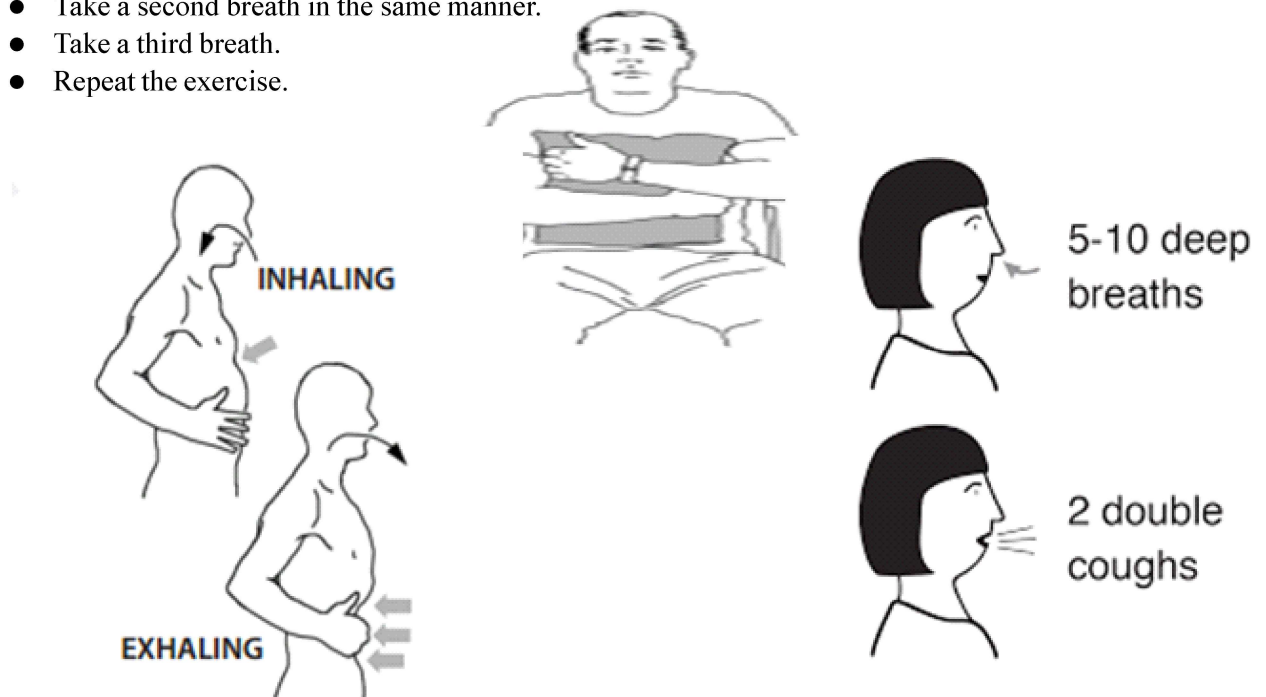
Put a rolled towel under the person's knee. For the ankle exercises, support the person's ankle with one hand, and his toes with the other hand. For the toe exercises, allow his foot to relax on the bed, and hold only his toes.

- Ankle bends: Bend the person's foot so his toes point toward the ceiling. Then bend his foot the other direction so his toes are pointed.
- Ankle rotation: Raise the person's foot slightly off the bed. Roll his foot in circles. Then roll his foot in circles in the other direction.
- Ankle movement, side to side: Tilt the person's ankle in so the sole of his foot points toward the opposite leg. Then tilt his ankle out so the sole of his foot points away from the opposite leg.
- Toe bends: Curl the person's toes down toward the sole of his foot. Straighten them. Curl the toes up toward the ceiling. Then straighten them again.
- Toe spreads: Spread the big toe and the second toe apart, then bring them back together. Perform the same with the rest of the toes.

PROCEDURE OF COUGHING AND BREATHING EXERCISE-

Instruct your patients:

- Hold a pillow against the stomach.
- Take a slow, deep breath. ...
- Breathe out through the mouth and concentrate on feeling the chest sink downward and inward.
- Take a second breath in the same manner.
- Take a third breath.
- Repeat the exercise.



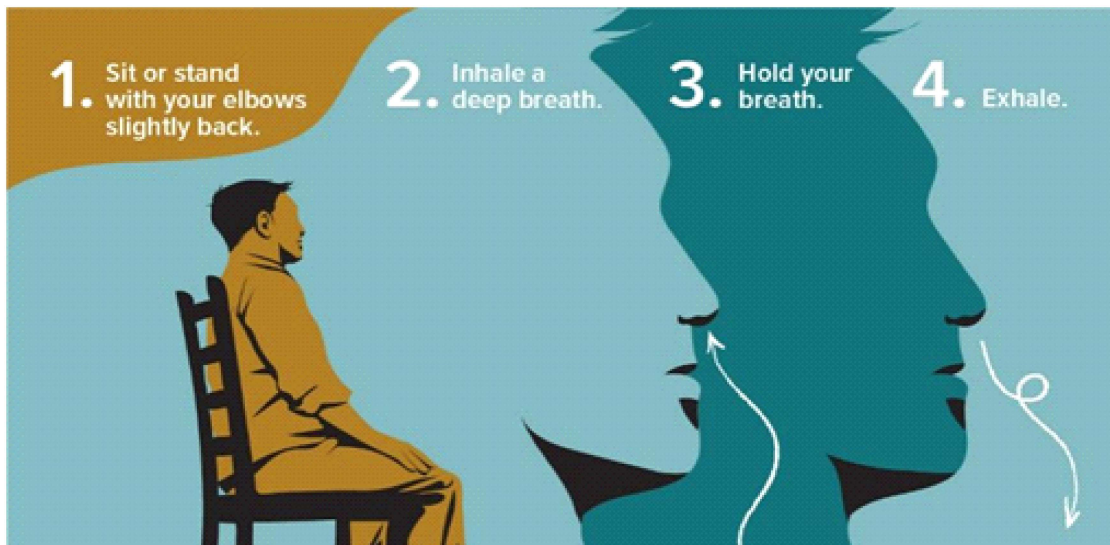


Fig 15(a): Coughing and Breathing Exercise

WORKING OF TRIFLE-

How to do the breathing exercises?

To do it:

1. Choose a comfortable seated position.
2. Breathe in and out through the nose.
3. Count during each inhale and exhale to make sure they are even in duration. ...
4. Ask the patient to add a slight pause or breath retention after each inhale and exhale if he or she feels comfortable. ...
5. Continue practicing this breath for at least 5 minutes.

DEEP BREATHING AND COUGHING EXERCISE-

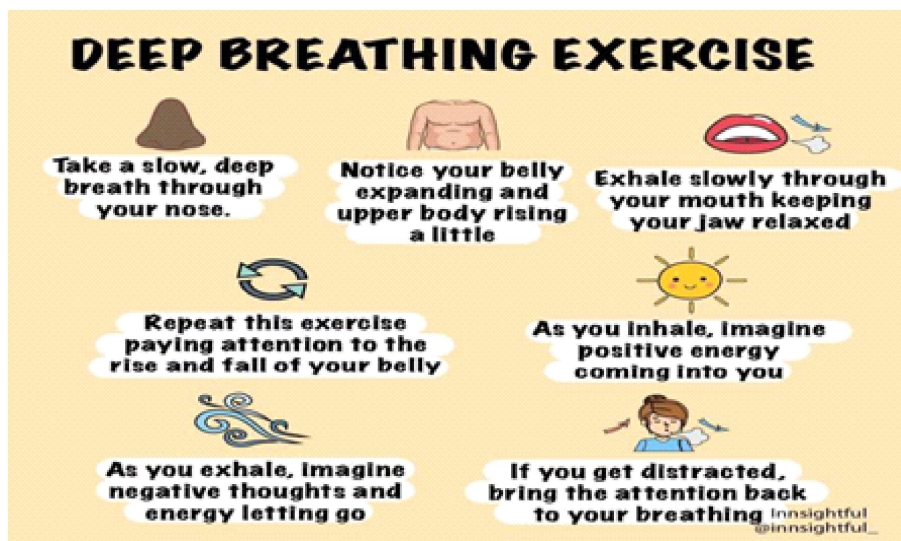




Fig 15(b): Coughing and Breathing Exercise

PERFORMED PURSED LIP BREATHING , DIAPHRAGMATIC BREATHING, ABDOMINAL BREATHING AND BELLY BREATHING EXERCISE-

❖ **LIP BREATHING EXERCISE-**

To practice pursed lip breathing, **breathe in slowly through the nose for two counts**, keeping the mouth closed. Take a normal breath. Pucker or “purse” the lips as if patient were going to whistle and breathe out. Pursed lip breathing is one of the simplest ways to control shortness of breath.

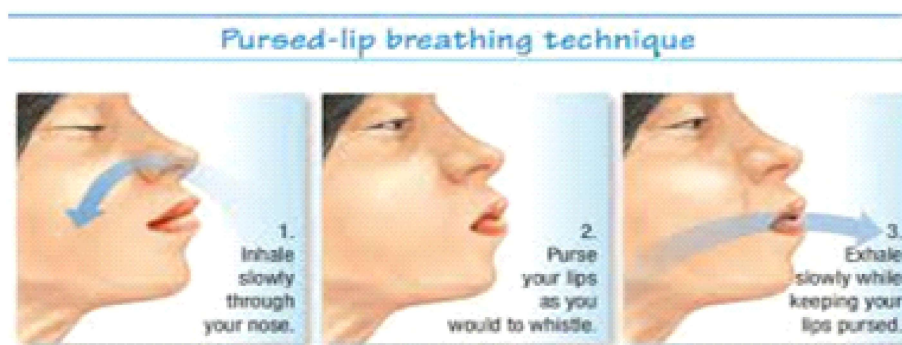


Fig 16: PURSE LIP BREATHING EXERCISE

❖ **DIAPHRAGMATIC BREATHING EXERCISE-**

Diaphragmatic breathing technique

Instruct your patients:

1. Sit comfortably, with your knees bent and your shoulders, head and neck relaxed.
2. Place one hand on your upper chest and the other just below your rib cage. ...
3. Breathe in slowly through your nose so that your stomach moves out against your hand.

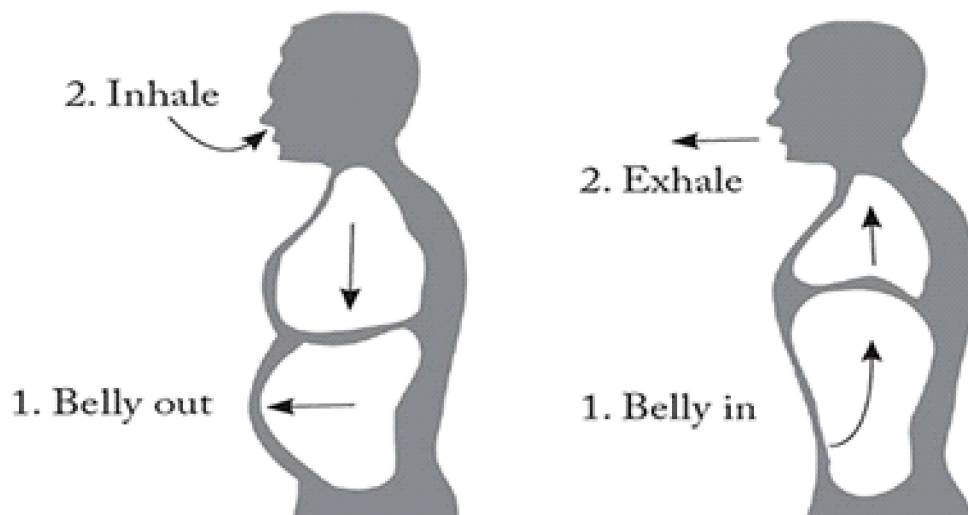


Fig 17: DIAPHRAGMATIC BREATHING EXERCISE

❖ **ABDOMINAL BREATHING AND BELLY BREATHING EXERCISE**

Belly breathing

Instruct your patients:

1. Sit or lie flat in a comfortable position.
2. Put one hand on your belly just below your ribs and the other hand on your chest.
3. Take a deep breath in through your nose, and let your belly push your hand out. ...
4. Breathe out through pursed lips as if you were whistling. ...
5. Do this breathing 3 to 10 times.

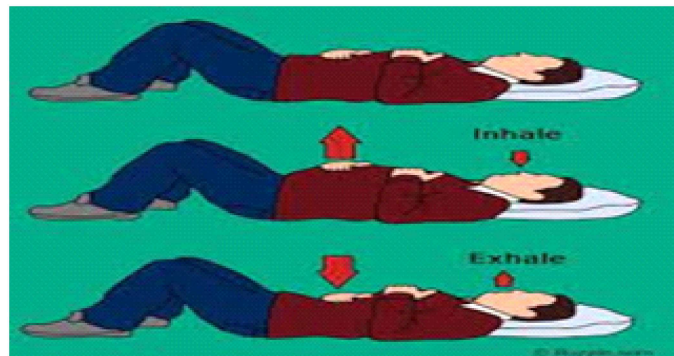
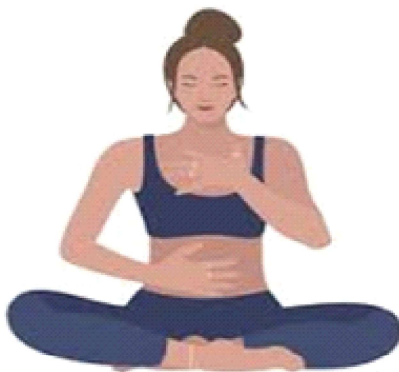


Fig 18: ABDOMINAL BREATHING AND BELLY BREATHING EXERCISE

CONCLUSION-

‘Prevention is better than cure’, The differences in routes of administration of different drugs, and the regional differences in routes of use, have implications for the provision of preventive and treatment services. Interventions to prevent transitions to injecting may be especially appropriate in areas where injecting is not prevalent. Physical therapy is an important component in the treatment of back pain syndromes. More judicious use of physical therapy, both in terms of patient profile and in terms of timing of referral, is the goal in order to achieve the most favorable results and reduce morbidity.

ASSESSMENT:

- ✓ *What is body mechanics?*
- ✓ *What are the basic principles of body mechanics?*
- ✓ *Explain the reasons for the use of proper body mechanics.*
- ✓ *State the precautions to be taken while performing physical exercises.*
- ✓ *Describe passive range of motion exercise.*
- ✓ *What are the selection criteria of active ROM exercise?*
- ✓ *Explain physiotherapy.*
- ✓ *What are the basic principles of physiotherapy?*
- ✓ *Differentiate between deep breathing and coughing exercise.*
- ✓ *Explain the techniques of Active and Passive ROM exercise.*

UNIT 6

BIO MEDICAL WASTE MANAGEMENT

TABLE OF CONTENTS

SESSION 1: INTRODUCTION TO BIO MEDICAL WASTE MANAGEMENT

SESSION 2: SOURCES AND DISPOSAL OF BIO MEDICAL WASTE

SESSION 3: SEGREGATION, PACKAGING, TRANSPORTATION AND STORAGE OF BIO MEDICAL WASTE

SESSION 4: ROLE OF PERSONNEL INVOLVED IN WASTE MANAGEMENT

SESSION 1: INTRODUCTION TO BIO- MEDICAL WASTE MANAGEMENT

In this session, you will learn about the concept of Bio-medical waste management. You will study about the importance of bio medical waste management, its risks involved with poor waste management, classification of hospital waste and disposal of biomedical waste.

Relevant Knowledge

Biomedical waste is any type of waste either solid or liquid comprising of harmful materials produced by healthcare facilities e.g. hospitals, practices, health camps etc. This waste comprises of human tissues, contaminated blood, body fluids, discarded medicines, drugs, contaminated cotton, dressings, and sharps such as needles, glass, blades, scalpels, lancets. Biomedical waste collection and disposal has highest risk to healthcare, sanitation workers and the general community. The biomedical waste minus appropriate disinfection leads to acquired immune deficiency syndrome (AIDS), Hepatitis B & C, severe acute respiratory syndrome (SARS), tetanus, psychosocial trauma etc. Biomedical waste management is significant to defend the environment and health of the population.

In hospital waste management, the popular term is bio-medical waste. Bio- medical waste is defined as “waste that is generated during the diagnosis, treatment or immunization of human beings and are contaminated with patients body fluids, such as syringes, needles, ampoules, organs and body parts, placenta,

- dressings, disposables plastics and microbiological wastes”. It generates around 1-2kg per bed per day in a hospital and 600 gm per day per bed in a clinic. This medical waste needs to be disposed off effectively. Of the total amount of waste generated by health-care activities, about 85% is general, non-hazardous waste. The remaining 15% is considered hazardous material that may be infectious, toxic or radioactive.

Importance of biomedical waste management

Biomedical waste management plays a vital role in preventing any outbreak of infectious diseases and protecting the society from transmission of these diseases. Here are few benefits that biomedical waste management programs provide:

- Hygienic and healthy environment in medical center
- Low incidence of community and occupational health hazard

- Low impact on ecological system
- Potential epidemics are prevented
- Improved public health and cleaner environment
- Improve image of the healthcare establishment and increased quality of life

Definition

Before we study the classification and disposal of hospital waste, let us first try to understand the meaning of some of the terminologies used in hospital waste management:

- **Infectious waste:** waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples), cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories), or waste from patients with infections (e.g. swabs, bandages and disposable medical devices);
- **Pathological waste:** human tissues, organs or fluids, body parts and contaminated animal carcasses;
- **Sharps waste:** syringes, needles, disposable scalpels and blades, etc.;
- **Chemical waste:** for example solvents and reagents used for laboratory preparations, disinfectants, sterilants and heavy metals contained in medical devices (e.g. mercury in broken thermometers) and batteries;
- **Pharmaceutical waste:** expired, unused and contaminated drugs and vaccines;
- **Cytotoxic waste:** waste containing substances with genotoxic properties (i.e. highly hazardous substances that are, mutagenic, teratogenic or carcinogenic), such as cytotoxic drugs used in cancer treatment and their metabolites
- **Radioactive waste:** such as products contaminated by radionuclides including radioactive diagnostic material or radiotherapeutic materials; and
- **Non-hazardous or general waste:** waste that does not pose any particular biological, chemical, radioactive or physical hazard.


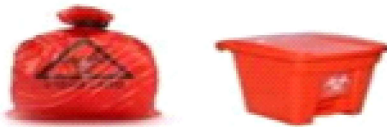


These type of wastes may be generated from various sources. As per the nomenclature the waste generated includes as follow:

1. **General Waste:** The waste generated from office, administrative offices, kitchen, laundry and stores.
2. **Sharps:** Hypodermic needles, needles attached to tubing, scalpel blades, razor, nails, broken glass pieces, etc.
3. **Infected waste:** Equipment and instruments used for diagnostic and therapeutic procedures, waste from surgery like tissues and organs removed and autopsy.
4. **Chemical waste:** Formaldehyde used for preserving tissues and organs, fixer and developers used in radiology department. Solvents like xylene, acetone, ethanol and methanol used in laboratories.
5. **Radioactive waste:** Various radioactive wastes generated through the activities of the department like research activity, clinical laboratory and nuclear medicine department
6. **Cytotoxic drugs:** Various anti-cancer drugs

How Bio Medical waste management helps in environment protection:

The internal environment of the hospital has got direct communication with the outside environment. The gases and heat generated inside the hospitals are exhausted into the external environment. The internal environment of the hospital is contaminated with bacteria, viruses and parasites, which can cause a threat of spreading infection to the outside environment. The foul gases from mortuary or foul smelling discharges from the labour room, pathology department, anatomy department are discharged directly to the outside environment, which are responsible for the environmental pollution. All such activities have invited attention of the environmentalists and the Government have enacted laws to protect the health of the people and also to safeguard the environment.

Table 2: Storage of Biomedical Waste

| S. No. | Category | Type of waste | Colour & Type of Container |
|--------|-----------------|---|--|
| 1. | Yellow Category | <ul style="list-style-type: none"> - Human Anatomical Waste - Animal Anatomical Waste - Soiled Waste - Discarded or Expired Medicine - Microbiology, Biotechnology and other clinical laboratory waste - Chemical Waste (yellow-e) - Chemical Liquid Waste | <p>Yellow coloured non-chlorinated Plastic Bags</p>  <p>Note: (i) Chemical waste (yellow-e) comprising of un-used, residual or date expired liquid chemicals including spent hypo of X-Ray, should be stored in yellow container</p> |
| 2. | Red Category | Contaminated Waste (Recyclable) | <p>Red Coloured Non Chlorinated Plastic Bags (having thickness equal to more than 50 μ) and Containers</p>  |
| 3. | White Category | Waste Sharps including metals | <p>White Coloured translucent, puncture proof, leak proof, Temper Proof containers</p>  |
| 4. | Blue Category | <ul style="list-style-type: none"> • Glassware • Metallic Implants Body | <p>Puncture proof, leak proof boxes or containers with blue coloured marking</p>  <p>Cardboard Box with Blue marking</p> |

The routes of transmission of infection can be:

- *Air borne* for example, through inhalation of hospital dust.
- *Direct contact* for example, through abrasions on skin, or through mucous membrane.
- *Faeco – oral route* for example, through ingestion of food, water with contaminated hands
- *Parenteral route* during the process of injections and infusions.
- Through equipment and materials.

Hospital acquired infections (Nosocomial Infections): Nosocomial infections are infections that have been acquired in a hospital and are potentially caused by organisms that are resistant to antibiotics. It is the infection that was not present or incubating prior to the patient's being admitted to the hospital, but occurs within 72 hours after admittance to the hospital. The sources of hospital acquired infection can be self, by other patients, attendants, visitors and hospital staff or through fomites (any object or substance capable of carrying infectious organisms)

SESSION 2: SOURCES AND DISPOSAL METHODS OF BIO- MEDICAL WASTE

In this session, you will learn about the sources and disposal methods of bio-medical wastes.

Relevant Knowledge

Sources of biomedical waste

Biomedical waste is generated from biological and medical sources and activities in hospitals, clinics, healthcare organizations, veterinary hospitals, etc. Let us now try to identify the various generators of biomedical wastes. The sources can be broadly grouped as follows:

1. Hospital

- a) Hospital also fall category like general, specialist hospitals, private as well as public sector. Waste is generated from all departments (clinical, paraclinical, preclinical) including wards, Operation theaters, intensive care units, outpatient department, kitchen etc.

2. Clinics including immunization clinics, maternal and child health clinics, dialysis centres, dispensaries etc. Other Health care organizations such as geriatric homes, mentally challenged centre

Support Services like

blood banks, pharmacy, mortuary, laundry, Laboratories

3. Veterinary Hospitals

Disposal of Wastes

Biomedical waste should not be mixed with other wastes for disposal. It should be treated and disposed as per guidelines issued by Government of India and in compliance with the standards prescribed in schedule V of the notification of Bio Medical Waste (BMW) rule (1998) of Ministry of Environment & Forest, Govt. of India. Once the wastes have been treated by one or the other method it is to be finally disposed of in the following manner:

- Disposal of human anatomical, blood and body fluids as per central government guidelines.

- Disposal of sharps: the needles should be destroyed by the needle destroyers and other sharps and store in puncture proof container.
- Disposal of microbiological and bio-technological wastes: This is done by autoclaving, hydroclaving, microwave or incineration.
- Disposal of pharmaceutical wastes: The preferred method is by incineration and they can be disposed of by landfilling.
- Disposal of infectious solid waste: it is first treated and converted to non-hazardous waste which is then disposed of as general waste.
- Disposal of chemical waste: Non-hazardous waste is disposed of as general waste and the hazardous waste is first converted into non-hazardous waste and then disposed of as general waste.
- Disposal of radioactive wastes: This is done in accordance with the guidelines issued by the Bhabha Atomic Research Centre (BARC).

All records are subjected to inspection and verification by the prescribed authority at any time. The authorized person maintains records related to generation, collection, reception, storage, transportation, treatment disposal and/or any form of handling of bio-medical waste. Untreated bio-medical waste should be kept beyond a period of 48 hours.

SESSION 3: SEGREGATION, PACKAGING, TRANSPORTATION AND STORAGE OF BIO-MEDICAL WASTE

In this session, you will learn about segregation, packaging, transportation and storage of bio-medical waste. You will study the colour coding criteria recommended by Government of India *guidelines for Management of Healthcare Waste 2016 for storing and disposing different class of bio-medical wastes*.

Relevant Knowledge

The following points should be remembered while segregating, packaging, transportation and storage of biomedical wastes:

1. Biomedical waste shall not be mixed with other wastes.
2. Biomedical waste shall be segregated into containers / bags at the point of generation in accordance with latest Government of India guidelines 2016 prior to its storage, transportation, treatment and disposal.
3. If a container is transported from the premises where biomedical waste is generated to any waste treatment facility latest guidelines 2016.
4. Notwithstanding anything contained in the Motor Vehicles Act, 1988, or rules there under, untreated biomedical waste shall be transported only in such vehicle as may be authorized for the purpose by the competent authority as specified by the government.
5. No untreated biomedical waste shall be kept stored beyond a period of 48 hours. Provided that if for any reason it becomes inevitable to store beyond 48 hours, the authorized person must take permission of the prescribed authority and take measures to ensure that the waste does not adversely affect human health and environment.

Autoclaves for Medical Waste

Autoclaves are closed chambers that apply heat and sometimes pressure and steam, over a period of time to sterilize medical equipment. Autoclaves have been used for a century to sterilize medical instruments for reuse. Surgical knives and clamps, for instance, are put in autoclaves for sterilization.

For medical waste that will be disposed of, autoclaves can be used as heat treatment processing units to destroy microorganisms before disposal in a traditional landfill or further treatment. Autoclaves are a batch process, not a continuous one. Autoclaves are “chemical free” and that appeals to many stakeholders in a complex waste management environment. Chemical-free means no chemicals are added.

Autoclaves are best for wastes that are unlikely to combust or give off substantial off-gas. While incinerators can be built with [pollution abatement systems](#), autoclaves are smaller and it is not economical to make a treatment system for vapors emitting from the the unit. one of the problems with autoclaves is that the process can aerosolize chemicals present in the waste, leading to the potential for release of materials you would prefer to not release. This can pose a hazard to human operators and to some extent the environment – even though the facility HVAC system may take much of the brunt. It is possible this aerosolized material will deposit on surfaces in ductwork or countertops and floors in your facility – much as what happens in a kitchen. Aerosolized grease is the source of much grime in kitchens.

Are autoclaves a substitute for incineration? Yes, to a large extent. Autoclaves can be used to process the large bulk of infectious waste produced at a hospital or clinic. Autoclaves come in a wide range of sizes and capacities.

Autoclave Cycle Time

The process design of any waste management system must consider the cycle time of the autoclave. Total cycle time includes

- Time for operators to place waste in unit.
- Heat up time - to achieve target temperature
- Processing time – time spent at target temperature
- Cool down time
- Removal time for operators to open autoclave once it has cooled sufficiently and to remove waste and put it into packaging for storage until transport.

INCINERATION:

It is a treatment process used to transform pathological and pharmaceutical waste into ash, flue gases and heat. Functioning temperature for incineration should be in the range of 800-1400 degree Celsius. It reduces the bulk of waste by 90-95% and thus decrease harmful effects of the surroundings .Incineration is a high temperature dry oxidation process, that reduces organic and combustible waste to inorganic incombustible matter and results in a very significant reduction of waste-volume and weight. The process is health-care usually selected to treat wastes that cannot be recycled, and reused or disposed off in a land fill site.

TYPES OF INCINERATORS

Incinerators can range from very basic combustion unit that operates at much lower temperature to extremely sophisticated, high temperature operating plants. It should be carefully chosen on the basis of the available resources, the local situation, and the risk-benefit consideration.

Three basic kinds of incineration technology are of interest for treating health-care waste :

- a) Double-chamber pyrolytic incinerators which may be especially designed to burn infectious health care waste
- b) single-chamber furnaces with static grate ,which should be used only if pyrolytic incinerators are not affordable, and
- c) Rotary kilns operating at high temperatures, capable of causing decomposition of genotoxic substances and heat-resistance chemicals.

Transportation of Biomedical Wastes

Transportation of bio-medical wastes can be divided into intramural (internal) and extra mural (external) transportation.

1. Intramural (internal) transport

The sanitation staff from the centralized team shall be responsible for transporting the different coloured polythene bags in garbage bins from the sluice room where used disposables such as incontinence pads, bed pans and reusable products are cleaned and disinfected), nursing station and treatment room of each ward. Push carts and garbage trollies designed for the purpose should only be used. From all the floors and wings, the waste shall be taken to the designated site of the hospital. Any spillage or leakage should be reported to Sanitation Inspector Incharge, and it is his/her responsibility to get the respective trolleys/carts cleaned and disinfected.

2. Extramural (external) transport

Only general waste collected in the black coloured plastic bags shall be transported in the vehicle by the Municipality authorities. The request shall be made by the hospital authorities to the Municipal authorities to send the vehicle once in day without any failure. The segregated biomedical waste should be transported to the **Common Bio Medical Waste Treatment Facility (CBWTF)** as per latest Government of India 2016 guidelines.

SESSION 4: ROLE OF PERSONNEL INVOLVED IN WASTE MANAGEMENT

In this session, you will learn about the roles and functions of authorities or personnel involved in bio-medical waste management in a hospital. You will also study the importance of providing training to the staff of the hospital.

Relevant Knowledge

A. Role of Medical Superintendent/Director

The overall responsibility of Medical Superintendent/Director is to implement the guidelines for hospital waste management and ensure that waste is handled without any adverse effect to human health and environment. He/she is responsible for submitting an annual report on biomedical waste management. He is answerable to the higher authorities regarding implementation of biomedical waste management policy.

B. Functions of Hospital Waste Management Committee

1. To ensure the circulation of copies of Bio-medical Waste Rules and guidelines in Departments.
2. To conduct awareness programmes regarding bio-medical waste management
3. To conduct training programmes for Medical Professionals, Nursing Professionals, General Duty Assistant and other staff on biomedical waste management.
4. To hold meeting of the Hospital Waste Management Committee and formulate a detailed plan of action in regard to segregation, collection, storage and transport of waste. To procure the items required in this regard and make them available.

Each Clinical Department (Unit), Lab Services, Blood Bank, Microbiology, Pathology shall make one Faculty Member responsible for supervision of segregation of biomedical waste in their area of activities. Floor wise nurses /GDA are responsible for supervision of segregation in the wards of each floor. In each and every OT one Incharge is responsible for segregation of waste.

C. Role of Officer Incharge of Waste Management

The Officer Incharge of Bio-medical Waste Management liaise with the Heads of Departments, Infection Control Officer and Matron. He is the member of the Hospital Waste Management Committee. He is responsible for monitoring the programme from time to time at various levels i.e. generation, segregation, collection, storage, transportation and treatment (including disposal). He is responsible for circulation of all policy decisions and the hospital waste management manual. He is responsible for accident reporting in Form III to the prescribed authority.

D. Role of Heads/Incharge of Labs/Units/Departments

They are responsible for the formulation and implementation of waste management procedures for their departments which should be done in conformity with the general guidelines issued by the administration. They shall also be responsible for getting all staff, doctors, nurses, paramedics and group-D staff trained in hospital waste management, and shall liaise with the Officer Incharge of bio-medical waste management for administrative support. With regard to the departments which generate radioactive waste, one of the consultants should be designated as Radiation Protection Officer and he/she shall be responsible for implementation of necessary guidelines.

E. Role of Matron / Nursing Superintendent

The Matron shall designate one of the senior administrative level deputies as Sister In-charge of Hospital Waste Management, who shall be responsible for close monitoring of the activity. She shall conduct surprise rounds and shall review and evaluate the various aspects of scientific hospital waste management at all levels from generation and segregation to final disposal. She shall also attend the meetings of Hospital Waste Management Committee on behalf of the Matron and co-ordinate the training of nurses on Hospital Waste Management with administration.

F. Role of Sanitation Inspector

The In-charge Sanitation Inspector is responsible for the implementation, monitoring and evaluation of hospital waste management from collection and storage of hospital waste to its final disposal. He/she attend the Hospital Waste Management Committee meetings and ensure the training of the staff. Regular in-service training and evaluation of the sanitation attendants carried out by him/her. He/she shall also provide feedback information to Officer In-charge Waste Management in case of accidents and spills.

Training on Hospital Waste Management

In order to be able to comprehend and implement the Bio-Medical Waste Management, it is mandatory to provide training to all categories of staff i.e. resident doctors, nurses, paramedical staff, GDA, attendants, canteen staff, etc. Before the training is carried out, the training needs are to be identified and the content of the training programme should be contextualized. It should be interactive and should include awareness sessions, demonstrations and behavioural science inputs. It should include the following:

- i) Awareness of different categories of waste and potential hazard
- ii) Waste minimization, reduction in use of disposables
- iii) Segregation policy

Proper and safe handling of sharps

- iv) Use of protective gear
- v) Colour coding of containers
- vi) Appropriate treatment of waste
- vii) Management of spills and accidents
- viii) Occupational health and safety

UNIT 7

MEDICAL RECORDS

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| SESSION 1: PREPARING MEDICAL RECORDS |
| SESSION 2: PRINCIPLES OF DOCUMENTATION |
| SESSION 3: CONTENT OF MEDICAL DOCUMENTATION |
| SESSION 4 :MAINTAINING RECORDS |

A chronological written account of patient's examination and treatment that includes the patient 's medical history and complaints ,the physician's physical findings ,the results of diagnostic test and procedures ,and medications and therapeutic procedures.

SESSION 1: PREPARING MEDICAL RECORDS

In this session, you will learn about the purpose and importance of documentation. You will also study the significance of documentation in analyzing the needs of the patient.

Relevant Knowledge

Purpose of Documentation

- A) The purpose of documenting medical records are –
- i) Better and evidence based care,
 - ii) Accurate and faster diagnosis leading to better treatment at lower costs of care,
 - iii) Avoid repeating unnecessary investigations,
 - iv) Support personalized care,
 - v) Improved health policy decisions,
 - vi) Support medico- legal decisions, and
 - vii) Effective communication among health professionals.

All these translates into improved personal and public health. Patient Documentation is the written, legal record of all pertinent interactions with the patient – assessing, diagnosing, planning, implementing and evaluating .It is a legal record that is permanent and retrievable for future purposes.

- B) Documentation of patient's care promotes continuity of care throughout 24 hours of care. Team members who interact with the patient at different times and different ways get a clear picture of what took place in their absence. It is essential that all personnel provide written documentation of anything they have observed or done with a patient to ensure coordination of activities and continuity of care. Proper documentation informs appropriate personnel about a patient s condition and response to illness and the care that has been given as the result of the illness.

- C) Documentation helps in auditing and thus improving quality of care. Audit of patient's records serves two purposes, quality assurance and reimbursement. As part of quality assurance programme, healthcare agencies periodically conduct chart audits to determine whether or not the care provided meets the established standards of patient care. Results of the audit can lead to changes in the manner in which care is provided. If deficiencies are found, training can be used to remedy the problem and improve the quality of care. Good medical documentation can help fill lacunae in the existing medical care and thus, planning of subsequent medical research.
- D) (iv) The patient's record also serves as documents for reimbursement process as well as a legal document of the patient's health status and the care received.
- (v) The medical team taking care of the patient is responsible for ensuring diagnostic and therapeutic orders that are entered in the patient's record and implemented. Most often it is the policy of the healthcare agency that the diagnostic and therapeutic orders are written and signed by the medical officer before it is being executed by the medical team.

Exercise

1. Visit a nearby hospital and observe various medical records. Fill the name of record in the table given below:

| Purpose of Medical Record | Name of Medical Record |
|---------------------------|------------------------|
| Assessment | |
| History | |
| Diagnostic | |
| Therapeutic | |
| Education | |

SESSION 2: PRINCIPLES OF DOCUMENTATION

In this session, you will learn about the basic principles of documentation.

Relevant Knowledge

The patient's medical record is the permanent legal record. Accepted terminology should be commonly understood by the health care team and should communicate clearly and concisely. Only standard medical and nursing terminology and commonly recognized abbreviations and symbols should be used to facilitate communication. Consistency in their use saves time and space, without interrupting communication.

- (i) The documents should contain the date and time of each recording.
- (ii) Correct spelling of words should be used. Check the dictionary and use the correct spelling.
- (iii) Record only that information which pertains to the patient's health problem and care.
- (iv) Accurate and complete documentation give legal protection to the GDA and other health care professionals of the institution.
- (v) Patient's name and identification data must be written on each page of the clinical record. Entries must be accurate. An observation made by another health professional must be identified as such.

- (vi) Document all information necessary to explain the events in a shift. Anyone reading the document should have a clear picture of what took place or is being described. Complete, pertinent assessment data, such as vital signs, wound drainage, patient complaints, who notified GDA on subsequent shift, etc. can make objective evaluation and would help in revising the plan as needed.
- (vii) Good charting is concise and brief. Use partial sentences and phrases. Use only accepted abbreviations.
- (viii) Writing must be clear and easily readable by others. Legibility is all the more important while recording numbers and medical terms.
- (ix) Recording of information on the patient's record must follow a chronological order. Charting statements must be logically organized according to time and content. Use of organized sequence will help to prevent omitting information about the patient. Documentation on data collection should be organized sequence. The statement is more easily read when written in a logical pattern.
- (x) Documentation in a timely manner can help avoid errors. Record all medications at the time they are given. Procedures, treatments and assessments should be recorded as soon as possible after their completion. Timelines help to avoid forgetting important information.
- (xi) While writing, if an error occurs, do not erase it. Common policies followed in such cases include, drawing a single line and writing the word void or error in the space above the incorrect entry, followed by the initials of the writer. A single line instead of multiple line is required to keep the incorrect entry legible.
- (xi) Blank space should not be left on the chart. Avoid writing outside the lines of the charting format. A horizontal line is drawn through any empty space to the right margin to prevent later entries being made in front of a signature.
- (xii) A signature must follow every entry into a patient's record. The correct way to sign a notation is using the first initial and full last name followed by the abbreviation of the health care worker's position/title.
- (xiii) All patients records are confidential files that require written permission of the patient to be copied. Information within the chart is often of a personal matter as well as legal evidence of the care provided and should be available to the insurance companies or third party without the written permission of the patient. Those who are in need of patient's information from records need to go through the proper channel which varies with the policies of the hospital.

Exercise

1. Visit a nearby hospital and observe the various medical records. Fill the name of records

| Name of Record | Designation of Health care Professional maintaining the Record |
|----------------|--|
| | |
| | |
| | |
| | |

2. Visit a nearby hospital and examine a sample of patient case file and prepare the list of the content. Identify general types of information kept, such as referral letters, clinical notes, pharmacy or drug information and so on. Identify how the records are filled in chronological order.

SESSION 3: CONTENT OF MEDICAL DOCUMENTATION

In this session, you will learn about the types of entries and notes to be prepared while maintaining the medical record of the patient. Description of observations, symptoms, complaints and medical treatments will also be studied in this session.

Relevant Knowledge

Content of Documentation

Healthcare agencies/hospitals vary in their specific requirements about what needs to be included in the chart. All significant patient care should be documented either in narrative notes or on flow sheets (forms used to document data that can be more easily followed in graphic or tabular form). On admission to a facility, a complete health history is obtained and documented.

This is followed by the current need assessment. These may be combined or maintained on separate forms.

Types of Entries

Various types of entries may be made in a chart. They are described as follows:

(1) Admission Note

An admission note is part of the medical record that documents the patient's status, reasons why the patient is admitted for inpatient care to a hospital and the initial instructions for the patient's care. It is the note acknowledging the arrival of a new patient. Following the admission note, a narrative entry is made. This is followed by a description of the patient's current status at appropriate intervals. On arrival, the patient's orientation to the hospital facility should be made.

The admission note usually includes – time of arrival, age, sex, how the patient arrived, where the patient came from, medical diagnosis, chief complaint, general appearance, treatment in progress, allergies, vital signs and notifications of physician. An ideal admission note would include the following:

i) Patient Identifying Information

- Name
- ID number
- Chart number
- Room number
- Date of birth
- Attending physician
- Sex
- Admission date
- Date
- Time
- Service

ii) Chief complaint

- Age
- Race
- Sex
- Present complaint

iii) History of present illness

- Statement of health status
- Detailed description of chief complaint
- Positive and negative symptoms related to the chief complaint based on the differential diagnosis the health care provider has developed .
- Emergency actions taken and patient responses if relevant

iv) Allergies

- First antigen and response
- Second antigen and response

v) Past medical history

List of the patient's on-going medical problems . chronic problems should be addressed as to the whether or not they are well controlled or uncontrolled . Include dates of pertinent items.

vi) Past Surgical History

List of surgeries in the past with dates of pertinent items.

vii) Family history

Health or cause of death for:

- Parents
- Siblings
- Children
- Spouse

viii) Social History

In medicine, a social history is a portion of the admission note addressing familial, occupational, and recreational aspects of the patient's personal life that have the potential to be clinically significant.

ix) Medications

- For each: generic name - amount - rate
- Medications on arrival (aspirin, Goody's medicated powder, herbal remedies, prescriptions, etc.)
- Medications on transfer

x) Review of Systems

- General
- Head
- Eyes
- Ears

- Nose and sinuses
- Throat, mouth, and neck
- Breasts
- Cardiovascular system
- Respiratory system
- Gastrointestinal system
- Urinary system
- Genital system
- Vascular system
- Musculoskeletal system
- Nervous system
- Psychiatric
- Hematologic system
- Endocrine system

(xi) Physical examination

Physical examination or clinical examination is the process by which a health care provider investigates the body of a patient for signs of disease.

(xii) Labs

e.g.: electrolytes, arterial blood gases, liver function tests, etc.

(xiii) Diagnostics

e.g.: EKG, CXR, CT, MRI

(xiv) Assessment and Plan

Assessment includes a discussion of the differential diagnosis and supporting history and exam findings.

2) Change of Shift Report

During each shift, documentation of the patient's assessment made is done. The "Change of Shift Report" is the communication between the nursing staff during shift

changeover periods regarding patient care. At the end of each shift nurses report information about their assigned patients to nurses working on the next shift. A handover report is usually given orally in person or during rounds at the bedside. Reports given in person or during rounds in hospital permit nurses to obtain immediate feedback when questions are raised about a patient's/patient's care.

(i) Assessment Notes

Documentation of the complete assessment of patient is done. Assessment of the patient's overall physical, emotional and behavioural state. Consideration for all patients include: looks well or unwell, pale or flushed, lethargic or active, agitated or calm, complaint or combative, posture and movement.

(ii) Transfer and Discharge Notes

When a patient is transferred to another facility either temporarily or permanently, a transfer note is written. This note may include the following:

- Reason for transfer
- Method of transportation
- Person giving and receiving the report
- Notification of the patient, including vital signs and treatments in progress.

A similar note is made when a patient is sent for a test within the same facility. When the patient returns to unit a similar note may be made.

(iii) Patient Teaching Notes

Instructions given to a patient need careful study. All teaching that occurs must be noted including reinforcement of the information already taught. It also must state the patient's response to teaching.

(iv) Symptoms and Complaints

Any symptoms or complaints by patient should be documented in detail. This can include subjective or objective data and must be specific in terms of location, duration, intensity, amount, size and frequency. While documenting, the complaints of the patient, care given and response of the patient is also noted.

(v) Dressing Tubes or Attached Devices

Observation of the tubes must be documented in the initial entry of each shift and at least every 2 hours thereafter. Documentation of dressing should include location of dressing, amount as well as description of any drainage observed. If the dressing is changed, condition of the skin wound also must be described. If I/V fluids are administered, correct placement of the tube, observation of infusion site for any redness, tenderness, edema or warmth, also must be documented.

(vi) Medications and Treatments

Usually there will be a medication administration record. When all the medicines are administered, charting is done. If any medication is not given, the reason for that should be documented and it is better to inform the physician concerned. Time, route and dosage of medicine and the reason for administration and the response of the patient are also documented.

(vii) Observation of Psycho social Status

The patient's sensorium in relation to level of consciousness and orientation to time, place and person are also documented. Patient leaving against medical advice (LAMA) must be documented clearly with the reason for the LAMA.

What is the difference between

1. Absconded
2. Left Against Medical Advice (LAMA)
3. Discharged Against Medical Advice (DAMA)
4. Discharged at request
5. Discharged

All these related to situations when an alive patient has left the hospital. If the patient is dead, then we have situations like Found Dead, Brought Dead, Dead on Arrival and Expired which are discussed below. The question whether Unconscious Patients / Patients on Ventilatory Support be discharged Against Medical Advice AMA, DAMA, LAMA is dealt separately, but you are advised to first read this article and then go there

Now let us define the various situations in simpler terms

Absconded

1. Patient went out of the hospital without Doctor's or other staff's Knowledge.
2. Hospital does not know that the patient left and they do not know when the patient left
3. They found out during next rounds
4. Patient may not have discussed with the doctor / hospital about going out
5. It is wrong to write, For example, that the patient absconded at 7 PM. If the doctor (either directly or through other paramedical staff) knows the time patient went out, it is not absconded, it is Left Against Medical Advice
6. The proper way of recording in Case Sheet is "Patient found to have been missing from _____. Patient has been Reported Absconded from the ward before ____" In this way, the medical officer is safe

AMA or Against Medical Advice

may refer to LAMA or DAMA

LAMA : Left Against Medical Advice :

1. Doctor asked the patient to stay / continue treatment.
2. Patient / Patient's Relatives did not inform their plan of leaving the hospital, but they left suddenly.
3. But the Hospital was aware of them going out and the time patient left.
4. Doctor had said that Taking the patient out may endanger life
5. Patient / Patient's Relatives did not sign anything
6. Hospital may not give any discharge summary
7. In fact, Patient may not have discussed with the doctor / hospital about going out
8. Since the doctor (either directly or through other paramedical staff) knows the time the patient is going out, it should be recorded as "Patient left Against Medical Advice at _____. Since the patient did not inform prior to leaving, discharge summary has not been given to the patient"

DAMA : Discharged Against Medical Advice :

1. Doctor has clearly explained that Taking the patient out may endanger life, but still patient / patient's relatives want to take the patient to some other hospital
2. They sign a declaration saying that the risks were informed to them – by taking the patient out of hospital, they are immediately endangering the life

3. Hospital gives a discharge Summary
4. The proper way of recording in Case Sheet is “Patient has been discharged against Medical Advice on _____ at _____. Discharge Summary has been given to the patient”

Discharge at request :

1. Here, treatment is not complete, but by taking the patient out of hospital, there is no immediate danger to life
2. Patient signs
3. Hospital Gives Discharge Summary

Discharge :

1. Treatment is complete
2. Discharge Summary is Given

We can also look at this from the Other way

1. Treatment Over -Doctor says Discharge
2. Gives Discharge Summary – Routine Discharge
3. A major part of treatment / or the most important part of treatment is over - Active surgical or medical intervention is needed and hospital supervision is not needed – Only observation is needed - Doctor says discharge after few days, but not today, Patient wants to go
4. Patient signs, discharge summary given - Discharge at request
5. A major part of treatment / or the most important part of treatment is not completed -Active surgical or medical intervention is needed and hospital supervision is mandatory -Doctor says no discharge – Doctor says continue treatment –Patient wants to go
6. Patient signs, discharge summary given - Discharge against Medical Advice
7. A major part of treatment / or the most important part of treatment is not completed -Active surgical or medical intervention is needed and hospital supervision is mandatory -Doctor says no discharge – Doctor says continue treatment – Patient wants to go
8. Patient does not sign, just leaves, no discharge summary is given - Left against Medical Advice
9. Irrespective of Treatment Stage, Irrespective of Doctor’s opinion –
10. Patient not found in ward – Absconded

In Short

Based on Knowledge of Patient Leaving the Hospital

1. If the Staff of the hospital is aware, It can be Discharge, Discharge at Request, DAMA ie Discharge Against Medical Advice, LAMA Left Against Medical Advice
2. If the Staff of the Hospital is not aware about patient leaving – It is Absconded
Based on whether the patient / patient’s relatives, planned with the doctor about going out
3. If the patient / patient’s relatives has discussed the plan with the doctor, it can be Discharge, Discharge at Request, DAMA ie Discharge Against Medical Advice, LAMA Left Against Medical Advice,
4. If the patient / patient’s relatives has not discussed the plan with the doctor, it can be LAMA Left Against Medical Advice, Absconded
Based on whether Discharge Summary is given or Not
5. If Discharge Summary is given, it can be Discharge, Discharge at Request, DAMA ie Discharge Against Medical Advice, LAMA Left Against Medical Advice,

6. If Discharge Summary is not given, it can be LAMA Left Against Medical Advice, Absconded Based on whether Patient / Patient's Relatives sign or Not
7. If they sign, it can be Discharge, Discharge at Request, DAMA ie Discharge Against Medical Advice, LAMA Left Against Medical Advice,
8. If they do not sign, it can be LAMA Left Against Medical Advice, Absconded Based on whether shifting out of hospital may cause immediate danger to life or not
9. If shifting out of hospital may not cause immediate danger to life, it can be Discharge, Discharge at Request,
10. If shifting out of hospital may cause immediate danger to life, it can be DAMA ie Discharge Against Medical Advice, LAMA Left Against Medical Advice,, Absconded Based on whether the treatment is complete or not
11. If the treatment is complete, it is discharge
12. If they do not sign, it can be Discharge at Request, DAMA i.e Discharge Against Medical Advice, LAMA Left Against Medical Advice,, Absconded

Discharge Summary be given for Discharged AMA – Discharge against Medical Advice

1. Yes. Discharge Summary must be given for Discharged AMA ie Discharge Against Medical Advice.
2. It is not needed for Left Against Medical Advice and cannot be given for Absconded Is it possible to record Absconded if the patient is unconscious / non ambulant
3. If the patient had been on Ventilator, it is highly unlikely that the time of patient leaving the hospital was not know to the hospital staff
4. If the patient had been non Ambulant, it is highly unlikely that the time of patient leaving the hospital was not know to the hospital staff
5. Hence it is better to record Left Against Medical Advice for Such Patients
6. As we have already seen, Discharge Summary is not needed for such patient.

SESSION 4: MAINTAINING RECORDS

Documentation is a set of documents provided on paper or on digital media. The procedure of documentation include drafting, formatting, submitting, reviewing, approving, distributing, reporting, tracking, etc. the purpose of complete and accurate documentation is to foster quality and continuity of care. In this session, you will learn about different methods of documentation and their formats. You will also study different types of records.

Relevant Knowledge

The different methods of documentation system are evolved to achieve specific aims. Familiarity with the different systems will enable you to adapt the appropriate system in a particular health care setting.

Source Oriented Medical Record

Source Oriented Medical Record is a type of medical record kept according to health discipline e.g., medicine, nursing, laboratory, X-ray etc. These records include information about care given, the patients response to care, and other events documented chronologically and sequentially in a specific location in the record designed for the particular health team member making the entry.

The advantage is that the filing and retrieving of data is easy. It organizes the information according to patient care department that provided the care, or who provided the care. The main advantage of this format is that the

filing of reports is easy. Professionals would just have to look at where their report came from and date, and file in that section. The main disadvantage is that it would be difficult to follow a certain course of treatment for the patient, since they would have to search through everything, making it time-consuming. Also if a facility has many different departments, there will be even more sections in the record to search through.

Problem Oriented Medical Records

There is an index list that defines each problem. Everything is itemized and specific problems are organized into four parts. The main advantage is that it makes it easier to follow a course of treatment under a specific problem. However, this type would be time-consuming as well, especially to file a new problem in it. The POMR consists of four components, the database, the problem list, initial plan for each problem and progress notes for each problem.

Documentation Format

- (i) There are a variety of documentation formats utilized by the health care provider. They include: Narrative charting: It is a free style method of documentation. It is a method of charting that provides information in the form of statements that describe events surrounding patient care. It is often relatively unstructured and so provides flexibility in determining how information is recorded or the format may be structured and problem focused.

Problem focused charting: This includes the following:

- (ii) A-Assessment
P-Pr Identification
I-Intervention
E-Evaluation

The process begins with an admission assessment that is usually completed on a separate form and the initiation of a problem list that is based on the initial assessment. Documentation of patient care is focused on intervention and evaluation related to problems listed. Each entry in the progress notes is preceded by the date, time, and problems listed.

Maintenance of Records

- a) The records are kept under the safe custody of the GDA in each ward or department.
- b) No individual sheet is separated from the complete record.
- c) Records are kept in a place, not accessible to the patients and visitors.
- d) No stranger is ever permitted to read the records.
- e) Records are not handed over to the legal advisors without the written permission of the administration.

All hospital personnel are legally and ethically obligated to keep in confidence all the information provided in the records.

All records are to be handled carefully. Careless handling can destroy the records.

All records are filed according to the hospital custom so that they can be traced easily.

All records are identified with the bio-data of the patients such as name, age, ward, bed no., diagnosis etc.

Records are never sent out of the hospital without the doctor's permission. Reference is made by writing separate sheets and sending to the agency who requests for them.

Types of Records

Outpatient and Inpatient Records – in most of the hospitals, the inpatient record will be continuation of the outpatient record. Outpatient record is continuation of the outpatient department. This will contain the filled up in the outpatient department. This will contain the biodata of the patient, diagnosis, family history, history of the past and present illness, signs and symptoms, findings of medical examination, investigations, treatments, medications progress notes and summary made at the discharge of the patient.

Doctor's Order Sheet – The doctor's orders regarding the medication investigations, diet etc. may be written on separate sheets.

Graphic charts of T.P.R. – In this type of record, the temperature, pulse and respiration are written in a graphic form so that a slight deviation from the normal can be noted at a glance.

Reports of Laboratory Examination

Diet Sheets

Consent form for Operation and Anesthesia

Intake and Output Chart – Patients on intravenous fluids or on the fluid diet, critically ill patient post-operative patients, patient with oedema, patients having vomiting and diarrhea, patients getting diuretics etc.

Reports of Anesthesia, Physiotherapy, Occupational Therapy and other Special Treatment

Registers – To maintain the statistics, every hospital maintains certain register, such as registers for the births and deaths, registers for operations and deliveries, census register, register for the admission and discharge, register for the OPD attendants, etc. Documentation of Medico-legal cases

The important documents to be maintained by the hospital in Medico-legal cases are as follows:

- (i) Police intimation: This has to be given to the nearest police station by the hospital.
- (ii) Wound certificate: These are given on request by the police. It must be duly signed by the medical officer, who has attended the patient.
- (iii) Discharge certificate – this is given on demand from the police for MLC cases
- (iv) Accident cum wound register: this is usually maintained by the casualty medical officer. In case the patient demands, medical certificate may have to be issued by the hospital.

Medication Record

This is a record which keeps track of medicines taken by the patient. It includes date, time, route of drug, frequency and signature of GDA.

Nursing Discharge / Referral Summaries

This is made on discharge of a patient or at the time of transfer of a patient to another health care institution.

Role of GDA in Maintaining the Records

The major role of GDA is to compile, process and maintain medical records, which include information about the patient's care on the following aspects:

- Baths
- Showers
- Oral care
- Denture care
- Foot care
- Hair and nail care
- Urinary catheter care
- Back care
- Turning and positioning
- Meal intake
- Fluid intake
- Activities, like walking
- Range of motion exercises if don
- Warmsoaks
- Height
- Weight
- Urinary drainage bag output
- Temperature
- Pulse
- Respiration rate
- Blood pressure
- Blood glucose readings

Exercise

Visit a nearby hospital and observe the records maintained in different Department and fill the following table:

| Department | Type of Record |
|------------|----------------|
| | |
| | |
| | |
| | |

SUMMARY:

Medical records form an important part of a patient management . It is important fr the doctor and medical establishment to properly maintain the records of the patient for two important reasons . First one is that it helps in proper evaluation of the patient and to plan treatment protocol. Second is that the legal system relies mainly on documentary evidence in cases of medical negligence. Therefore, medical records should be properly written and preserved to serve the interest of doctors as well as his patient.