



MEDICAL-SURGICAL NURSING I PROCEDURES MANUAL



**MEDICAL-SURGICAL
NURSING DEPARTMENT
2025–2026**



Al Ryada University for Science and Technology Mission / Vision

Mission

The University is committed to providing a distinguished graduate capable of innovating and competing in the labour market and meeting the challenges of the future by providing a stimulating educational environment with intelligent and sophisticated techniques and strengthening partnerships with local and international universities and institutions and employing scientific research to achieve academic and research excellence while adhering to national identity, ethical values and community responsibility.

Vision

Al Ryada University for Science and Technology aspires to be a distinguished and highly competitive leading university at the local and international levels in line with the sustainable development goals.



College of Nursing

Mission / Vision

رؤية الكلية

"تُطمح كلية التمريض جامعة الريادة للعلوم والتكنولوجيا أن تكون كلية رائدة في تبني التعليم الشمولي المتميز، مما يعزز القدرات الشخصية للطالب، ويسهم في التطوير الذاتي المستمر. وينعكس إيجابياً على المنافسة المهنية النزيهة محلياً واقليمياً ودولياً ، كما يسهم في تعزيز التطور الأكاديمي والبحثي والمجتمعي للمهنة".

Vision :

"The Faculty of Nursing at Al-Riyadah University for Science and Technology aspires to be a leading institution in adopting distinguished holistic education that enhances students' personal capabilities and supports continuous self-development. This vision reflects positively on fair professional competitiveness at the local, regional, and international levels, and contributes to strengthening the academic, research, and societal advancement of the nursing profession".

رسالة الكلية

"لتلزم الكلية باستخدام الوسائل والنظريات التعليمية الحديثة بما يتوافق مع المستجدات العلمية ومعايير جودة التعليم لخريج كوادر تمريضية متميزة لديها قدرة تنافسية عالية في ممارسة مهنة التمريض وفي مجال البحث العلمي وتسهم إيجابياً في تطوير المهنة وخدمة المجتمع وتحقيق أهداف التنمية المستدامة."

Mission:

"The Faculty is committed to employing modern educational methods and theories in alignment with scientific developments and quality-education standards, in order to graduate highly competent nursing professionals with strong competitive abilities in clinical practice and scientific research. The Faculty aims to contribute positively to the advancement of the profession, community service, and the achievement of sustainable development goals".



Medical -Surgical Nursing Department

Mission / Vision

Mission

The primary goal of the medical and surgical nursing department is to focus on delivering the best possible nursing care across a range of specializations while also providing students with a foundational understanding of medical concepts and practices.

الرسالة

الهدف الأساسي لقسم التمريض الباطني والجراحي هو التركيز على تقديم أفضلرعاية تمريضية ممكنة عبر مجموعة من التخصصات مع تزويـد الطـلـاب أـيـضاـ بـفـهـمـ أسـاسـيـ لـالمـفـاهـيمـ وـالمـمارـسـاتـ الطـبـيـةـ.

Vision

In addition to offering top-notch nursing services that are sensitive, current, and focused on the needs of the patient, the department of medical and surgical nursing is fundamentally built on competence, critical thinking, and a holistic perspective of the patient.

الرؤية

بالإضافة إلى تقديم خدمات تمريضية من الدرجة الأولى حساسة وحديثة وتركز على احتياجات المريض، فإن قسم التمريض الباطني والجراحي مبني بشكل أساسى على الكفاءة والتفكير النقدي والمنظور الشامل للمريض.



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Wound Dressing



Surgical Hand Scrub

➤ **Definition**

- Surgical hand washing or scrub is used to remove soil and most transient microorganisms from the skin.

➤ **Purpose:**

1. Remove dirt and transient microorganisms
2. Reduce resident skin flora
3. Delay microbial regrowth
4. Prevent surgical site infections
5. Maintain a sterile operating environment

➤ **Equipment**

- Deep sink with foot or knee controls for dispensing water and soap (faucets should be high enough for hands and forearms to fit comfortably)
- Antimicrobial agent approved by the health care facility
- Surgical scrub sponge with plastic nail pick.
- Paper face mask, cap or hood, surgical shoe covers
- Sterile towel
- Sterile pack containing sterile gown
- Protective eyewear (glasses or goggles)

Steps	Rationale
Consult manufacturer policy regarding required length of time and antiseptic to use for hand antisepsis.	Guidelines vary regarding ideal time needed and antiseptic to use for surgical scrub.
Be sure that fingernails are short, and clean. Artificial nails should be removed. Natural nails should be less than 1/4 inch long	<ul style="list-style-type: none"> - Long nails and chipped or old polish increase number of bacteria residing on nails. - Artificial nails are known to harbor gram-negative microorganisms and fungus



Inspect condition of cuticles, hands, and forearms for abrasions, cuts, or open lesions.	Broken skin permits microorganisms to enter layers of the skin.
Remove bracelets, rings, and watches in a locker.	Jewelry may harbor or protect microorganisms from removal.
Routine hand hygiene	To reduce transmission of infection.
Apply surgical shoe covers, cap or hood, face mask, and protective eyewear	Mask prevents escape from microorganisms that can contaminate hands into air.
Turn on water using knee or foot controls and adjust to comfortable temperature.	Knee or foot controls prevent contamination of hands after scrub.
Pre-scrub wash/rinse: Wet hands and arms under running warm water and lather with detergent to 5 cm (2 inches) above elbows. (Hands need to be always above elbows.)	Keeping hands elevated allows water to flow from least to most contaminated areas.
Rinse hands and arms thoroughly under running water. Remember to keep hands above elbows.	Rinsing removes transient bacteria from fingers, hands, and forearms.
Under running water clean under nails of both hands with nail pick. Discard after use	Removes dirt and organic material that harbors large numbers of microorganisms. 
Surgical hand scrub (with brush) a. Wet clean sponge and apply antimicrobial agent. Visualize each finger, hand, and arm as having four sides. Wash all four sides effectively. Scrub the nails of	Friction loosens resident bacteria that adhere to skin surfaces.

one hand with 15 strokes and all surfaces of each finger. Scrub the thumb, palm, and posterior side of hand with 10 strokes each



Scrub side of fingers.

Divide the arm mentally into three thirds: scrub each third 10 times with circular strokes. Rinse brush and repeat sequence for the other arm. A two-brush method may be substituted.

Eliminates transient microorganisms and reduces resident hand flora.



Scrub forearms



Rinse arms.

Discard brush. Flex arms and rinse from fingertips to elbows in one continuous motion, allowing water to run off at elbow

Hands remain the cleanest part of upper extremities

Turn off water with foot or knee control, with hands elevated in front of and away from body. Enter operating room suite by backing into room.

Keeps hands free of microorganisms

Approach sterile setup: grasp sterile towel, taking care not to drip water onto sterile setup

Water contaminates sterile setup.

Bending slightly at waist, keeping hands and arms above waist and outstretched, grasp one end of sterile towel and dry one hand, moving from

Dry skin from cleaner (hands) to less clean (elbows)



fingers to elbow in a rotating motion	
Repeat drying method for other hand by carefully reversing towel or using a new sterile towel.	Prevents accidental contamination
Drop towel into linen hamper or circulating nurse's hand.	Prevents accidental contamination.
Proceed with sterile gowning	

Applying a Sterile Gown and Performing Gloving

➤ Purpose

1. Maintain a sterile field
2. Protecting patients from infection
3. Protect staff from exposure to blood, body fluids, and potentially infectious materials during surgical procedures, reducing the risk of cross-contamination and occupational infections.
4. Ensure aseptic technique
5. Meet surgical safety standards

➤ Equipment

- Package of proper-size sterile gloves (latex free if nurse or patient has sensitivity or allergy)
- Sterile pack containing sterile gown.
- Clean, flat, dry surface
- Paper face masks, cap or hood, surgical shoe covers
- Protective eyewear/face shield.

Procedure

Steps	Rationale
Before entering operating room or treatment area, apply cap, face mask, eyewear, and foot covers (paper or cloth covers fit over work shoes).	To prevent hair and air droplet nuclei from contaminating sterile work areas. Eyewear protects mucous membranes of eye. Foot covers reduce contamination from shoes.
Perform surgical hand scrub	To remove transient and resident bacteria.
Circulating nurse assists by opening sterile pack containing sterile gown (folded inside out).	Outer surface of gown remains sterile.
Reach down to sterile gown package; lift folded gown directly upward and step back away from table.	Provides wide margin of safety, avoiding contamination of gown.



Pick up the sterile gown at the inner neckline	This preserves the sterility of outer gown surface.
Hold the gown away from the body and other unsterile objects.	
Allow gown to unfold, keeping inside of gown toward body. Do not touch outside of gown with bare hands.	Outside of gown is sterile surface
With hands at shoulder level, slip both arms into armholes simultaneously. Ask circulating nurse to bring gown over your shoulders by reaching inside to arm seams and pulling gown on, leaving sleeves covering hands.	Careful application prevents contamination. Gown covers hands to prepare for closed gloving
Have circulating nurse securely tie back of gown at neck and waist. (If gown is wraparound style, do not touch sterile flap to cover it until you are gloved.)	Gown must completely enclose underlying garments
	



Place arms in sleeves

Circulating nurse ties scrub gown

With hands covered by gown sleeves, open inner sterile glove package

Hands remain clean. Sterile gown cuff touches sterile glove surface



Wearing gloves (closed method)	
With dominant hand inside gown cuff, pick up glove for non-dominant hand by grasping folded cuff	Sterile gown touches sterile glove
Extend non-dominant forearm with palm up and place palm of glove against palm of non-dominant hand. Glove fingers point toward elbow	Positions glove for application over cuffed hand, keeping glove sterile.
Grasp back of glove cuff with covered dominant hand and turn glove cuff over end of non-dominant hand and gown cuff	Seal created by glove cuff over gown prevents exit of microorganisms over operative sterile field.
Grasp top of glove and underlying gown sleeve with covered dominant hand. Carefully extend fingers into glove, being sure that glove cuff covers gown cuff	
Glove dominant hand in same manner, reversing hands. Use gloved non-dominant hand to pull on glove. Keep hand inside sleeve	Sterile touches sterile
Be sure that fingers are fully extended into both gloves	Ensures that nurse has full dexterity while using gloved hand
 Scrub nurse opens glove package. Second glove is applied	 Glove is applied to left hand as right hand remains inside cuff



	
<p>For wraparound sterile gowns: take gloved hand and release fastener or ties in front of gown</p>	<p>Front of gown is sterile</p>
<p>Hand paper tab connected to sterile tie to circulating nurse, who is non-sterile. Circulating nurse stands still as you turn completely around to left, allowing for margin of safety as gown wraps around and covers your back. Take back sterile tie from circulating nurse and secure tie to gown.</p>	<p>Contact with team member could contaminate gown and gloves. Gown must enclose undergarments</p>
 <p>Hand tie to sterile team member</p>	

Donning and removing sterile gloves (open method)

Steps	Rationale
1- Place the package of gloves on a clean dry surface.	Any moisture on the surface could contaminate the gloves.
2- Open the outer package without touching the inner sterile wrapper.	Maintains sterility of the inner surface.
3- Open the inner package according to the manufacturer's directions. a- Place the package in the center of the work area so that the top flap of the wrapper opens away from you. b- Reaching around the package (not over it), pinch the first flap on the outside of the Wrapper between thumb and index c- Repeat for the side flaps, opening the top one first. Use the right hand for the Right flap, and the left hand for the left flap. e- Pull the fourth flap toward you by grasping the corner that is turned down.	<ul style="list-style-type: none"> - Pull the flap open, laying it flat on the far surface. - The hands are not sterile. By touching only the inside glove, the nurse avoids contaminating the outside. <p style="text-align: center;">c</p> 
4- Grasp the dominant hand glove by its cuff the palmer side with the thumb and first finger of the nondominant hand. Touch only the inside of the cuff.	Touching only the inside preserves sterility.
5- Insert the dominant hand into the glove and pull the glove on keep the thumb of the inserted hand against the palm of the hand	If the thumb is kept against the palm, it is less likely to contaminate the outside of the glove

during insertion. Leave the cuff turned down.	
6- Pick up the other glove with the sterile gloved hand, inserting the gloved fingers under the cuff and holding the gloved thumb close to the gloved palm.	
7- Pull on the second glove carefully holds the thumb of the gloved first hand as far as possible from the palm.	In this position the thumb is less likely to touch the arm and become contaminated.
8- Adjust each glove so that it fits smoothly and carefully pull the cuffs up by sliding the fingers under the cuffs.	
9- Remove first glove by pulling near cuff over the hand so that the glove inverts itself with the contaminated surface inside.	
10- Slide two fingers of the bare hand against the wrist under the cuff of the outer glove and slide the second glove off, inverting it over itself and the first glove. Discard the gloves in the designated container.	<p>This helps prevent accidental contamination of the glove by the bare hand. Sterile gloves are considered contaminated once they have been used.</p>

Asepsis

➤ **Asepsis** is the freedom from disease-causing microorganisms.

➤ **Types of asepsis**

1. **Medical asepsis** includes all practices limiting the growth, number and transmission of microorganisms.
2. **Surgical asepsis:** A practice designed to eliminate all microorganisms—including spores—from objects and areas, ensuring sterility during procedures that penetrate the skin or enter sterile body cavities.

➤ **Categories or levels of asepsis**

First category: for Critical items – by sterilization

- **Sterilization** is the highest level of asepsis.
 - It is a type of surgical asepsis that kills all microorganisms, including viruses and spores.
 - Sterilization methods include pressurized steam, dry heat, and radiation or gas.
 - Sterilization is used on instruments and equipment that enter sterile tissue or vascular systems. Examples:
 1. Surgical instruments
 2. Cardiac catheters
 3. Urinary catheters
 4. Needles
 5. Implants

Second category: for Semi critical items-by Disinfection

- **Disinfection** is the middle level of asepsis.
 - Disinfection is a type of medical asepsis that destroys most pathogens but is not always effective on viruses and spores.

- Items that come in contact with skin that is not intact or mucous membranes present risks. So, these objects must be free of all microorganisms (except bacterial spores). Some of these items follow:
 1. Respiratory therapy equipment
 2. Endotracheal tubes
 3. Gastrointestinal endoscopes
 4. Reusable mercury thermometers

Third category: for Noncritical items – by Cleaning

- **Cleaning** is the lowest level of asepsis. It is also called sanitization.
- The cleaning process does not require harsh chemicals to destroy pathogens, so cleaning can be used on people.
- Items that come in contact with intact skin but not mucous membranes must be clean. Some of these items follow:
 1. Bedpans
 2. Blood pressure cuffs
 3. Crutches
 4. Linens
 5. Food utensils

Principles of Aseptic techniques

➤ Definition of aseptic technique

- Aseptic technique is the technique used to avoid the introduction of pathogenic organisms into the body.

➤ Purpose of aseptic technique

- Protect the patient from contamination by pathogenic organisms during medical, surgical and nursing procedures.

➤ Principles of aseptic techniques

Principles	Practices
1. All objects used in a sterile field must be sterile.	<ul style="list-style-type: none"> • Check packages for sterility by assessing intactness, dryness, and expiry date prior to use. • Any torn, previously opened, or wet packaging, or packaging that has been dropped on the floor, is considered non-sterile and should not be used in the sterile field.
2. A sterile object becomes unsterile when touched by a non-sterile object.	<ul style="list-style-type: none"> • Handle sterile objects that will touch open wounds or enter body cavities only with sterile forceps or sterile gloved hands. • Discard or re-sterilize objects that come into contact with unsterile objects.
3. Sterile objects that are out of sight or below the waist or table level are considered unsterile.	<ul style="list-style-type: none"> • Sterile objects are always kept in view. Nurses do not turn their backs on a sterile field.

	<ul style="list-style-type: none"> • Only the front part of a sterile gown, from shoulder to waist (or table height, whichever is higher) • Cuff of the sleeves to 5 cm (2 in.) above the elbows are considered sterile. • Always keep sterile gloved hands in sight and above waist/table level; touch only objects that are sterile
4. Sterile objects can become unsterile by prolonged exposure to airborne microorganisms.	<ul style="list-style-type: none"> • Keep doors closed and traffic to a minimum in areas where a sterile procedure is being performed, because moving air can carry dust and microorganisms. • Keep areas in which sterile procedures are carried out as clean as possible by frequent damp cleaning with detergent germicides to minimize contaminants in the area. • Keep hair clean and short or enclose it in a net to prevent hair from falling on sterile objects. • Wear surgical caps in operating rooms, delivery rooms, and burn units. • Refrain from sneezing or coughing over a sterile field. This can make it unsterile because droplets containing microorganisms from the respiratory tract can travel 1 m (3 ft). Some agencies recommend that masks covering the mouth and the nose be worn by

	<p>anyone working over a sterile field or an open wound.</p> <p>When working over a sterile field, keep talking to a minimum.</p>
5. The wrapper of a sterile pack must be opened away from the body.	<ul style="list-style-type: none"> ● The distal flap first, the lateral flaps next and the proximal flap toward the body last, thus making it unnecessary to reach over the sterile field
6. Keep forceps blades in sight, above waist level and pointed downward.	<ul style="list-style-type: none"> ● As it is the correct position of the blades, sterile items that are out of vision or below the waist level of the nurse are considered unsterile
6. Any puncture, moisture, or tear that passes through a sterile barrier must be considered contaminated.	<ul style="list-style-type: none"> ● Moisture that passes through a sterile object draws microorganisms from unsterile surfaces above or below to the sterile surface by capillary action.
7. The edges of a sterile field are considered unsterile.	<ul style="list-style-type: none"> ● A 2.5-cm (1-in.) margin at each edge of an opened drape is considered unsterile because the edges are in contact with unsterile surfaces. Any article that falls outside the edges of a sterile field is considered unsterile.
8. The skin cannot be sterilized and is unsterile.	<ul style="list-style-type: none"> ● Use sterile gloves or sterile forceps to handle sterile items
9. When a sterile object becomes unsterile, it does not necessarily change in appearance.	
10. Educate and Communicate	<ul style="list-style-type: none"> ● Ensure all team members understand aseptic principles. ● Speak up if a break in sterility occurs—safety comes first.

Antiseptic Solutions

Difference between antiseptics, disinfectants, antibacterials and antibiotics

- **Antiseptics:** are biocides or products that destroy or inhibit the growth of microorganisms including viruses and spores in or on living tissue (e.g. health care personnel hand washes and surgical scrubs)
- **Disinfectants:** A chemical agent used to destroy, inactivate, or reduce the concentration of pathogenic microorganisms—such as bacteria, viruses, and fungi—on hard surfaces and in water, excluding bacterial spores in most cases
- **Antibacterial:** are effective in killing or slowing the growth of bacteria.
 - They do not kill or prevent viruses from growing.
- **Antibiotic:** An antibiotic is an agent that either kills or inhibits the growth of a microorganism.

N.B: All antibiotics are anti-bacterial but all anti-bacterial are not antibiotics.

Uses of antiseptics

1. *Hand hygiene:* chlorhexidine gluconate and povidone-iodine solutions are often used in hand scrubs and hand rubs and. Alcohol in concentrations 70% in hospitals.
2. *Pre-operative skin disinfection* – antiseptics applied to the operation site to reduce the resident skin and prevent surgical site infections.
3. *Disinfection of mucous membrane*— antiseptic irrigations may be instilled into the bladder, urethra or vagina before catheterization to treat infections or cleanse the cavity.
4. Preventing and treating infected wounds and burns.
5. Treating mouth and throat infections

General guidelines for using antiseptic solutions:

1. Consider using a topical antiseptic solution to cleanse wounds presenting with

- signs and symptoms of local infection,
2. Consider using topical antiseptic solutions as an adjunct to systemic antibiotics in patients who have signs of spreading wound infection.
 3. Do not use more than one topical antimicrobial or antiseptic product at a time.
 4. A topical antiseptic solution should be used for up to five days and for no longer than 14 days at the most.
 - After five days of use, the wound should be re-assessed for signs of improvement, such as a reduction in slough or odor, which would indicate a reduced bacterial burden.
 - Once the wound starts to improve, the antiseptic solution should continue to be applied for up to 14 days and then discontinue
 - If, after 14 days, the wound is found to have deteriorated or shows signs of spreading infection, use of systemic antibiotics should be considered.
 5. Once the wound has improved, stop using the antiseptic cleaning solution

The most common antiseptic solutions are:

1) Betadine (povidone-iodine)

Mechanism of action:

- It kills bacteria spores, fungi, and viruses by penetrating microbial cell membranes and interacting with proteins, nucleotides, and fatty acids in the cytoplasm and cytoplasmic membrane.
- This interaction ultimately results in rapid cell death.

Indications:

- Pre- and post-operative skin disinfection.
- Used for cleaning closed wounds.
- Used to treat infection in septic wounds e.g. decubitus ulcer.

- Preparation of the skin and mucous membranes of injections, and aspiration needle biopsy.
- Maintaining oral hygiene before, during and after dental or oral surgery.
- Antiseptic treatment of inflammation of the vagina (non-specific or mixed).

Side effects:

- Many patients are allergic to iodine as it interferes with tissue granulation.
- Neutropenia (low white blood cells). Excessive absorption of iodine can result in systemic effects such as metabolic acidosis (a metabolic disorder).
- Hyperthyroidism (increased secretion of thyroid hormone) and hypothyroidism (decreased thyroid hormone).

Different concentrations of Betadine:

Concentration	(0.5% povidone-iodine) Oral Antiseptic	(7.5% povidone-iodine) Surgical Scrub	(Povidone-iodine, 10%) Antiseptic Solution
Uses	Oral rinse for the preparation of the oral mucosa prior to injection, dental surgery or tooth extraction	Significantly reduces the number of microorganisms on the hands and forearms prior to surgery.	For preparation of skin prior to surgery Help reduce bacteria on the skin that can potentially cause infection
Figure			

2) Alcohol

Available Concentrations:

- Ethyl alcohol 70%. It is commonly used in the hospital
- Isoprobyl alcohol 91%.

Mechanism of action:

- Alcohol works better at 50% to 80% concentration because it can go through dirt and body fluids more easily at that level.
- Denatures proteins: Alcohol unfolds and inactivates microbial proteins, leading to cell death.
- Disrupts membranes: It dissolves the lipid layer of cell membranes, causing leakage and destruction.
- Inhibits enzymes: Stops essential microbial enzymes from functioning.
- Water enhances effect: 60–90% alcohol solutions are most effective—water helps penetrate cells and denature proteins more efficiently

Indications:

- It is used to disinfect skin before a needle stick and before surgery.
- Strong antiseptic solution used for closed stitched wounds.
- Alcohol is used to clean the skin around a wound, but not inside the wound. If alcohol touches the open wound, it can cause irritation and make the bleeding worse.

3) Hydrogen peroxide (H₂O₂)

Mechanism of action:

- It liberates O₂ which when it comes in contact with the tissue's effervescence occurs and brings microorganisms to the surface.

Indications: It is powerful antiseptic solution, used in septic and non-deep wounds that

include necrotic dead tissues.

Notes:

- Effervescence should be removed at once.
- After use should be washed by normal saline as mechanical wash.
- When epithelial tissue begins to be formed, hydrogen peroxide is discontinued as it inhibits tissue formation.



4) Chlorhexidine

- Chlorhexidine: is a powerful antiseptic and disinfectant that is widely used in medical setting e.g. chlorhexidine gluconate 4%

Mechanism of action:

- Chlorhexidine kills by disrupting the cell membrane.
- It has both bacteriostatic (inhibits bacterial growth) and bactericidal (kills bacteria).

Indications:

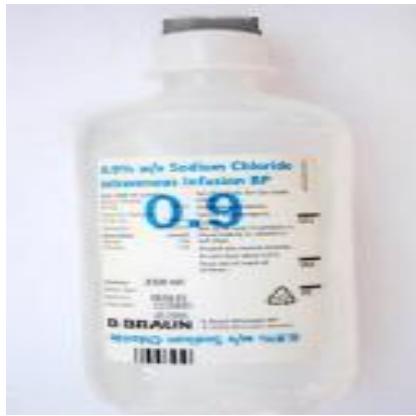
- *Surgical hand scrub* significantly reduces the number of microorganisms on the hands and forearms prior to surgery or patient care
- *Patient preoperative skin preparation*
- *Skin superficial wound and general skin cleansing* as it causes severe irritation in deep wounds.
- *Mouth wash products* e.g. Listerine – Hexitol.



5) Normal saline 0.9% (NaCl)

Indications as antiseptic solution:

- Using sterile saline water to irrigate wounds is one of the most common cleansing methods in hospitals.
- Used as mechanical washing after another solution as H₂O₂.
- It can be used to wet dressing if it adheres to the wound (softening of old dressing).



6) Tincture of iodine

Mechanism of action:

- It kills microbes by breaking down their proteins and DNA. The alcohol helps iodine enter cells quickly and work fast.

Indication: Used for closed wounds and minor abrasions.

Contraindications:

- Newborn infants.
- Large open wounds.
- Patients who are allergic to iodine products.

Notes:

- It contains 2% iodine in 7% alcoholic solution.
- It should be fresh because old solution becomes concentrated sand can cause tissue damage.



7) Glycerin magnesia

- Available as aqueous solution and glycerine-based gel dressing (elasto gel) which is advanced wound dressing.

Mechanism of action: It creates a hypertonic environment that draws water out of microbial cells, causing dehydration and cell death.

Indication: Used for deep septic wound.

Advantages:

- Absorb the excessive exudates from the wound: It can absorb 3–4 times its own weight of fluids.

- The dressing will not dry out or allow the exudate to dry out, thus keeping the dressing from becoming bonded to the wound or the surrounding tissue.
- It has been also proven to be bacteriostatic / fungi static.

Note: It must be left without drying.

8) Acetic acid

- Acetic acid concentration is frequently used in wounds as a 0.25 % or 0.5% solution.

Mechanism of action: It is bactericidal against many Gram-positive and Gram-negative organisms, especially *Pseudomonas aeruginosa*.

Side effect: Acetic acid initially delayed re-epithelialization HP 17 - Acetic acid is cytotoxic



9) Mixture solution

Composition: 60% normal saline + 30 % glycerin magnesium +10% acetic acid.

Mechanism of action: Promote granulation

Uses: Deep septic wound

10) Aloe Vera Gel

Mechanism of action:

1. Aloe Vera Gel promotes wound healing by directly stimulating the activity of macrophages and fibroblasts.
2. Anti-inflammatory

Uses: effective against *Salmonella* and aerobic bacteria



Preparing Package and Sterile Field

- **A sterile field** provides a sterile surface for placement of sterile equipment.
- **Sterile drapes** provide a work surface for placing sterile supplies and manipulating items with sterile gloves and establishing a sterile field around a treatment site such as a surgical incision, venipuncture site, or site for indwelling urinary catheter.

➤ **Responsibilities for maintaining a sterile field**

Surgical Technician

- 1- Prepare the sterile field before the surgical procedure begins.
- 2- Ensure that all instruments and materials placed within the field are sterile.
- 3- Work closely with the surgical team to maintain sterility throughout the operation.

Nurse

- 1- Establishes and maintains a sterile field during procedures that require sterile technique, such as:
 - Dressing changes for burns or large wounds
 - Invasive bedside procedures
- 2- Follow principles of aseptic technique

➤ **Types of packages**

1. Minor package, package contains one artery forceps
2. Major package, package contains two artery forceps or more
3. Package for removal of suture, package contains one artery forceps & one scissor for removal of suture

➤ **Equipment:**

- Iodine bowel.
- Kidney basin
- Number of dressings as needed
- Number of gauzes.
- Number of cotton sponges.
- One artery forceps or tissue forceps in (minor package) and Two artery forceps in (major package), scissors for removal of suture if needed.
- Clean towel or drape.
- Adhesive tape.

➤ **Procedure:**

Steps	Rationale
1 -Perform hand washing.	To prevent contamination
2 -Prepare equipment	To save time and effort.
3 - Place the towel or drape of package in the middle of clean table. a- Proximal flap. b- Right flap. c- Left flap. d- Distal flap.	
4- Place the kidney basin in the middle of towel.	

5 - Arrange the equipment and supplies in the kidney basin according to use	To facilitate handling
6- The dressing on the right side with each downward. The gauze and cotton sponge in the middle, ideal bowl on the left side and small layer of cotton in it.	
7- All articles must be opened and separated by a small layer of cotton.	To increase permeability of steam for good sterilization.
8- Close the package or sets as follows: Close the first flap (proximal). Two lateral flap next (right and left) and the distal flap.	
9- Fix the pack with adhesive tape	To maintain closure and prevent exposure and contamination of sterilization.
10- Label the package with name of section, date and type of package.	

Opening Sterile Package

➤ **The principles of opening sterile packages:**

1. Hand hygiene
2. Check that sterile package is dry and unopened also note expiration date
3. Always face the sterile field.
4. Always sufficient space between your body and the sterile field.
5. Open sterile packs away from the body.
6. Don't reach across sterile fields.
7. A sterile item needs to be covered if it is not being used immediately.
8. Reapply the cover by touching only the outside of the wrapper.

➤ **Procedure:**

Steps	Rationale
- Hand washing & wear mask.	- To minimize contamination.
- Place the package in the center of the work area. So that the top flap of the wrapper opens away from you.	
- Remove the adhesive tape.	
- Pinch the first flap (distal) on the outside of the wrapper between the thumb and index finger.	Touching only the outside of the wrapper to maintain the wrapper sterilization
- Lift the distal flap up and toward the back, away from the package.	- This position prevents subsequent reaching directly over the exposed sterile content.
- Start to open the sides of the towel without touching inner surface, use the right hand for the right flap, and the left hand for the left flap.	To prevent cross infection.
- Open the proximal flap, lift the flap up and toward you.	
- Cover the content with the far side (inner side touch inner side only).	
- Open the cover slowly with the left hand&take the artery forceps with right hand and start the steps of dressing.	Both hands used to avoid reaching over the sterile contents
- Leave the cover&close the artery forceps with the two hands (pointed down).	
- Be sure that the towel covers all the content.	

Preparing dressing cart

- Dressing cart is a stretcher or trolley made of stainless steel with wheels and different draws or shelves.
- It is used for storing and transferring all equipment and supplies needed for dressing.



➤ Steps of preparing dressing cart

A. Trolley cleaning and setup

1. Hand washing bring round container with soap, water, and wash cloth.
2. Wearing clean gloves. Put wash cloth in soapy water or apply disinfectant.
3. Clean the trolley using soap and water, or disinfectant, and a cloth.
4. Start at the top of the trolley and work down to the bottom legs of the trolley using single strokes with your damp cloth.
5. Dry the trolley, remove gloves and wash your hand.
6. Trolley setup for sterile dressing procedure
 - a. Top shelf arrangement:
 - Left Side:
 - Sterile dressing package
 - Other sterile equipment
 - Right side:
 - Antiseptic solutions
 - Package of disposable gloves
 - Additional items such as syringes for irrigation or a catheter
 - Center area:
 - Keep free to maintain a clean working space

b. Lower shelf:

- Place a rubber sheet
- Add a large basin for used instruments
- Store any additional non-sterile items as needed

c. Trolley side:

- Hang the wound care list or procedure checklist for easy reference

B. Sterile packet preparation and documentation

7. Prepare and check sterilization of the following packets

- Sterile dressing packet.
- Sterile artery forceps packet.
- Sterile iodine ball packet
- Inspect the integrity of the sterile item.
- Check the expiration date of equipment.
- Check the seal of packages.
- Check sterile indicator

8. Wound dressing record sheet (dressing list) should include:

- Patient name
- Date of admission
- Diagnosis
- Date of surgery
- Type of wound: The wound types listed in the dressing record sheet should be documented in the specified order: clean closed wound (as stitched wound), clean open wound, superficial septic wound, and deep septic wound (e.g., gas gangrene).
- Remarks
- Signature

Dressing Technique

➤ **Definition**

Dressing is the process of cleaning & covering the wound to protect it from infection and help it heal as much as possible by healthy way.

➤ **Purposes**

1. To provide the optimum environment for wound healing
2. To maintain a moist environment at the wound dressing interface
3. To allow gaseous exchange of oxygen, carbon dioxide & water
4. Providing mechanical protection
5. To allow monitoring and assessing for the wound

➤ **Characteristics of ideal dressing**

1. Lessens wound pain
2. Is acceptable to patients?
3. Can be removed easily and completely
4. Maintains a moist wound environment
5. Allow gaseous exchange
6. Is impermeable to external contamination
7. Absorbs excess wound fluid
8. Helps to prevent external injury to the wound bed
9. Avoids damaging the wound edges
10. Avoids maceration of surrounding tissue
11. Requires infrequent changes
12. Reduces scarring
13. Is readily available
14. Is affordable (within the means of the client and caregiver for continuity of care)

➤ **Types of dressing**

- There are many types of wound dressings. The decision about what type of dressing to use depends on several factors: the location, size, and type/depth of wound; the amount of drainage/exudate; the presence of infection/ need for debridement; and the frequency and difficulty of the dressing change, costs, and patient comfort.
 - 1- According to material
 - 2- According to technique
 - 3- According to type of wounds
 - 4- According to healing of the wound (colors).

According to material

- 1. Absorbent dressing** e.g. gauze that will absorb exudates from the wound & used in clean incision of wound.
- 2. Alginate dressing** e.g., Kalt state to provide wounds with calcium
- 3. Hydro gel dressing;** to absorb & retain enough water
- 4. Hydrocolloid dressing**
 - Designed to provide an ideal moist wound environment.
 - Interactive with wound exudate: fluid is absorbed into the dressing. This absorption causes a physical transformation, forming a gel-like substance that promotes healing.
 - Suitable for moderate exuding wounds and helps in autolytic debridement.
- 5. Hydro cellular dressing:**
 - A soft, absorbent dressing composed of hydrocolloid fibers.
 - Upon contact with wound exudate, it transforms into a cohesive gel, maintaining comfort and conformability.
 - Capable of absorbing large volumes of exudate, making it ideal for highly exuding wounds.

- Supports a moist healing environment while minimizing dressing change frequency.

According to technique

1-Dry sterile dressing: This technique is used for wounding such as surgical incisions that have minimal drainage, no tissue loss&that heal by primary intention.

Purpose

- a. To promote wound healing by primary intention
- b. To prevent infection
- c. To assess the healing process
- d. To protect the wound from mechanical trauma.

1- Wet to dry dressing: It is prescribed for debridement of wounds with extensive tissue loss that heal by secondary intention e.g., burns, varicose ulcer, or decubitus ulcer these wounds are not amenable to suturing.

- Wet-to-dry dressing uses moistened gauze that touches the wound surface.
- The gauze is left to dry for 4–6 hours between dressing changes.
- As it dries, it traps necrotic material in its fibers. Dry dressings do not trap debris as effectively.
- If the wet dressing does not dry properly, it may promote bacterial growth and cause tissue breakdown due to the damp environment.

Purpose

To debris a wound and promote secondary intention healing.

3-Moist transparent wound barrier: Moist transparent wound barrier such as op-site, Tegaderm often applied to ulceration or burned skin area.

Purpose

- a. To contain exudates and prevent wound infection

- b. To provide a moist wound environment & promote wound healing.
- c. To protect the wound from the trauma.
- d. To facilitate assessment of the wound healing.

Advantages

- 1- Transparent that allows observation of the wound
- 2- They are non-porous, self-adhesive dressing that doesn't require changing as other dressing do.
- 3- They are often in place until healing has occurred or as long as they remain intact.
- 4- The occlusion, the wound remains moist and retains the serous exudates, which hastens the healing, reduces the risk of infection.
- 5- Elastic they can be placed over joint without disrupting the client's mobility.
- 6- They adhere only to the skin area around the wound, not to be the wound itself, because the wound is kept moist
- 7- They allow the client to shower or bathe without removing the dressing.

According to types of wounds

1) - Open wound.

- a- Superficial wound
- b- Deep wound
- c- Deep septic wound

2) - Closed wound.

- a- Clean closed wound
- b- Closed wound with signs of inflammation

According to wound healing

1- Red wound: Characterized by traumatic or surgical wound, possible presence of serosanguinous drainage pink to bright or dark red healing with granulation tissue

Treatment focus.

- Protection and gentleness but through cleansing

Dressing /Therapy may include:

- Transparent film dressing
- Hydrocolloid or hydro gel
- Gauze a dressing with antibiotic ointment

2- Yellow wound: Characterized by presence of slough or soft necrotic tissue, liquid to semi-liquid

Treatment focus:

- Wound cleansing to remove non-viable tissue & absorb excess drainage

Dressing / therapy

- Irrigation
- Wet - to - dry dressing
- Hydro gel.

3- Black wound: Characterized by black, gray, or brown adherent necrotic tissue (Escher); possible presence of pus

Treatment focus:

- Debridement of Escher & non-viable tissue

Dressing / Therapy:

- Topical enzyme debridement
- Surgical debridement
- Hydrotherapy

- Chemical debridement
- Moist gauze
- Absorption dressing

➤ Dry sterile dressing

Indications of dry sterile dressing

- **Clean surgical incisions**
 - Protects sutured or stapled wounds from contamination and mechanical trauma.
- **Closed wounds with minimal or no drainage**
 - Provides a barrier against infection while keeping the wound environment dry.
- **Superficial wounds or abrasions**
 - Shields the wound from friction, dirt, and external irritants.
- **Post-operative wounds**
 - Used immediately after surgery to absorb small amounts of exudate and maintain sterility.
- **Protective covering for catheter or IV insertion sites**
 - Maintains sterility and prevents entry of pathogens.
- **Secondary dressing**
 - Serves as a cover over topical agents, ointments, or other primary dressings to keep them in place.

Equipment: -

- Clean, and sterile gloves
- Sterile prepackaged dressing
- Sterile towel
- Tape
- Antiseptic solutions

➤ **Procedure for dry sterile dressing**

Steps	Rationale
Pre-dressing Preparation	
1. Hand washing	
2. Prepare equipment (dressing cart and dressing list)	
3. Prepare environment	To keep privacy of patients
4. Identify the patient at least three names and explain procedure	<ul style="list-style-type: none"> • To ensure that the patient understands the procedure and has given his/her valid consent and that this is recorded.
5. Obtain and document verbal consent.	
6. Position the patient in a comfortable position in which the wound can be readily exposed. Expose only the wound area and use a bath blanket to cover the client, if necessary.	<ul style="list-style-type: none"> • To maintain the patient's comfort and dignity
7. Put a face mask, and clean disposable gloves (unsterile gloves)	
8. Take the makintouch from lower shelf and put it beside the patient.	<ul style="list-style-type: none"> • To prevent contamination of the wound by droplet spray from the nurse's respiratory tract, to prevent cross infection, and maintain comfort environment.
Removal of old dressing	
9. Remove old dressings by tucking adhesive tape under dressing.	<ul style="list-style-type: none"> • To loosen the dressing and prevent disruption of healing tissue.
10. Collect old dressing and assess for color, odor and consistency (Note) if the dressing adheres to wound, pour a small amount of sterile saline on the wound	
11. Remove gloves, Wash hands	<ul style="list-style-type: none"> • To prevent contamination of the wound



Preparation of sterile field

12. Open the package from the back and avoid crossover the package and Put cotton sponge in bowel

13. Pour solution in ideal bowl

- To be used as base line

14. Hand rub, put on sterile gloves and place sterile towel under wound.

Wound assessment and cleaning

15. Assess wound location, type, color, odor, wound drainage and signs of infection such as (redness, hotness, swelling and pain)

- To follow the principles of aseptic technique to decrease risks of cross infection.

16. Clean the wound using the artery or tissue forceps and gauze swabs moistened with antiseptic solution (saline). Soak sponge in saline then squeezes it on wall of bowl then elevate edges upward. Always keep the forceps tips lower than the handle. Use a separate swab for each stroke, cleaning from the top of the incision downward. Discard each swab after use

a. Clean with strokes from the top to the bottom by gentle pressure, starting at the center and continuing to the outside. Or clean with strokes outward from the incision on one and then outward on the other side.

b. Repeat the cleaning process until all drainage is removed.

c. If a drain is present, clean it after the incision.

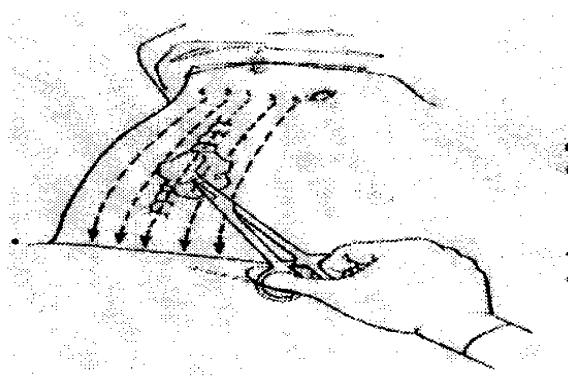


FIGURE 39-6 Cleaning a wound from top to bottom, starting at the center.

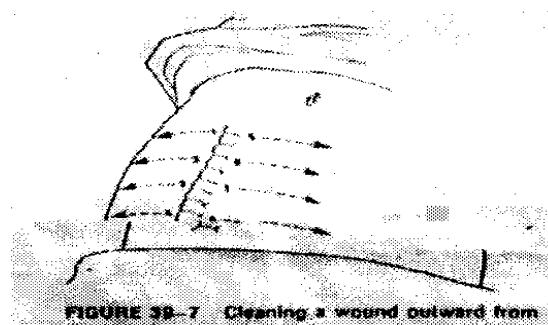


FIGURE 39-7 Cleaning a wound outward from the incision.



- d. Dry the wound with dry gauze swabs
- e. For irregular wounds, such as a decubitus ulcer, clean from the center of the wound-out word using circular strokes.

Note. In case of closed wound with signs of inflammation squeeze the wound by using two pairs of dressing before cleaning the wound.

Disinfection Notes:

- In case of clean closed wound using alcohol in disinfection of wound.
- In case of closed wound with signs of inflammation using betadine in disinfection of wound.
- In case of clean open wound using betadine in disinfection of wound.



Dressing application

17. Apply powder or ointment if required. Shake powder directly on to the wound, use sterile applicators or tongue blades to apply ointment
18. Apply sterile dry gauze on the wound. Apply sterile dressing with forceps, then adhesive tape (closed or window technique)

If a wound drain is present:

- Inspect the tube insertion site at least twice daily for signs of redness, swelling, or tenderness.
- Change the dressing around the drain daily after bathing, and as needed to keep the area clean and dry.
- Avoid pulling, kinking, or dislodging the tube during movement or care.
- Wash hands thoroughly and wear gloves before handling the drain reservoir.
- Observe and record:
 - *Amount of drainage:* The drainage will be greater just after surgery and will decrease as time goes. Amounts of 100cc's or greater are considered normal, decreasing to about 30 cc's or less just before the drain is removed.
 - *Color:* The drainage will be cherry red for about 24 hours after surgery but will become more yellow-straw colored prior to removal. If the drainage does not change from red after about two to three days, notify the surgeon.
 - *Consistency:* Initially, the consistency is slightly thicker than water and moves easily through the tube. It should become thinner with time. If the fluid becomes





<p>thicker or will not move easily through the tube, notify the surgeon.</p> <p>- <i>Odor</i>, if present</p> <ul style="list-style-type: none">• Before emptying the reservoir, close the clamp to prevent backflow.• Empty the reservoir from the designated port while holding it upside down over a measuring container.• Squeeze the reservoir gently to remove all collected fluid.• Connect the drain to the suction source if required.• Ensure the drain system is secure, intact, and patent to prevent dislodgement, leakage, or skin irritation.• Replace fluid loss through the drain with additional intravenous fluids (IVFs) as prescribed.	
19. Reassure the patient and rearrange equipment	
20. Remove gloves and discard all waste.	To prevent cross infection
21. Secure the dressing with tape, tie or a binder. 22. Hand hygiene 23. Document the dressing changes and all nursing assessments.	

➤ **Saline moistened sterile dressing**

Indications of saline-moistened sterile dressing

- **Debridement of necrotic tissue**
 - Used in *wet-to-dry* or *wet-to-moist* dressings to help remove slough and dead tissue.
- **Septic / infected wounds**
 - Helps absorb exudate, reduce bacterial load, and mechanically cleanse the wound when changed frequently.
- **Maintaining a moist wound environment**
 - Prevents desiccation, supports granulation tissue formation, and promotes faster epithelialization.
- **Protection of exposed structures**
 - Keeps tendons, bone, or other delicate tissue moist and protected.
- **Packing of deep or tunneling wounds**
 - Fills dead space, prevents abscess formation, and manages heavy drainage.
- **Temporary coverage**
 - Serves as a simple, low-cost option until advanced wound dressings are available.

Equipment:

- Clean, and sterile gloves
- Sterile prepackaged dressing
- Sterile towel
- Tape
- Antiseptic solutions
- Apron
- Sterile thin mesh gauze dressing

➤ **Procedure of a saline moistened sterile dressing**

Steps	Rationale
Pre-dressing Preparation	
1. Hand washing and wearing gloves	• To ensure that the patient understands the procedure and has given his/her valid consent and that this is recorded.
2. Prepare equipment (dressing cart and dressing list) & prepare environment	
3. Identify the patient at least three names and explain procedure, obtain and document verbal consent.	
4. Position the patient in position that enhance removal of fluid or drainage by gravity in kidney basin	• To maintain the patient's comfort and dignity
Removal of old dressing	
5. Put a face mask, and clean disposable gloves (unsterile gloves)	• To prevent contamination of the wound by droplet, to prevent cross infection
6. Take the mackintosh from lower shelf and put it beside the patient.	
7. Remove old dressings	
8. Collect old dressing and assess for color, odor and consistency then discard in red basket according hospital policy	
9. Take a swab from wound according to doctor order then put label of patient name, medical record number, name of department on the specimen according to policy. (Note) if the dressing adheres to wound, pour a small amount of sterile saline on the wound	<p style="text-align: center;">9</p> 

	<ul style="list-style-type: none"> • To loosen the dressing and prevent disruption of healing tissue.
12. Remove gloves. Wash your hands.	<ul style="list-style-type: none"> • To prevent contamination of the wound

Preparation of sterile field

10. Open the package from the back and avoid crossover the package and put cotton sponge in bowel
 11. Pour solution in ideal bowl
 12. Hand rub, Put on sterile gloves and place sterile towel under wound.

Wound assessment and cleaning

13. Assess wound location, type, color, odor, wound drainage and signs of infection such as (redness, hotness, swelling and pain)
 14. Collect pus then squeeze the wound by using two pairs of dressing (one in center of the wound and other squeeze from all edges of wound)
 15. Clean the wound by using syringe filled by normal saline.
 16. In case of superficial septic wound, deep wound with wide opening and deep wound with narrow opening make cleaning as a wound irrigation technique by syringe or by ideal bowl
- To be used as base line.
 Changes in the type or amount and characteristics of drainage may be signs of wound infection.

Wound debridement & package

17. Make wound debridement (removal of dead tissue or necrotic tissue from edges of wound), then make another cleaning of wound

18. Discard sterile gloves, apply hand hygiene and apply another sterile gloves.	
19. Disinfection of wound by betadine and the area around any wounds by alcohol ** In case of superficial septic open wound using squeezing technique, then make disinfection in two steps, first step by using hydrogen peroxide and saline then the second step by betadine.	
20. Pack the moistened dressing into all depressions and grooves of the wound, ensuring that all exposed surfaces are covered, if necessary, and use forceps to feed the gauze gradually into deep depressed areas.	Necrotic tissue is usually more prevalent in depressed wound areas and needs to be covered with the wet- to-dry gauze.
21. Using sterile technique cuts fine mesh gauze at appropriate length. . Saturate mesh gauze. . Pack the wound gently with moistened gauze. . Use applicators to press gauze into wound. . Dry around the wound with dry gauze swabs . Apply a dry gauze over the wet dressing . Assess the overall appearance of the wound. . Apply sterile dressing (surgical pad) can be picked up by hand, touching only the outside. . Secure the dressing with tape . Reassure the patient and rearrange equipment Remove gloves and discard all waste.	
22. Hand washing	To prevent cross infection

23. Document the dressing changes and all nursing assessments.

Wound irrigation

➤ **Definition of wound irrigation:**

Wound irrigation promotes wound healing through removing debris from a wound surface, decreasing bacteria counts, and loosening and removing eschar.

➤ **Indications of wound irrigation**

Contaminated or dirty wounds: Essential for wounds with soil, foreign bodies, or visible debris to reduce infection risk.

Septic / infected wounds: Helps flush out bacteria, pus, and necrotic tissue, supporting other antimicrobial measures.

Before wound closure (suturing or dressing): Irrigation is performed to minimize bacterial load and prevent post-closure infection.

Traumatic wounds and lacerations: Common in emergency settings; irrigation reduces complications and improves healing outcomes.

Wounds with exudate or topical residue: Removes dried secretions or remnants of ointments/antiseptics that may interfere with healing.

Routine dressing changes: Used to hydrate the wound bed, ease removal of old dressings, and prepare for new ones

➤ **Equipment:**

- Irrigate (cleansing solution).
- Sterile irrigation syringe.
- Sterile soft catheter if needed.
- Sterile basin for the irrigation solution.
- Sterile basin to receive the irrigation return.

- Sterile gloves.
- Clean gloves.
- Waterproof.
- Gown, if risk of spray.
- Goggles, if risk of spray.
- Dressing supplies.

➤ Procedure

Steps	Rationale
1- Review patient's medical record for presence of physician's prescription for irrigation of open wound and type of solution to be used	1- Open wound irrigation requires medical order including type of solution to use.
2- Assess recent recording of signs and symptoms related to patient's open wound: a- extent of impairment of skin integrity. b- Elevation of body temperature. c- drainage from wound d- odor e- size of wound (depth, length, and width) f- dressing dry and clean.	2- Data used as baseline to indicate change in condition of wound.
3- Hand hygiene	3- Reduce microorganisms
4- Explain procedure of wound irrigation and cleansing.	4- Providing necessary information will reduce client anxiety.
5- Position patient in comfortable position to permit gravitational flow of irrigating solution through wound and into collection basin	5- Directing solutions from top to bottom of wound and from clean to contaminated area prevents further infection.
6-Close the door and curtains.	6- Maintain privacy.
7.Before wound irrigation: <ul style="list-style-type: none"> • Remove the old dressing first and assess color, odor, amount, consistency of drainage & signs of infection • Discard old dressing and gloves • Perform Alcohol hand rub 	

8.Wound irrigation

- a. Pour warmed sterile irrigating solution into the sterile container.
- b. Wear sterile gloves
- c. Fill the irrigation syringe with solution. Using your non dominant hand, gently apply the basin against the skin below the wound to form a seal with the skin.
- d. Direct solution gently into the wound, keeping syringe tip 1 inch above, flushing from clean to dirty.
- e- Watch for the solution to flow smoothly and evenly. When the solution from the wound flows out clear, discontinue irrigation.
- f- Apply gentle squeezing at the sides of the wound
- g- Dry the surrounding skin in circular motion with gauze dressings.

9.Finally, apply a sterile dressing.

Removal of suture

➤ Procedure

Steps	Rationale
1. Perform hand hygiene	1- Prevent transmission of microorganisms.
2. Prepare the equipment.	2-Facilitate its use
3. Identify the patient and explain the procedure	3- Providing necessary information will reduce client anxiety.
4. Apply clean gloves.	4- Used for removing old dressing
5. Properly dispose of the soiled dressings in the biohazard trash container. Then Remove gloves and wash hands.	5- reduce microorganisms.
6. Open suture removal packet using sterile asepsis.	
7. Put on sterile gloves: a- With the thumb forceps, grasp the end of the knot closest to the skin surface and lift it slightly and gently up from the skin. b- Cut the suture below the knot, as close to the skin as possible. c- Use the thumb forceps to pull the suture out of the skin with a smooth motion	7. Maintain complete aseptic technique. a- Clearly identify the suture. b- Reduce the space which enters the skin that reduces the numbers of microorganisms.
9. Place the suture on the gauze sponge	9. Maintain it will help identify its numbers.



10. Clean the site with an antiseptic solution and cover it with a sterile dressing.	
11. Thank the patient.	
12. Properly dispose of the equipment and supplies.	
13. Clean the work area, remove your gloves, and wash your hands.	
14. Record the procedure, including the time, location of sutures, the number removed, and the condition of the wound.	14. Help with the transmission of information for the doctor.



Intravenous Therapy and Intravenous Solutions



Intravenous therapy (I.V therapy)

- It is the main method of supplying the patient with fluids and medications when the patient is unable to take them with the other methods.



➤ Indications of IV therapy:

1. Patients who have decreased fluid intake or excessive fluid loss—such as from hemorrhage, severe vomiting or diarrhea, or moderate to excessive drainage from wounds (especially burns)—are at risk of dehydration.
2. Infuse blood or blood products

➤ Contraindications of IV therapy:

1. Allergic reactions to components
2. Infection at the injection site
3. Poor peripheral venous access
4. Severe bleeding disorders
5. Peripheral arterial disease (PAD)
6. Severe venous insufficiency

➤ Complications of I.V Therapy

1. Pain at IV-line site.
2. Infiltration (leakage of non-irritating IV fluid into the surrounding tissue).
3. Extravasation (leakage of irritating or damaging drugs into the surrounding tissue).
4. Thrombophlebitis

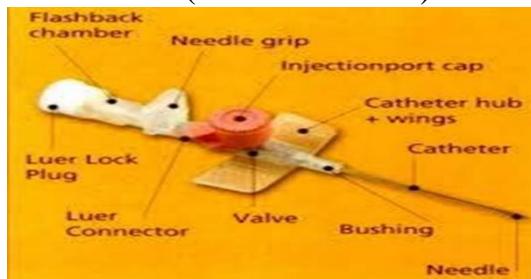
5. Bacteremia
6. Circulatory overload
7. Air Embolism
8. Hemorrhage
9. Venous Thrombosis
10. Hematoma

N.B. Accurate recording of the patient's intake and output is needed to determine the number of fluids necessary for daily replacement.



➤ Equipment:

- Intravenous infusion tray, including (tourniquet, alcohol swab, adhesive tape)
- Extension tubing and stand.
- IV catheter (needle/cannula)



- The prescribed fluid, medications to be given.
- Infusions pump if needed.
- Kidney basin
- Saline syringe
- Gloves.
- Sterile gauze or transparent dressing
- Three ways if needed
- The IV tubing set consists of
 - Spike end: which is inserted into the bag
 - The drip chamber
 - The tubing
 - Flow regulator or clamp,
 - A needle adapter.



➤ **Intravenous sets**

1. Primary intravenous sets
2. Controlled volume intravenous sets

1. Primary intravenous sets

- The primary IV tubing set is *selected according to the size of the drop to be delivered into the drip chamber*. There are three major sizes:
 - a. Regular drops (usually 15) of fluid as specified by the manufacturer used for administering IV therapy to most adult patients.



- b. Macro-drops (10 gtt/ml)-used for viscous (Sticky or gummy) fluids, such as blood.



- c. Micro drops (60 gtt/ml)-used when small amounts of fluid are required or when extreme care must be used to measure the exact amount; most often used for giving IV fluids to infants and children.



2. Controlled-volume intravenous sets (Infusion pump)

It is a machine that delivers IV fluids at a rate that is set by the nurse to administer small volumes of fluid or medication





➤ Different venous access devices

1. IV catheter (cannula) with different sizes

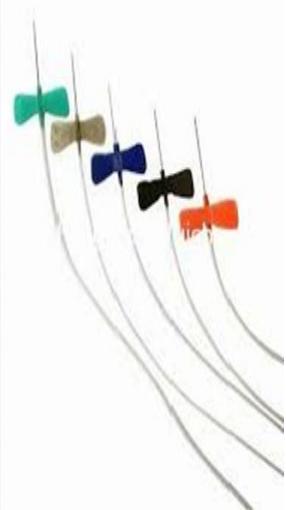
Cannula Sizes



Gauge (G)	Color Code Flow Rate (approx.)		Common Uses
	Color	Flow Rate (mL/min)	
14G	Orange	240 mL/min	Major trauma, rapid fluid resuscitation
16G	Grey	180 mL/min	Surgery, blood transfusion, emergency access
18G	Green	90 mL/min	Blood transfusion, IV fluids
20G	Pink	60 mL/min	Medications, IV fluids, routine use
22G	Blue	36 mL/min	Pediatrics, elderly patients, small veins
24G	Yellow	20 mL/min	Neonates, fragile veins
26G	Violet	13 mL/min	Extremely small veins, neonatal care



2. Intermittent infusion set





Procedure:

Steps	Rational
Review medication record for medications to be given.	To ensure safe and correct administration of IV therapy.
Assess for clinical factors that will respond to or affected by IV fluid such as peripheral edema/dry skin/poor skin turgor.	To provide baseline to determine effect on patient fluid and electrolyte balance
Hand hygiene and wearing gloves.	To reduce transmission of infection.
Preparing for the environment - By adjusting lighting as necessary. - Close room, door and pull curtains.	To keep privacy.
Prepare equipment. - Organize equipment - Checking IV solution using five rights of medication administration and check solution for color, clarity and expired date. - Cut pieces of tap and place on edge of clean over - bed table. - IV set preparation: <ul style="list-style-type: none">Move roller clamp to off positionWhen using bottled IV solution, remove metal cap.When using plastic solution bag remove plastic cap.	<p>To reduce risk for error.</p> <p>To save time & effort.</p> <p>To prevent accidental spillage of fluid.</p>  



- Place the container on flat surface, remove protector cap from insertion spike and insert into IV opening.



- Hang the solution on an IV stand and allow drip chamber to be filled with fluid at least halfway before opening the clamp.

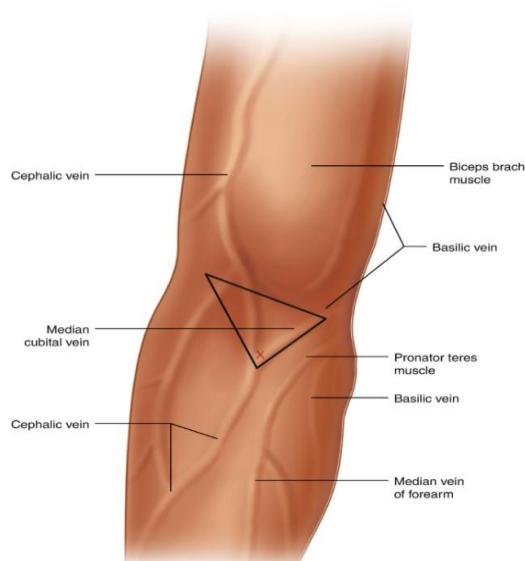
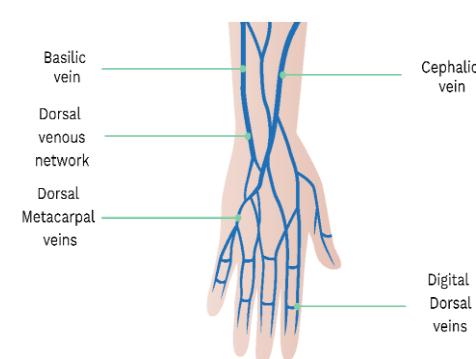


- Remove needle protector and release roller clamp to allow fluid to move through tubing to tubing to needle adaptor.
- Allow fluid to flow until air bubbles disappear.
- Return roller clamp to off position.
- Replace needle protector.

Introducing myself, and explain

To relieve patient (pt) anxiety & gain his

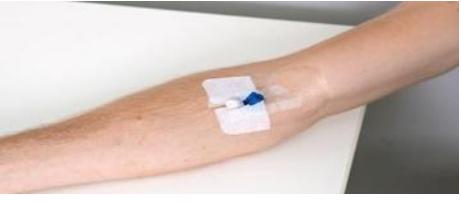


procedure	Cooperation
Verify patient identity by use at least two patient identification.	To improve patient safety.
Assist patients to comfortable position.	To promote comfort and relaxation of patient.
Assist patient to minimize anxiety by deep breathing and not looking at the site.	Assists in minimizing apprehension, sympathetic nervous system stimulation, and possible vasovagal reaction to venipuncture.
<p>Select the appropriate vein based on the following criteria:</p> <ul style="list-style-type: none">• If possible, choose a vein in the non-dominant arm or hand.• Choose large, straight, and visible veins.• Choose veins that are palpable and recoil when pressed, and not only visible.• Use veins on the dorsal and ventral surfaces of the upper extremities, including the metacarpal, cephalic, basilic, and median veins.• When choosing a site, avoid areas of flexion (joints); areas where there's pain on palpation; veins that are compromised by bruising, or poor skin integrity, infiltration, phlebitis, sclerosis.• Avoid veins with signs of repeated use.• Avoid the inner surface of the wrist because of the risk of nerve damage and they are usually very small veins.• Avoid using veins of the lower extremities because of the increased risk for tissue damage, thrombophlebitis, and ulceration.• Avoid vessels in an extremity with compromised circulation such as in cases of mastectomy, dialysis graft, or paralysis.• Don't choose veins on an extremity affected by radiation therapy, lymph edema, or stroke.	 <h2>DORSAL VEINS OF THE HAND</h2>  <p>VascuFirst</p>



<p>Apply tourniquet around arm 10 cm to 15cm (4 to 6 inch) above the selected site & should be tight enough to impede venous return but not occlude arterial flow.</p>	<p>To facilitate observation and puncture of distended veins.</p> 
<p>Ask the patient to open and close the fist a couple of times and hold it close. Then, recheck the vein</p>	<p>To destine the vein</p>
<p>Cleanse the insertion site from the insertion site outward and allow it to dry.</p> 	<p>To remove microorganisms from puncture site.</p>
<p>Stretch skin taut and stabilize vein with a non-dominant hand.</p> 	<p>To prevent vein from moving during procedure.</p>
<p>Remove the needle cover and holding IV cannula bevels up, enter the skin at 20–30-degree angle. Then lower angle to 10 degrees and enter vein wall.</p>	<p>Allow needles to enter smoothly through skin and approach vein wall.</p>
<p>Follow vein lumen with tip of needle to ensure placement in vein, watching ‘flashback’ of blood.</p> 	



Stabilize catheter with one hand and release tourniquet.	To confirm placement within vein.
	
Holding guide needle in place, gently thread plastic catheter off needle and into vein.	To decrease potential for vein rupture.
Apply gentle pressure over catheter in vein, remove guide needle, and attach sterile connection end of primed tubing into catheter hub.	To prevent needles from going through catheter & vein and prevents catheter from being dislodged by slight movement.
	
Secure with tape	Prevent the catheter from moving within the vein or from being accidentally pulled out
	
Label the insertion site, and solution container with time, date and medication if added to solution.	Serves as reminder to change site and tubing.
Adjust fluid flow rate according to accurate drop rate calculations.	To provide fluid therapy according to medical order.
Return equipment.	
Remove gloves, and perform hand wash	
<u>Documentation:</u>	
<ul style="list-style-type: none">- Type of fluid.- Injection site.- Flow rate, size and type of catheter / needle.- Signature.	
Immediately report for any abnormal reactions (e.g. shock, thrombophlebitis.)	

Calculating IV Flow Rate

To calculate the flow rate, you must know how many drops are contained in each milliliter as it passes through the drip chamber of the tubing.

- The standard set produces 15 gtt/mL.
- The pediatric or micro drip chamber produces 60 gtt/mL
- Macro drip of the transfusion-type sets gives 10 gtt/ml.

Example: If the physician ordered 1000 cc normal saline 0.9% intravenous over 8 hours. Calculate the flow rate of the IV fluid?

$$\text{Drops per minute} = \frac{\text{Volume to be infused in cc} \times \text{Drop factor of IV set}}{\text{Time in minutes}}$$

- Formula for flow rate calculation:

$$\frac{\text{Amount of solution (in mL)} \times \text{No. drops/mL}}{\text{Time (in min)}} = \text{Drops/min}$$
- When the order reads "1000 mL of D₅W over 10 hours," use a regular drip set (15 gtt/mL):

$$\frac{1000 \text{ mL} \times 15 \text{ gtt/mL}}{10 \text{ hr} \times 60 \text{ min}} = \frac{15,000}{600} = 25 \text{ gtt/min}$$
- When the order reads "D₅ ½ NS at 125 mL/hr," use:

$$\frac{125 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}} = \frac{1875}{60} = 31.25 \text{ or } 31 \text{ gtt/min}$$
- Formula for using a standard adult pump (mL/hr):

$$\frac{\text{Amount of solution (in mL)} \times 60 \text{ min/hr}}{\text{Time (in min)}} = \text{mL/hr}$$
- When the order reads "250 mg of medication in 100 mL, deliver over 30 minutes," use:

$$\frac{100 \text{ mL of solution} \times 60 \text{ min/hr}}{30 \text{ min}} = 200 \text{ mL/hr}$$

I.V solutions

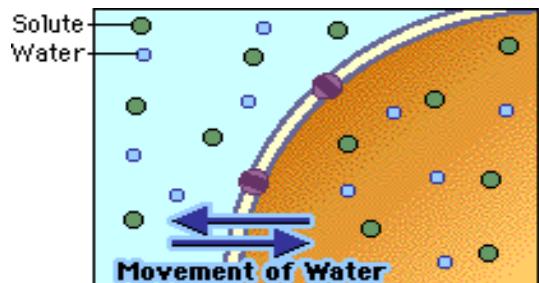


➤ Types of I.V solutions

1. **Crystalloids solutions:** Many of the best-known types of intravenous fluid fall under the general class of crystalloid solutions. These solutions contain chemicals with small molecules which can easily pass through the walls of capillaries into the body's cells. These fluids are divided into three groups:
 - a. Isotonic
 - b. Hypotonic
 - c. Hypertonic
2. **Colloids solutions:** Colloids contain larger insoluble molecules, such as gelatin; as blood and intralipid. Colloids preserve a high colloid osmotic pressure in the blood, while, on the other hand, this parameter is decreased by crystalloids due to hemodilution.
 - Another difference is that crystalloids generally are much cheaper than colloids. Colloids have large particles in them, so they are not as easily absorbed into the vascular bed. Because of this property colloids are used to replace lost blood, maintain healthy blood pressure, and volume expansion

Isotonic solutions

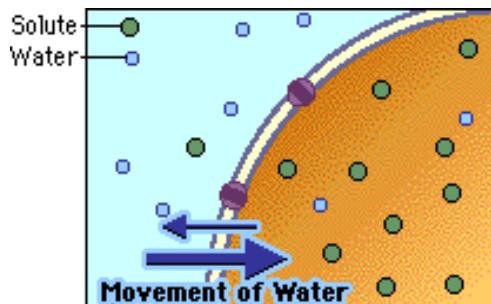
- Solution that exerts the same osmotic pressure as that found in plasma without causing a fluid shift from one compartment to another.
- Isotonic fluids match the body's electrolyte level.
- Serve a range of functions as increase blood volume(hypotension)
 - Normal Saline 0.9%.
 - Lactated Ringer



potonic solutions

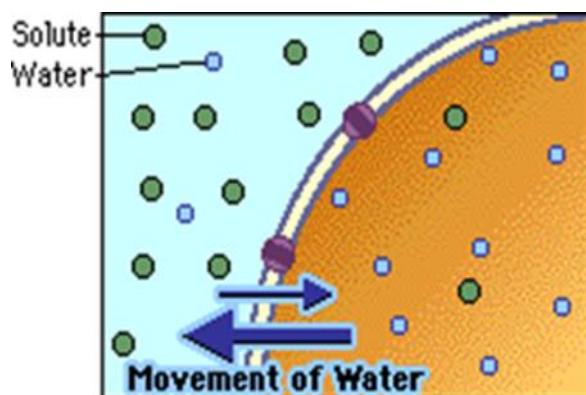
- Solution that exerts less osmotic pressure. It forces water movement into cell solutions to move into the cells causing them to ENLARGE.
- They have fewer electrolytes than plasma and are frequently used to hydrate patients.

- 5% dextrose
- 0.45% Saline (1/2 NS)
- 0.225% Saline (1/4 NS)
- 0.33% saline (1/3 NS)



Hypertonic solution

- A solution that exerts higher osmotic pressure than blood plasma. These fluids can fill blood vessels by withdrawing water from cells as in cerebral edema.



Solutions	Tonicity	Examples of clinical use
Saline 0.9%	Isotonic	With blood transfusions, hyponatremia.
Ringer's lactate	Isotonic	Trauma, dehydration from severe diarrhea or vomiting
5% Dextrose in 0.9% saline	Hypertonic	Early treatment of burn.
5% Dextrose in Ringer's	Hypertonic	Burns, dehydration from severe diarrhea or vomiting
0.45% Saline	Hypotonic	To supply normal daily salt and water requirements

Blood Transfusion

➤ **Definition**

- A blood transfusion is the infusion of whole blood or a blood component such as plasma, red blood cells, or platelets into the patient's venous circulation.
- The person receiving the blood is the recipient. The person giving the blood is the donor.

➤ **Indications**

- Acute blood loss – due to trauma, accidents.
- Blood disease (Anemia, hemophilia).
- Major operative procedures
- Severe burns

➤ **Blood and blood components that are commonly used in transfusion therapy**

1. **Whole blood transfusion:** Rarely used in patients with massive hemorrhage of $\geq 25\%$ total blood volume loss or for exchange transfusion.
2. **Red blood cells (RBCs):** The most needed blood component, red blood cells transport oxygen through the body. It is indicated in acute blood loss of greater than 1,500 ml and for patients with symptomatic anemia if they cannot function without treating the anemia
3. **Plasma:** Plasma is a liquid portion of blood.
 - It is used for correction of coagulopathies. It contains different proteins and other substances (electrolytes for example) that are needed for our bodies to function normally.
 - Plasma transfusions are often critically needed by burns, some organ transplant recipients, massive blood loss, and immunodeficiency disorders.
 - N.B. Frozen Plasma (FP) separated from an individual unit of whole blood and frozen within 24 hours of donation, whereas Fresh Frozen Plasma (FFP) within 8 hours of donation. FFP contains stable coagulation factors and plasma proteins present in fresh plasma.
4. **Platelets:**
 - It is used prophylactically to prevent bleeding in patients with bone marrow failure and treat hemorrhage in patients with thrombocytopenia or inherited or acquired platelet function defects such as leukemia or cancer chemotherapy treatment.
 - Heart surgery patients with this product owing to treatment-related loss, damage,

and/or destruction of their platelets.

5. **Cryoprecipitate** is indicated for acute Disseminated intravascular coagulation (DIC), severe liver disease with bleeding, and prophylactically for surgery when fibrinogen <1.5 g/L.

➤ Cross matching

- Cross matching is the process of determining compatibility between the blood
 - If blood is compatible-->no agglutination
 - If blood is no compatible -->agglutination occurs

➤ ABO and Rh / and compatibility basics

- Everyone has one of four blood types: A, B, AB, or O with either Rh positive or negative.
- Each group relates to the presence or absence of antigens on surface the RBCs and antibodies in the serum
- Rhesus (RH) factor:
 - The Rh factor is an inherited antigen in human blood. Blood that contains the Rh factor is known as Rh positive, when it is not present on the surface of the blood is said to be Rh negative.
 - If Rh-positive blood is injected into an Rh-negative person, the recipient develops Rh antibodies and may cause serious reactions with hemolysis of red blood cells

Table 1. Antigens and Antibodies Present for Each Blood Group

Blood Group	Ag Present on RBC	ABO Abs Present in Plasma
O	No Ag	Anti A and anti B
A	Ag A	Anti B
B	Ag B	Anti A
AB	Ag A and Ag B	No Abs
Rh+	Rh D	No Abs
Rh-	No Ag	No Abs

N.B.

- **Antigens:** Antigen is a substance that causes the immune system to produce antibodies against it.
- **Antibodies:** Antibodies are a protein substance developed in response to the presence of an antigen that has entered the body.

➤ Blood Compatibility

- Recipients shall receive ABO group-specific whole blood or ABO group-compatible red blood cell components. Transfused blood cells must lack the antigens to which the patient has the antibody, while transfused plasma must lack the antibodies against the patient's antigen(s).

N.B.

- In red blood cell transfusion, AB is universal acceptor and O is universal donor. But in plasma transfusion, AB is universal donor and O is universal receptor.

Patient ABO Group	Whole Blood	Red Blood Cells	Platelets	Plasma	Cryoprecipitate
O	O	O	Any (O preferred)	O,A,B,AB	N/A
A	A	A or O	Any (A preferred)	A or AB	N/A
B	B	B or O	Any (B preferred)	B or AB	N/A
AB	AB	AB,A,B, or O	Any (AB preferred)	AB	N/A

➤ Donated blood testing

- After collecting donors' blood are tested for ABO and Rh blood groups, red cell antibodies, microbiological markers (hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV), human T-lymphotropic virus (HTLV) and syphilis).

➤ What is blood transfusion reaction?

- It is abnormal signs and symptoms that will occur during or after transfusion and effects the patients' health.

Reaction	Causes	Clinical manifestations	Management
1-Allergic	<ul style="list-style-type: none"> - Sensitivity to donor antigen and antibody, which reacts 	<ul style="list-style-type: none"> - asthmatic wheezing (bronchospasm) - Hives - Flushing - Itching, rash - Hypotension 	<ul style="list-style-type: none"> - Stop transfusion immediately - Keep vein open with normal saline - Notify doctor, blood bank - Give antihistamine as directed.



	with recipient antigen		<ul style="list-style-type: none">- Send blood samples and blood bags to blood bank.- Collect urine samples for testing
2-Septic reaction	<ul style="list-style-type: none">- Transfusion of contaminated blood or blood components	<ul style="list-style-type: none">- Rapid onset of chills- High fever- Vomiting, diarrhea- Marked hypotension	<ul style="list-style-type: none">- Stop transfusion immediately- Keep vein open with normal saline- Notify doctor, blood bank- Give antipyretic- Check temp. Every 1/2hrs.- Obtain cultures of patients' blood- Treat septicemia as directed (IV fluids, antibiotics)
3-Hemolytic reaction	<ul style="list-style-type: none">- Infusion of incompatible blood product (Immune system attack the red blood cell of the donor)	<ul style="list-style-type: none">- Chills, fever- Lower back pain- Feeling of headache,- Flushing- Tachycardia, tachypnea and- Hypotension- Bleeding- Acute renal failure	<ul style="list-style-type: none">- Stop transfusion immediately- Keep vein open with normal saline- Notify doctor, blood bank- Administer prescribed diuretic- Maintain blood flow- Collect urine and blood samples for testing
4-non – hemolytic reaction	<ul style="list-style-type: none">- Hypersensitivity to donors, platelets, or plasma protein	<ul style="list-style-type: none">- Flushing- sudden chills and fever- Headache- anxiety	<ul style="list-style-type: none">- Stop transfusion immediately- Keep vein open with normal saline- Notify doctor, blood bank- Give antipyretics as directed.- Check temperature every 1/2hrs.or as indicated.

5- Circulatory overload	<ul style="list-style-type: none"> - Fluid administrated at a rate or volume greater than the circulatory system - Increased blood in pulmonary vessels and decreased lung compliance. 	<ul style="list-style-type: none"> - Distended neck veins - Hypertension, tachycardia - Dyspnea - Cyanosis - Crackles at base of lunges 	<ul style="list-style-type: none"> - Stop transfusion immediately - Keep vein open with normal saline - Notify doctor, blood bank - Keep airway open (pt. In fowler position) - Administer prescribed diuretic, oxygen, and aminophylline.
6. Febrile Non- Hemolytic Transfusion Reaction (FNHTR)	<ul style="list-style-type: none"> - Cytokine accumulation in stored blood components, especially platelets and red cells - Recipient antibodies reacting with donor leukocytes (e.g. anti-HLA antibodies) - Previous transfusions or pregnancies leading to immune sensitization 	<ul style="list-style-type: none"> - Fever typically begins within 2 hours after the transfusion is begun. - chills - Headache and malaise. - Muscle stiffness. 	<ul style="list-style-type: none"> - Stop transfusion immediately - Keep vein open with normal saline - Notify doctor and vital signs are monitored. - Usually, paracetamol is administered and transfusion resumed; however, severe reactions may be associated with rigours, myalgia, nausea, and hypotension and may prompt discontinuation of the transfusion

➤ **General considerations to prevent blood transfusion reaction:**

1. Donors

- Blood donated from people who haven't history of chronic diseases, such as tuberculosis, types of cancer, and hemophilia, is usually not used.
- Check vital signs and blood test.

2. Patient

- Previous allergic reaction
- Check vital signs

3. Nurse

- Sending blood sample for cross matching with clear and correct patient name, file number, room number, age, sex, department, bed number, date, time, nurse name and signature.

➤ **Nursing consideration in blood transfusion**

- Before receiving blood:
 - Check doctor order.
 - Patient assessment.
 - Pre-medicate the pt. 30 min. before receiving blood.
 - Check the blood compatibility, types before transfusion.
 - Monitor the pt. and vital signs every 15 minutes in 1st hour of blood administration.
- Never inject any medication into IV line with blood component infusing because of possible incompatibility or bacterial contamination of blood product.
- When clients require rapid infusion of multiple units of blood product, infusion tubing may be hung through a special blood warmer.
- Heating of blood unit itself, e.g. microwave or under hot water is strongly discouraged because it can cause destruction of cells.
- Rapid transfusion of cold blood through central line is discouraged because it may cause ventricular dysrhythmias.
- A transfusion should be completed within 4 hours of initiation. The risk of sepsis increases if blood hangs for a longer period. Blood tubing is changed with each subsequent unit transfused.
- It was misperceived that smaller-bore IV access results in slower infusion rates and cell hemolysis and it is necessary to select the largest-bore one possible administer to avoid PRBCs destruction. PRBCs infusion through smaller-gauge catheters could be completed within 4 hours without adverse infusion outcomes.
- Under any circumstances, blood components must not be stored on the unit refrigerator.
- Administer only 0.9% normal saline or morphine with blood transfusion. Solutions containing calcium (e.g. Ringer's lactate) or calcium-containing colloids antagonize citrate anticoagulant and may allow clots to form if mixed in the same infusion line.
- Hypotonic solutions, such as 5% dextrose in water, can cause hemolysis of red blood cells because of cell swelling.

Calculation of flow rate:

- Most infusion rates are given at a certain volume per hour.
- Delivery of the prescribed volume is determined by calculating necessary drops per minute to deliver the volume.
- **Calculate the infusion rate using the following formula**

$$\text{Drops/minute} = \frac{\text{total volume infused} \times \text{drops/mL}}{\text{total time for infusion in minutes}}$$

Example:

- Example: Infuse 150 mL of RBCs in 1 hour (set indicates 10drop/ml)?

$$\frac{150 \times 10}{60 \text{ minutes}} = 25 \text{ drops/minute}$$

➤ **Prepare the equipment:**

- Blood filters are designed to trap fibrin clots, broken blood cells and other debris that accumulate during blood storage.
- Gloves
- Normal saline
- Multi-lead tubing
- Cannula
- Tourniquet
- Cotton
- Ice bag
- Normal Saline

Procedure

Steps	Rationale
Assessment	
1. Check physician blood transfusion prescription (type and volume or number of blood component, date and time the transfusion).	To prevent incorrect blood component transfusion error.
2. Assess the patient's laboratory data (Hb, Hct, platelets, clotting times). Check the patient's blood has been typed and cross matched	To identify the reasons for transfusion and anticipate how the component to be administered will affect these values over the next 24 hrs.
3. Assess for conditions that increase the risk for fluid volume overload (Heart failure, renal failure, severe anemia)	These conditions may require a slower infusion rate.
4. Obtain or confirm blood transfusion consent including description of the risks, benefits, and treatment alternatives and the right to accept or refuse transfusion.	To ensure patient rights and avoid legal liabilities.
5. Obtain or review the patient transfusion history.	If the client has experienced a reaction in the past, be prepared to rapidly intervene.
6. Verify that suitable venous access is available. If not, insert an appropriate cannula: 20–22G for routine transfusion, 16–18G for rapid transfusion, and smaller gauges for fragile or difficult veins (though they may limit flow).	To avoid any delay in administration of the transfusion
7. Check patency of venous access using normal saline 0.9 %	



8. Monitor the patient's vital signs pre transfusion	<ul style="list-style-type: none">- To ensure any transfusion reaction is quickly detected and managed based on baseline changes.- If vital signs are abnormal, consult the physician before starting the transfusion.- An elevated temperature may increase the rate of cellular component destruction.
9. Assess for the presence of dyspnea, rashes, pruritus, chills or wheezing	To avoid confusion of these signs and symptoms with a transfusion reaction.

Planning

Collection of blood components and delivery to clinical area 10. Collect one unit of blood component at a time unless rapid transfusion of large quantities is required.	<ul style="list-style-type: none">- To avoid wastage of the blood component
11. Perform first check at the blood bank a. Check and ensure that details on the transfusion prescription match the details on the compatibility label on the unit and that the blood group and unit number on the bag match those on the compatibility report form b. Check the unit expiry date c. Visual inspection to check any signs of leakage, presence of clots, clumping, change in color.	<ul style="list-style-type: none">- To prevent incorrect blood component transfusion (IBCT) error- Expired or damaged products must not be used
12. Blood components must be appropriately transported in boxes designed and validated for this purpose	to ensure the component surface temperature can be maintained within

	the correct ranges during transportation
Before initiation of transfusion /receiving blood in the clinical area 13.Check that the correct blood has been delivered and document component arrival (second check)	
14.Transfusion must be initiated within 30 minutes or returned to the blood bank for proper storage	To prevent bacterial growth and maintain the quality of the blood component.
15.Frozen blood components need to be thawed before initiating the transfusion. Thawing of frozen blood components <ul style="list-style-type: none">- Thaw it in warm water-bath- The unit should be kept upright- Put inside another plastic bag	
16.Gather the necessary equipment	
17.Empty urine drainage container or have patient to void.	If the transfusion reaction occurs, a urine specimen will be sent to the laboratory
18.Identify the patient and explain the procedure.	<ul style="list-style-type: none">- To verify that the correct component will be given to the correct patient.- To gain patient cooperation and reduce fear and / or anxiety.
19.Double check labels with another nurse or physician (This final check must be performed at the patient's side immediately before administering the blood independently by each one)	If there are any discrepancies during the bedside check the unit should not be transfused and the transfusion laboratory should be informed immediately. The unit and

	compatibility form should then be returned to the transfusion laboratory.
20. Making the patient physically comfortable	
Implementation (blood component administration)	
21. Perform hand hygiene	
22. Wear disposable gloves.	
23. Gently invert the blood component container several times.	To mix cells with plasma
24. Connect the blood bag with the blood administration set <ol style="list-style-type: none"> Pull the stopper off the spiking port of the blood bag (keep the port opening sterile and don't touch it). Remove the spike cover from the blood administration set (don't touch the spike). Spike the blood bag by inserting the spike into the spiking port (do this by performing a twisting motion). Hang the bag on the IV pole. Open the clamp and squeeze the drip chamber until it is half or two thirds way full (most chambers have a line on them, so fill to the line). 	
25. Use blood warmer if it is indicated to warm blood component. (Large volume, rapid transfusions, Patients with clinically significant cold agglutinins, plasma exchange for therapeutic apheresis in adult or exchange transfusion in neonates)	To avoid unnecessary use of blood warmer that results in bacterial growth



26. Disinfect the IV-line port with alcohol swab	
27. Attach the blood administration set to the needle	
28. Start infusion slowly not faster than 20 drop/ min (120 ml/hr.) for first 15 min	
29. Remove the gloves and perform hand hygiene	
30. Physical attendance at the patient's bedside for the first 15 min	To look for any signs of transfusion reactions, such as fever, chills, rash, itching, chest pain, or shortness of breath.
31. Adjusting the flow rate after the first 15 minutes: <ul style="list-style-type: none">▪ If no adverse effects occur during the first 15 min, adjust the flow rate according to the patient's condition and the physician's order with maximum duration of four hours.▪ If signs and symptoms of transfusion reactions occur including itching, hives, swelling, shortness of breath, fever, headache, flank pain or chills<ul style="list-style-type: none">➤ Stop the transfusion➤ Keep the IV line open with normal saline 0.9 % solution➤ Measure the patient's vital signs,➤ Notify physician about the assessment findings and implement any prescribed treatment.	
32. Monitor the patient's vital signs 15 minutes after the start of transfusion.	



33.Follow the hospital policy for monitoring patient's vital signs throughout the procedure and as guided with the patient condition	
34.After completing the blood component administration. Wear disposable gloves and disconnect the blood administration set and discard it according to local policies	
35.Flush the blood administration set with normal saline (use minimal volumes for fluid-restricted patients) patients.)	To clear any residual blood from the tubing
36.Dispose of used material appropriately.	
37.Remove and dispose of the gloves	
38.Measure vital signs after finishing blood transfusion.	
39.Perform hand hygiene	
40.Documentation <ul style="list-style-type: none">▪ Verification of the prescribed blood product, its compatibility, indication for the transfusion and proper patient identification .▪ Type and volume of blood product, infusion rate, date and time of initiation and completion of transfusion, any medication administered, including premedication.▪ Documentation of the vascular access device used for the transfusion therapy, including type, size, site, and condition and appearance of vascular access site.	



- Use of special equipment, the patient's clinical status throughout the transfusion therapy, including patient assessment data such as vital signs and lung sounds.
- Patient's response to therapy includes any complications or adverse reactions, treatment required, and response to that treatment; the amount of blood transfused and the return of the unused portion to the blood bank and patient education provided.



LAB INVESTIGATIONS AND DIAGNOSTIC PROCEDURES



Laboratory investigations and Diagnostic procedures

A. Laboratory tests

➤ *Normal range vs. Reference range*

- Normal ranges are established by testing a large group of healthy individuals to determine what typical “normal” result is.
- Reference ranges can vary depending on age and gender. For example, males have a higher level of hemoglobin than females.
- Lab results must be interpreted based on context. For example, an average normal heart rate is between 60-100, however, athletes (such as runners) may have a lower heart rate of 55 which is “normal” for them.

➤ *Critical values*

- These values indicate that immediate action must be taken as the results are dangerously abnormal and may be life-threatening if corrective action is not taken.

Common Lab Tests

Complete blood count (CBC)

Erythrocyte count / Red blood cells (RBCs)	
Normal range	Male: $4.7\text{--}6.1 \times 10^{12}/\text{L}$ Female: $4.2\text{--}5.4 \times 10^{12}/\text{L}$
Test explanation	<p>- The erythrocyte counts test measures the number of red blood cells (RBCs) in a specific volume of blood. RBCs are responsible for carrying oxygen from the lungs to the rest of the body and removing carbon dioxide.</p> <p>Blood Tube: Lavender</p>
Result and significance	<p>High RBC count may indicate:</p> <ul style="list-style-type: none"> - Polycythemia vera (a bone marrow disorder) - Dehydration - Heart or lung diseases (e.g., COPD) - Living at high altitude - Smoking <p>Low RBC count may indicate:</p> <ul style="list-style-type: none"> - Anemia (iron, B12, or folate deficiency) - Blood loss (trauma, menstruation, ulcers) - Bone marrow disorders - Chronic kidney disease - Nutritional deficiencies

Leukocyte count / White Blood Cell Count (WBCs)		
Normal range	4,500–11,000/ cells/mm ³	
Test explanation	<ul style="list-style-type: none"> - The WBC test measures the number of white blood cells in blood. - WBCs are larger in size and less numerous than red cells. They develop from stem cells in the bone marrow. WBC function involves the response to an inflammatory process or injury. - These cells are essential for fighting infections, inflammation, and foreign invaders. <p>Blood Tube: Lavender</p>	
Results and significance	<p>Lower (Leukopenia)</p> <ul style="list-style-type: none"> - Indicates the body is fighting infection - Indicates a viral or bacterial infection Inflammation - Leukemia 	<p>Higher (Leukocytosis)</p> <ul style="list-style-type: none"> - Bone marrow disorders or damage - Autoimmune disease, HIV - Sepsis - Cancer that spreads to bone marrow



Platelet Count (PLts) / Thrombocytes					
Normal range	150,000–400,000/cu mm				
Test explanation	<ul style="list-style-type: none">- The platelet counts test measures the number of platelets (thrombocytes) in blood.- Platelets are small cell fragments that help with blood clotting and wound healing.				
Blood Tube: Lavender					
Results and significance	<table><thead><tr><th>Lower (Thrombocytopenia)</th><th>Higher (Thrombocytosis)</th></tr></thead><tbody><tr><td><ul style="list-style-type: none">- Acute leukemia- Chemotherapy- Hemorrhage- Toxic effect of medications- Systemic lupus erythematosus- Viral infections</td><td><ul style="list-style-type: none">- Acute infections- Chronic pancreatitis- Cirrhosis- Collagen disorders- Iron deficiency- Polycythemia vera- Post splenectomy</td></tr></tbody></table>	Lower (Thrombocytopenia)	Higher (Thrombocytosis)	<ul style="list-style-type: none">- Acute leukemia- Chemotherapy- Hemorrhage- Toxic effect of medications- Systemic lupus erythematosus- Viral infections	<ul style="list-style-type: none">- Acute infections- Chronic pancreatitis- Cirrhosis- Collagen disorders- Iron deficiency- Polycythemia vera- Post splenectomy
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Hemoglobin (Hgb)		
Normal range	Men: 14–17 g/dL Women: 12–16 g/dL	
Test explanation	<ul style="list-style-type: none">- The hemoglobin test measures the amount of hemoglobin in blood.- Hemoglobin is the iron-rich protein in red blood cells that carries oxygen from the lungs to the rest of the body and returns carbon dioxide back to the lungs.- There are millions of hemoglobin molecules in each red cell.	
Blood Tube: Lavender		
Results and significance	Lower <ul style="list-style-type: none">- Chronic blood loss- Decreased dietary intake	Higher <ul style="list-style-type: none">- Chronic obstructive pulmonary disease- High altitudes- Polycythemia



Hematocrit (HCT) or Packed Cell Volume (PCV)

Normal range	Men: 42%–52% Women: 36%–48%				
Test explanation	<ul style="list-style-type: none">- The test for hematocrit measures the volume of cells as a percentage of the total volume of cells and plasma in whole blood.- This percentage is usually three times greater than the hemoglobin. Blood Tube: Lavender				
Results and significance	<table border="1"><tr><td>Lower</td><td>Higher</td></tr><tr><td><ul style="list-style-type: none">- Hemorrhage- Anemia- Excessive intravenous fluid infusion</td><td><ul style="list-style-type: none">- Dehydration- COPD- Congenital Heart Disease</td></tr></table>	Lower	Higher	<ul style="list-style-type: none">- Hemorrhage- Anemia- Excessive intravenous fluid infusion	<ul style="list-style-type: none">- Dehydration- COPD- Congenital Heart Disease
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Liver function tests

Albumin (AL)		
Normal range	3.5-5.5 g/dL	
Test explanation	<ul style="list-style-type: none"> - Albumin is a protein that is made in the liver. - Component of total serum protein (pre-albumin, albumin, and globulins). - Albumin maintains colloidal osmotic pressure. <p>Blood Tube: Red Urine: 24-hour urine collection.</p>	
Results and significance	<p>Lower</p> <ul style="list-style-type: none"> - Indicative of malnutrition - Liver disease - Ascites - Inflammatory disease - Autoimmune disorder - GI malabsorption syndromes - Pregnancy 	<p>Higher</p> <ul style="list-style-type: none"> - Severe dehydration



Ammonia (AMM, NH3)					
Normal range	15–56 _g/dL				
Test explanation	<ul style="list-style-type: none">- Measures the amount of ammonia in the blood.- Ammonia in the body is created by the breakdown of protein. The liver converts ammonia to urea, which is excreted as urine in the kidneys. <p>Blood Tube: Green</p>				
Results and significance	<table><thead><tr><th>Lower</th><th>Higher</th></tr></thead><tbody><tr><td>Essential or malignant hypertension</td><td><ul style="list-style-type: none">- Liver disease (cirrhosis or hepatitis)- Reye syndrome- Heart failure- Kidney failure- Severe bleeding from stomach or intestines</td></tr></tbody></table>	Lower	Higher	Essential or malignant hypertension	<ul style="list-style-type: none">- Liver disease (cirrhosis or hepatitis)- Reye syndrome- Heart failure- Kidney failure- Severe bleeding from stomach or intestines
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Aspartate Aminotransferase (AST) is formerly SGOT (Serum Glutamic Oxaloacetic Transaminase)					
Normal range	Adult: 8–20 U/L				
Test explanation	<ul style="list-style-type: none">- This enzyme is found in very high concentrations with highly metabolic tissue, such as the heart muscle, liver cells, skeletal muscle cells, and, to a lesser degree, in the kidneys, pancreas, and red blood cells. When disease or injury affects the cells of these tissues, the cells lyse. AST is released and picked up by the blood, and the serum level rises. The amount of AST elevation is related directly to the number of cells affected by the disease or injury. The degree of elevation depends on the length of time between the injury and when the blood is collected. <p>Blood Tube: Red</p>				
Results and significance	<table border="0"><tr><td>Lower</td><td>Higher</td></tr><tr><td><ul style="list-style-type: none">- Acute renal disease- Beriberi- Diabetic ketoacidosis- Pregnancy- Chronic renal dialysis</td><td><ul style="list-style-type: none">- Liver diseases such as hepatitis, hepatic- cirrhosis, drug-induced liver injury,- hepatic metastasis, mononucleosis- Skeletal muscle diseases such as muscle- Trauma, surgery, burns, muscular- Dystrophy, heat stroke- Other diseases such as acute hemolytic anemia and acute pancreatitis</td></tr></table>	Lower	Higher	<ul style="list-style-type: none">- Acute renal disease- Beriberi- Diabetic ketoacidosis- Pregnancy- Chronic renal dialysis	<ul style="list-style-type: none">- Liver diseases such as hepatitis, hepatic- cirrhosis, drug-induced liver injury,- hepatic metastasis, mononucleosis- Skeletal muscle diseases such as muscle- Trauma, surgery, burns, muscular- Dystrophy, heat stroke- Other diseases such as acute hemolytic anemia and acute pancreatitis
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ALT (alanine aminotransferase), formerly SGPT (Serum Glutamic Pyruvic Transaminase)					
Normal range	10–60 U/L				
Test explanation	<ul style="list-style-type: none">- It is an enzyme primarily found in the liver. It plays a key role in converting proteins into energy for liver cells. <p>Blood Tube: Gold or Red tube</p>				
Results and significance	<table><thead><tr><th>Lower</th><th>Higher</th></tr></thead><tbody><tr><td><ul style="list-style-type: none">- Pregnancy- Malnutrition- Severe liver failure (end-stage)- Vitamin B6 deficiency- Uremia (advanced kidney disease)</td><td><ul style="list-style-type: none">- Hepatitis (viral, autoimmune)- Fatty liver disease- Cirrhosis- Drug toxicity (e.g. paracetamol overdose)- Alcoholic liver disease- Obesity/metabolic syndrome- Liver tumors- Intense exercise (temporary rise)</td></tr></tbody></table>	Lower	Higher	<ul style="list-style-type: none">- Pregnancy- Malnutrition- Severe liver failure (end-stage)- Vitamin B6 deficiency- Uremia (advanced kidney disease)	<ul style="list-style-type: none">- Hepatitis (viral, autoimmune)- Fatty liver disease- Cirrhosis- Drug toxicity (e.g. paracetamol overdose)- Alcoholic liver disease- Obesity/metabolic syndrome- Liver tumors- Intense exercise (temporary rise)
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Bilirubin

Normal range	<ul style="list-style-type: none">- Total protein: 6.0-8.0 g/dL- Direct: 0.1–0.4 mg/dL- Indirect: 0.1–0.4 mg/dL
Test explanation	<ul style="list-style-type: none">- Total protein: It reflects the combined concentration of albumin and globulin in the blood—two types of proteins primarily synthesized by the liver.- Bilirubin is a yellow pigment produced during the breakdown of hemoglobin. The bilirubin cycle describes how the body processes and eliminates bilirubin<ul style="list-style-type: none">1. <u>Formation (Hemolysis)</u><ul style="list-style-type: none">- Old red blood cells are broken down in the spleen and reticuloendothelial system.- Hemoglobin splits into:<ul style="list-style-type: none">a. Globin → reused as amino acidsb. Heme → converted to biliverdin, then to unconjugated bilirubin (indirect)2. <u>Transport to Liver</u><ul style="list-style-type: none">a. Indirect Bilirubin (Unconjugated bilirubin) is not water-soluble.- It binds to albumin and travels through the bloodstream to the liver.b. Conjugation in Liver<ul style="list-style-type: none">- In the liver, glucuronic acid is added by the enzyme UDP-glucuronosyltransferase.- This forms conjugated bilirubin (direct), which is water-soluble3. <u>Excretion into Bile</u><ul style="list-style-type: none">- Conjugated bilirubin is secreted into bile and enters the small intestine4. <u>Intestinal Conversion</u><ul style="list-style-type: none">- In the colon, bacteria convert bilirubin into urobilinogen.- 80% → oxidized to stercobilin → excreted in feces (gives stool its brown color)- 20% → reabsorbed into blood → some goes to kidneys → converted to urobilin → excreted in urine (gives urine its yellow color)



	<p>yellow color)</p> <p>4. <u>Enterohepatic Circulation</u></p> <ul style="list-style-type: none">- Some urobilinogen returns to the liver via the portal vein, completing the cycle of red blood cells. The liver processes bilirubin and excretes it in bile. <p><input checked="" type="checkbox"/> Key Difference:</p> <ul style="list-style-type: none">- Indirect = before liver processing- Direct = after liver processing, ready for excretion <p>Blood Tube: Gold or Red tube</p>	
Results and significance	<p>Lower</p> <p>While low bilirubin is generally not clinically concerning, here are a few possible associations:</p> <ul style="list-style-type: none">- Certain medications: e.g., vitamin C, phenobarbital, caffeine- Malnutrition or poor dietary intake- Advanced kidney disease (uremia)- Overhydration (dilutional effect)- Genetic factors: Some individuals naturally have lower levels	<p>High levels of indirect bilirubin</p> <ul style="list-style-type: none">- Hemolytic anemia- Gilbert's syndrome- Liver's inability to process bilirubin <p>High levels of direct bilirubin</p> <ul style="list-style-type: none">- Bile duct obstruction- Hepatitis- Liver cirrhosis

Renal function tests

Blood Urea Nitrogen (BUN)					
Normal range	7–18 mg/dL				
Test explanation	<ul style="list-style-type: none"> - A test that measures the amount of urea nitrogen in the blood, which comes from the waste product urea. - Urea is made when protein is broken down in the body. Urea is made in the liver and excreted by the kidneys. <p>Blood Tube: Red or Green</p>				
Results and significance	<table border="1"> <thead> <tr> <th>Lower</th><th>Higher</th></tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> - Liver disease or damage to liver - Poor nutrition or low protein intake - Overhydration </td><td> <ul style="list-style-type: none"> - Heart failure - Dehydration - Diet high in protein - Shock - Kidney injury or disease </td></tr> </tbody> </table>	Lower	Higher	<ul style="list-style-type: none"> - Liver disease or damage to liver - Poor nutrition or low protein intake - Overhydration 	<ul style="list-style-type: none"> - Heart failure - Dehydration - Diet high in protein - Shock - Kidney injury or disease
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Blood urea					
Normal range	15–45 mg/dl				
Test explanation	<ul style="list-style-type: none">- Urea is a waste product formed in the liver when the body breaks down proteins. It's carried in blood to the kidneys, where it's filtered out and excreted in urine.				
Results and significance	<table border="1"><thead><tr><th>Low</th><th>High</th></tr></thead><tbody><tr><td><ul style="list-style-type: none">- Liver disease (reduced urea production)- Malnutrition or low protein intake- Overhydration</td><td><ul style="list-style-type: none">- Kidney dysfunction or failure- Dehydration- High protein intake- Heart failure- Internal bleeding (especially in the digestive tract)- Certain medications (e.g., corticosteroids, diuretics)</td></tr></tbody></table>	Low	High	<ul style="list-style-type: none">- Liver disease (reduced urea production)- Malnutrition or low protein intake- Overhydration	<ul style="list-style-type: none">- Kidney dysfunction or failure- Dehydration- High protein intake- Heart failure- Internal bleeding (especially in the digestive tract)- Certain medications (e.g., corticosteroids, diuretics)
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Serum creatinine		
Normal range	0.8–1.2 mg/dL	
Test explanation	<ul style="list-style-type: none">- A test that measures the level of creatinine, a waste product produced by muscles during normal metabolism. The kidneys filter creatinine out of the blood, so their level reflects how well the kidneys are working. <p>Blood Tube: Red or Green</p>	
Results and significance	Low	High
	<ul style="list-style-type: none">- Could suggest low muscle mass, liver disease, or poor nutrition	<ul style="list-style-type: none">- May indicate acute and chronic renal failure, dehydration, or muscle damage- Systematic lupus erythematosus- Leukemias

Uric acid		
Normal range	Men: 3.4–7.0 mg/dL Women: 2.4–6.0 mg/dL	
Test explanation	<ul style="list-style-type: none">- A test that measures the amount of uric acid in the blood or urine. Uric acid is a waste product formed when body breaks down purines, which are substances found in many foods and also released when cells die	
	Blood Tube: Red or Gold tube	
Results and significance	Low	High
	<ul style="list-style-type: none">- Liver disease- Certain medications- Low purine diet or malnutrition	<ul style="list-style-type: none">- Gout- Kidney stones- Kidney dysfunction- Cancer treatments- Metabolic disorders, obesity, or high blood pressure

Blood glucose tests

Glucose (GLU) (Random Blood Sugar)		
Normal range		Random Glucose <ul style="list-style-type: none"> - The reference values for a "normal" random glucose test in an average adult are 79–160 mg/dl, - 160–200 mg/dl is considered pre-diabetes, > 200 mg/dl is considered diabetes
Test explanation		<ul style="list-style-type: none"> - Test that measures the amount of glucose in the blood at any time of the day—regardless of when last ate. Glucose comes from carbohydrates, which are the main source of energy used by the body. - It's a quick and convenient way to check for abnormal glucose levels, especially in emergencies or outpatient settings. <p>Blood Tube: Gray</p>
Results and significance	Lower <ul style="list-style-type: none"> - Excessive doses of insulin - Inadequate food intake - Hypoglycemia, Starvation - Liver disease - Malnutrition - Eating disorder - Hypothyroidism - Addison disease 	Higher <ul style="list-style-type: none"> - Hyperglycemia - Diabetes - Prolonged corticosteroid therapy - Severe stress



Fasting Blood Glucose Test (FBS)			
Normal range	<p>Fasting Blood: 65–99 mg/dL</p> <ul style="list-style-type: none">- Impaired fasting glucose/prediabetes mellitus: 100–125 mg/dL,- Diabetes mellitus: ≥ 126 mg/dL		
Test explanation	<ul style="list-style-type: none">- The Fasting Blood Glucose Test measures the level of glucose (sugar) in blood after fasting for at least 8 hours. <p>Blood Tube: Gray</p>		
Results and significance	Lower indicates hypoglycemia	Prediabetes when blood glucose level between 100–125 mg/dL	Higher indicates diabetes



Oral Glucose Tolerance Test (OGTT)	
Normal range	<ul style="list-style-type: none">- less than 140 mg/dL is normal- 140 to 199 mg/dL indicates prediabetes- 200 mg/dL or above indicates diabetes.
Test explanation	<ul style="list-style-type: none">- It measures blood glucose levels before and after drinking a standardized glucose solution (usually 75g).- Blood is drawn at fasting, then at 2 hours. <p>Blood Tube: Gray</p>
Results and significance	<p>Lower indicates Hyperinsulinism</p> <p>Higher indicates diabetes</p>



Postprandial Glucose test (2 h)

Normal range	65–140 mg/dL
Test explanation	<ul style="list-style-type: none">- It measures blood glucose levels 2 hours after a regular meal to assess how well body processes sugar. <p>Blood Tube: Gray</p>
Results and significance	<ul style="list-style-type: none">- Normal: Indicates body handles sugar well; insulin is working properly.- High indicates diabetes



Hemoglobin A1C (HbA1c)		
Normal range	<p>HbA1c:</p> <ul style="list-style-type: none">- Normal for people without diabetes: Less than 5.7%- Pre-diabetes: 5.7%-6.4%- Diabetes: 6.5% and higher	
Test explanation	<ul style="list-style-type: none">- HbA1c results give an estimate of the average blood glucose level over the past two to three months. Thus, it is useful in checking how well a person is controlling his or her diabetes.- HbA1C test is used to evaluate long-term blood glucose control in people with known diabetes or diagnosed prediabetes.	
Results and significance	<p>Lower</p> <ul style="list-style-type: none">- Nondiabetic- hyperglycemia- Poorly controlled diabetes mellitus	<p>Higher indicates diabetes</p>

Serum lipid profile

Low density lipoprotein (LDL)		
Normal range	<ul style="list-style-type: none"> - Optimal: <u><100 mg/dL</u> - Near optimal: <u><130 mg/dL</u> - Borderline high: <u>130–159 mg/dL</u> - High: <u>160–189 mg/dL</u> - Very high: <u>>190 mg/dL</u> 	
Test explanation	<ul style="list-style-type: none"> - An LDL test measures the amount of low-density lipoprotein cholesterol in blood. - LDL is often called “bad cholesterol” because high levels can lead to plaque buildup in arteries, increasing the risk of heart disease and stroke <p>Blood Tube: Red or Gold</p>	
Results and significance	<p>High LDL levels</p> <ul style="list-style-type: none"> - Heart attacks - Strokes - Peripheral artery disease 	<p>Low LDL levels are</p> <p>generally good, but extremely low levels may be associated with:</p> <ul style="list-style-type: none"> - Hormonal imbalances - Brain bleeding (rare) - Malnutrition or chronic illness



High density lipoprotein (HDL)		
Normal range	<ul style="list-style-type: none">- Males: 35–65 mg/dL- Females: 35–80 mg/dL	
Test explanation	<ul style="list-style-type: none">- The HDL test measures the level of high-density lipoprotein cholesterol in blood.- HDL is known as “good cholesterol” because it helps remove excess cholesterol from bloodstream and transports it to the liver for elimination <p>Blood Tube: Red, green or Gold</p>	
Results and significance	High HDL levels are linked to: <ul style="list-style-type: none">- Lower risk of heart attack and stroke- Better blood vessel function- Reduced inflammation	Low HDL levels may increase the risk of: <ul style="list-style-type: none">- Atherosclerosis (plaque buildup)- Cardiovascular disease



Triglyceride		
Normal range	<ul style="list-style-type: none">- 40–150mg/dl	
Test explanation	<ul style="list-style-type: none">- A triglyceride test measures the amount of triglycerides—a type of fat—in blood.- Triglycerides are formed from excess calories, sugar, and alcohol, and body stores them in fat cells for energy use later <p>Blood Tube: Red, green or Gold</p>	
Results and significance	<p>High triglycerides are linked to:</p> <ul style="list-style-type: none">- Heart disease and stroke- Metabolic syndrome- Type 2 diabetes- Fatty liver disease- Pancreatitis (if very high)	<ul style="list-style-type: none">- Low triglycerides are usually not a concern unless related to malnutrition or chronic illness

Coagulation Studies

The following lab tests refer to blood-clotting studies and are used to diagnose bleeding and clotting disorders. These include prothrombin time (PT), partial thromboplastin time (PTT), and international normalized ratio (INR).

Prothrombin Time (PT)	
Normal range	12.0–14.0s
Test explanation	<ul style="list-style-type: none"> - PT is a blood test that measures how long it takes blood to clot. PT is also used to check whether medicine to prevent blood clots is working. <p>Blood Tube: Light blue</p>
Results and significance	<p>Higher</p> <ul style="list-style-type: none"> - Lack of or low level of one or more blood-clotting factors - Lack of vitamin K (due to liver disease, cirrhosis, or liver injury) - Indication of DIC (disseminated intravascular coagulation), which is life threatening



Partial Thromboplastin Time (PTT)	
Normal range	<ul style="list-style-type: none">- 22-37 sec- Clients receiving anticoagulant therapy: 1.5–2.5 times control value in seconds
Test explanation	<ul style="list-style-type: none">- The PTT test measures how long it takes blood to clot. It evaluates the function of specific clotting factors in the intrinsic and common pathways of the coagulation cascade.- PTT might be used in taking a blood-thinning medicine called heparin. This test checks if heparin dose is therapeutic. Also checks the effects of anticoagulants (e.g., Heparin, warfarin). <p>Blood Tube: Light blue</p>
Results and significance	<p>Higher</p> <ul style="list-style-type: none">- Deficiency of factors I, II, V, VIII, IX and X,<ul style="list-style-type: none">- XI, XII- Hemophilia- Heparin therapy- Liver disease- Low Vitamin K



International Normalized Ratio (INR)	
Normal range	0.8–1.2
Test explanation	<ul style="list-style-type: none">- The INR test measures how long it takes the blood to clot, specifically evaluating the extrinsic pathway of coagulation. It standardizes results from the Prothrombin Time (PT) test across different labs. <p>Blood Tube: Light blue</p>
Results and significance	<p>Higher</p> <ul style="list-style-type: none">- Lack of or low level of one or more blood-clotting factors- Lack of vitamin K (due to liver disease, cirrhosis, or liver injury)- Indication of DIC (disseminated intravascular coagulation), which is life threatening

B. Urine tests

Indications :

- Urinalysis is part of routine diagnostic and screening evaluations. It can reveal a significant amount of preliminary information about kidneys and other metabolic processes.
- UA is routinely done in all patients admitted to the hospital, pregnant women and pre-surgical patients .
- It is done diagnostically in patients with abdominal or back pain, dysuria, hematuria, or urinary frequency. It is part of routine monitoring in patients with chronic renal disease and some metabolic diseases. It is the most frequently ordered urine test.

N.B. The nurse is involved in obtaining urine samples such as urinalysis, urine for culture and sensitivity, and urine toxicology to determine the presence of infection or help diagnosis.





Urinalysis (UA)						
Normal range	- Appearance: Clear - Color: Amber yellow - Odor: Aromatic - pH: 4.6–8.0	Protein: - At rest: <50–80 mg/24 hr. - During exercise: <250 mg/24 hr.	Specific Gravity - Adult: 1.005–1.030 - Older adult: Values decrease with age			
Test explanation	Tests the urine for color, clarity, odor, concentration, and pH (acidity or alkalinity). It also checks for abnormal levels of protein, sugar, and blood cells or other substances that may contribute to an illness or disease in the body.					
Purpose	To screen for a disease or infection of the urinary tract. To monitor the treatment of certain medical conditions (e.g., diabetes, kidney stones, UTI, or kidney disease).					
Interfering factors	Foods that can color the urine (blackberries, beets, and rhubarb). Menstruating or starting menstrual period. Certain medications that can color the urine (vitamin B, Pyridium).					
Results and significance	Appearance and Color	Odor	pH	Protein		
Changes in color may be due to: - Drug therapy. - Infection: note a foul smell of the urine. - Gross hematuria : RBCs in	 - Ketonuria (smell will be fruity) - Urinary tract infection (UTI): foul smell - Phenylketonuria (urine will smell musty)	 Lower Higher	 Acidemia (excess hydrogen ion excreted) Diabetes Starvation UTI	 Higher - Glomerulonephritis - Malignant - Hypertension - Trauma		



<p>the urine cause red color.</p> <p>- Tumors, trauma, stones, and infections anywhere in the urinary tract can cause urine to be red.</p>		- Vomiting	
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Urine C & S (Culture and Sensitivity)		
Normal range	<ul style="list-style-type: none">- No bacteria or other organisms (such as fungi) grow in the culture. The culture result is positive.- Negative: <10,000 bacteria/ml urine- Positive: >100,000 bacteria/ml urine	
Test explanation	<ul style="list-style-type: none">- The urine C & S identifies the specific bacteria and tests its susceptibility to different antibiotic agents. This ensures that the proper antibiotic can be prescribed to clear up the infection.	
Purpose	To detect UTI.	
Interfering factors	<ul style="list-style-type: none">- A urine specimen that has been sitting for an hour or longer at room temperature (should be kept in refrigerator until assessed by lab).- Feces or toilet paper in the urine specimen.- Drugs and food.- Use of antibiotics.	
Results and significance	Lower < infection is unlikely	Higher >100,000 or more bacteria per milliliter (mL) of urine may indicate an infection

C. Diagnostic procedures

X-ray Imaging

Description

- X-ray imaging is a non-invasive diagnostic technique that uses electromagnetic radiation to produce images of internal body structures.
- Dense tissues like bones absorb more X-rays and appear white, while softer tissues appear in shades of gray or black.
- X-rays are quick, painless, and widely used in clinical settings.

Indications

- Bone assessment: Detect fractures, dislocations, and bone diseases
- Chest evaluation:
 - a. Evaluate chest walls and airway.
 - b. Diagnose lung infections (e.g., pneumonia), tumors, pleural effusion, chest trauma, persistent cough or fluid accumulation.
- Cardiac screening: Assess heart size and detect signs of heart failure
- Abdominal assessment:
 - a. assess organs such as the stomach, intestines, liver, kidneys, and bladder.
 - b. Investigating causes of abdominal pain
 - c. Detect bowel obstruction, kidney stones, ascites, masses, or paralytic ileus
- Device verification: Confirm placement of tubes, catheters, or pacemakers
- Trauma investigation: Identify internal injuries or foreign bodies
- Follow-up imaging: Monitor disease progression or treatment response

Procedure

1. Patients may wear hospital gowns.
2. Patients are placed standing, sitting, or lying down depending on the area to be imaged.
3. The X-ray machine is aligned; patients may be asked to hold their breath briefly. The image is captured in seconds.
4. The procedure is quick, painless and the patient can resume normal activities immediately.

Nursing implications

- **Before the procedure:**
 - Explain the procedure to reduce anxiety
 - Ensure removal of jewelry or metallic items
 - Confirm pregnancy status in female patients
 - Ensure testicles in men and ovaries in women are protected with a lead shield to prevent radiation exposure.
 - Inform the client that the procedure takes approximately 10–15 minutes to complete.
- **During the procedure:**
 - Assist with positioning and comfort
 - Encourage cooperation (e.g., breath-holding)
- **After the procedure:**
 - Monitor for discomfort or anxiety
 - Provide information on when and how results will be shared
 - Support follow-up care if abnormalities are found.

Computed Tomography (CT scan)

Description

A radiographic examination of the abdominal organs and pelvis taken from various angles using a scanner. The images obtained are then analyzed by a computer.



Indications

- To diagnose pathological conditions in the abdomen and pelvis (tumors, cysts, abscesses, inflammation, calculi, perforation of the bowel, ureteral obstructions) and monitoring diseases.
- To guide needles during biopsy of a tumor and aspirating fluid.
- To stage neoplasms.

Procedure

1. Client lies on CT table, table advances through a ring-shaped scanner, which takes hundreds of images of the abdomen and pelvis.
2. Clients are instructed to hold their breath during x-ray exposure.
3. The images are then displayed onto a computer screen and recorded digitally.
4. If better visualization is required, an oral or IV contrast dye is administered to the client.

Nursing implications

Before the Procedure:

- Ensure the consent form is signed and explain the procedure clearly to the client.
- Confirm the client is NPO for at least 4 hours to reduce nausea from contrast dye.
- Verify that the IV site is patent and ready for contrast administration.
- Instruct the client to remove any metal objects.
- Obtain a history of allergies to contrast dye, iodine, or seafood, and confirm pregnancy status in female clients.

- Inform the client that the test typically takes 30 minutes to one hour.

During the Procedure:

- Advise the client that if contrast dye is used, they may feel a warm, flushed sensation in the face or body.
- Ensure the client remains still during scanning to obtain clear images.

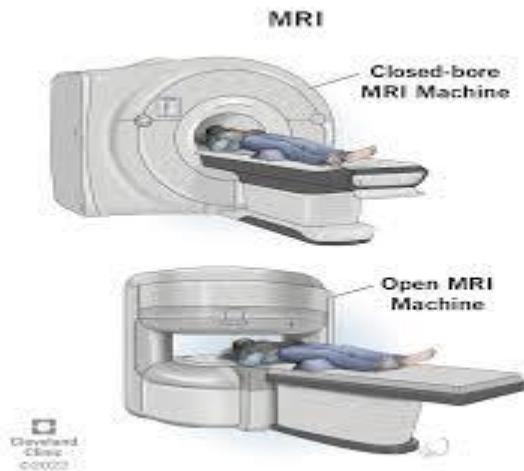
After the Procedure:

- Encourage the client to increase fluid intake to promote dye excretion and prevent contrast-induced nephropathy.
- Inform the client that diarrhea may occur if oral contrast was used.
- Monitor for delayed allergic reactions such as rash, hives, or dyspnea, and administer antihistamines or steroids if needed.

Magnetic Resonance Imaging (MRI)

Description

- Non-invasive scan that uses strong magnets and radio waves to create clear, detailed images of soft tissues inside the body—such as the brain, muscles, heart, spinal cord, breasts and internal organs—with out using harmful radiation.



Indications

- To detect the following:
 - a. Head injuries (bleeding or swelling)
 - b. Brain tumors (benign or malignant)
 - c. Kidney, heart, and liver diseases
 - d. Multiple sclerosis and other nerve conditions
 - e. Herniated discs, seizures, and body trauma
- Helps in staging diseases (knowing how advanced they are) in areas like: The spine, brain, heart, bones/joints, and abdomen

Procedure

1. The client must lie still on a narrow table that slides into a cylinder-shaped tubular magnet for scanning.
2. A contrast medium may need to be administered via IV if required.
3. The procedure takes approximately 45 minutes to an hour to perform.

Nursing Implications

Before the Procedure:

- Ensure the consent form is signed.
- Keep the client NPO for 4–6 hours prior to the scan and encourage them to void for comfort.
- Remove all metallic items: jewelry, hair pins, retainers, and any metal in clothing.
- Ask about metal implants or prosthetics, such as pacemakers, defibrillators, joint replacements, insulin pumps, aneurysm clips, cochlear implants, or IUDs. These items may interact dangerously with the magnetic field
- If the client wears a patch with metallic foil backing (e.g., nicotine patch), it must be removed to prevent burns.
- Assess claustrophobia and offer relaxation techniques or mild sedation if needed.

During the Procedure:

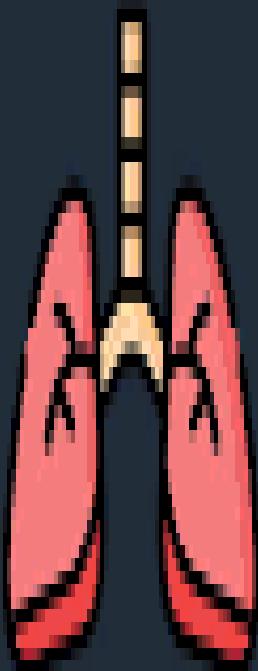
- Provide emotional support and reassurance, especially if the client is anxious.
- Monitor for signs of discomfort or distress.
- Ensure the client remains still throughout the scan to avoid image distortion.

After the Procedure:

- Assist the client as needed, especially if sedation was used.
- Monitor any delayed reactions or discomfort.
- Resume normal diet and activity unless otherwise instructed.



Chest Physiotherapy



Chest Physiotherapy

Definition

- Chest physiotherapy, also known as CPT, is a collection of procedures, including postural drainage, chest percussion, and vibration and breathing retraining.
- It is commonly used in the treatment of various respiratory conditions such as cystic fibrosis, bronchiectasis, chronic obstructive pulmonary disease (COPD) and pneumonia.

Purpose

- 1- Mobilization and clearance of secretion.
- 2- Improving ventilation.
- 3- Restoring effective breathing patterns.
- 4- Increase respiratory gas exchanges.
- 5- Decrease the risk of respiratory infection
- 6- Improve airway clearance
- 7- Increase in exercise tolerance
- 8- Increase the efficiency of the respiratory muscles

I. Postural Drainage

Definition

- It is a specific position in which the force of gravity removes the bronchial secretion.

Purpose:

- 1- Maintain a patent airway by mobilizing secretions into larger airways, where they can be coughed or suctioned.

2-Improve respiratory gas exchange.

3-Decrease the incidence of respiratory infection

Indications:

- Patients who are unable to exit secretion
- Retained secretions in the presence of an artificial airway.
- In case of atelectasis or mucus plugging.
- Presence of cystic fibrosis or bronchiectasis
- Presence of foreign bodies in airway

Contraindications:

- Cardiovascular disorders as: arrhythmias, hypotension, hypertension, congestive heart failure, and pulmonary edema, and angina.
- Acute head or neck injury or disease as it increase intracranial pressure (Intracranial pressure (ICP) > 20 mm Hg).
- Pulmonary emboli, large pleural effusion, or emphysema
- Undiagnosed chest pain.
- Active cases of tuberculosis
- Distended abdomen, pregnancy, obesity, and ascites.

Points to be considered in performing postural drainage:

- The patient should not sit up between position changes.
- Maintain each position for 5 to 15 minutes.
- Instruct the patient to breathe slowly and deeply during the procedure.
- Perform postural drainage before meals or tube feeding.
- Administer to patient bronchodilator before the procedure if ordered.
- Discontinue the procedure and inform the doctor if the patient experiences heart rate over 120 beats per minute or dysrhythmia.
- If the patient cannot tolerate any position, it should be omitted or modified.
- The recommended sequence starts with positions to drain the lower lobes, followed by positions to drain the upper lobes.

Equipment needed:

- A chair and extra pillows
- Bed suitable for Trendelenburg position.
- Small emesis basin
- Tissue paper
- Towel.
- Sputum Container.
- Mouth wash.
- Specimen label and requisition, if a specimen of sputum is required.
- Suction as needed.

Procedure of postural drainage

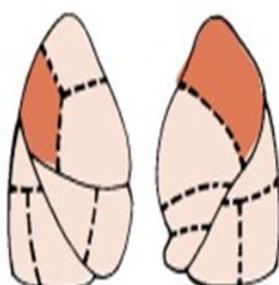
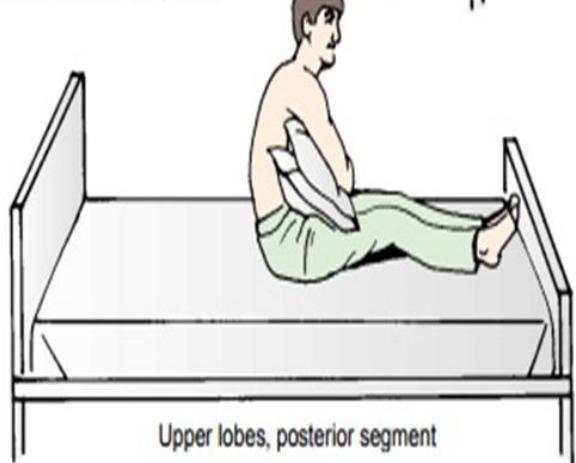
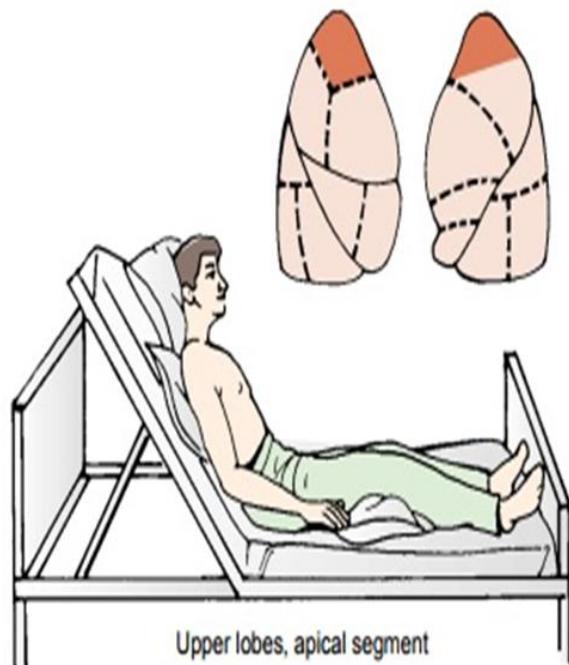
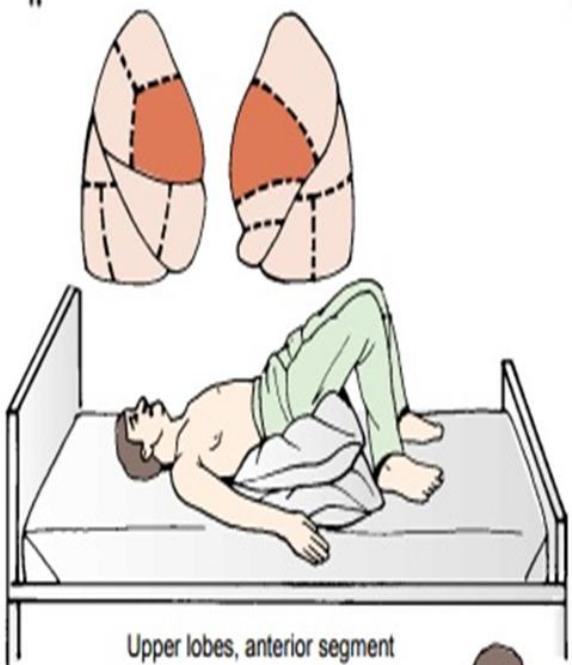
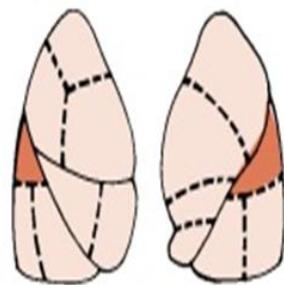
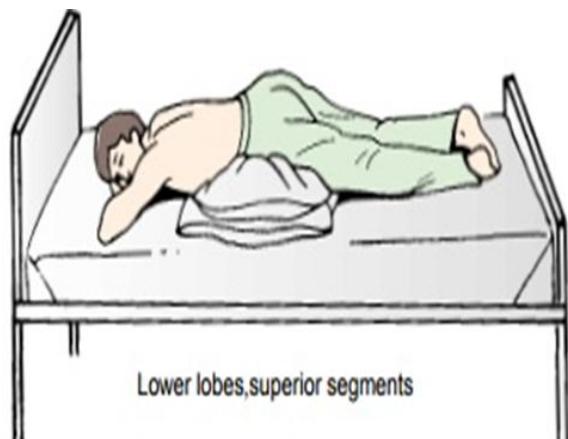
Steps	Rationale
1. Hand hygiene.	1- Prevent transmission of microorganisms.
2. Prepare the equipment.	2-Facilitate its use.
3. Identify the patient; explain the procedure and answer any questions.	3- Providing necessary information will reduce client anxiety.
4. Apply clean gloves.	4- Used for removing old dressing
5. The chest should be auscultated before and after the procedure.	5- Determine areas needing drainage and the effectiveness of the treatment
6. If prescribed, bronchodilators may be nebulized and inhaled before postural drainage.	6- Reduce bronchospasm decrease thickness of mucus and sputum.
7. Postural drainage is done usually for 2-4 times daily, before meals and at bedtime.	7- Prevent nausea, vomiting and prevent aspiration an emesis basin or sputum cup and tissue papers should be available.

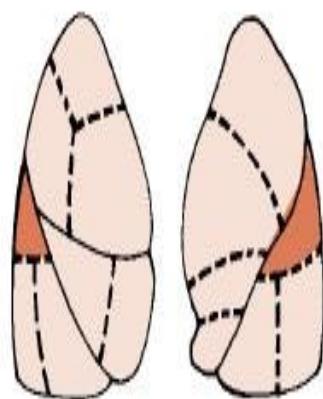
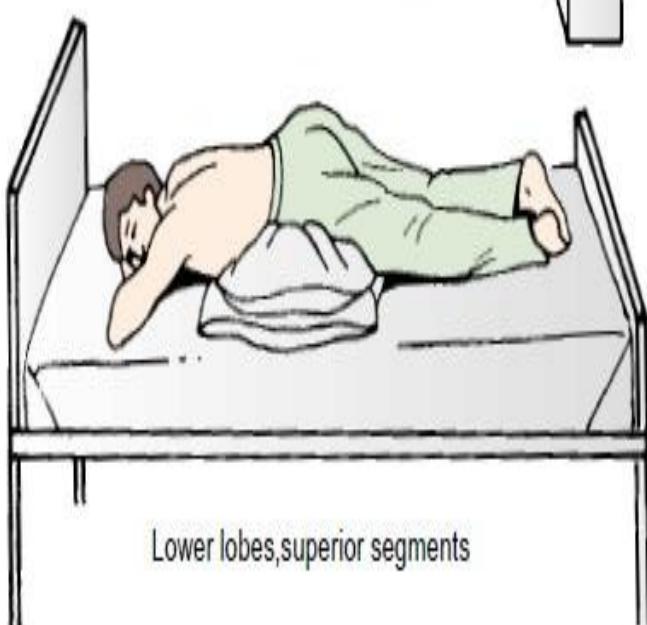
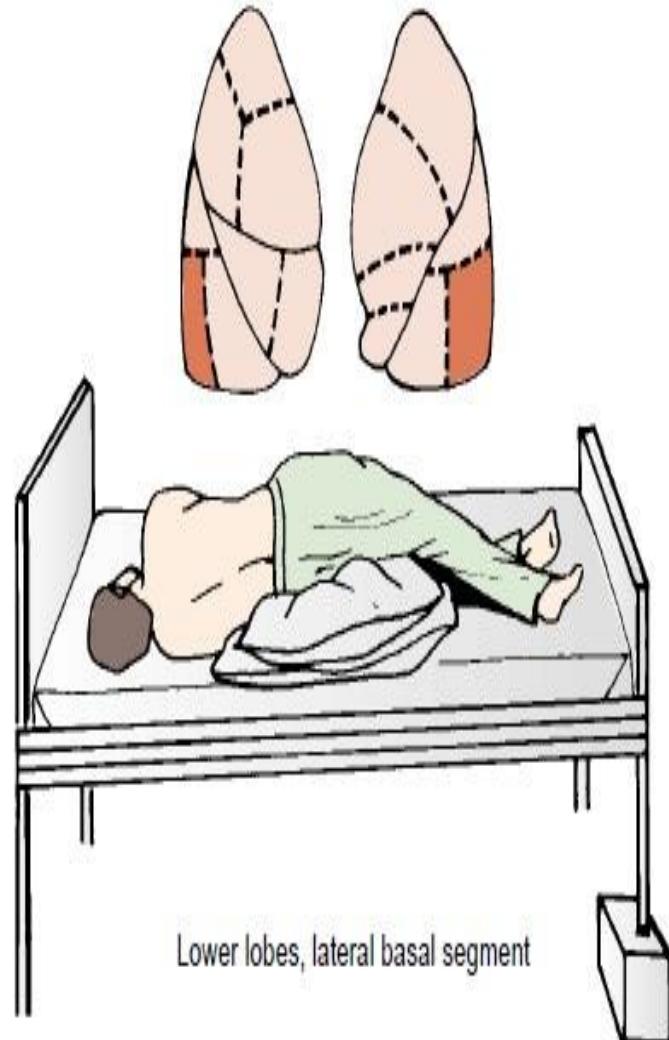
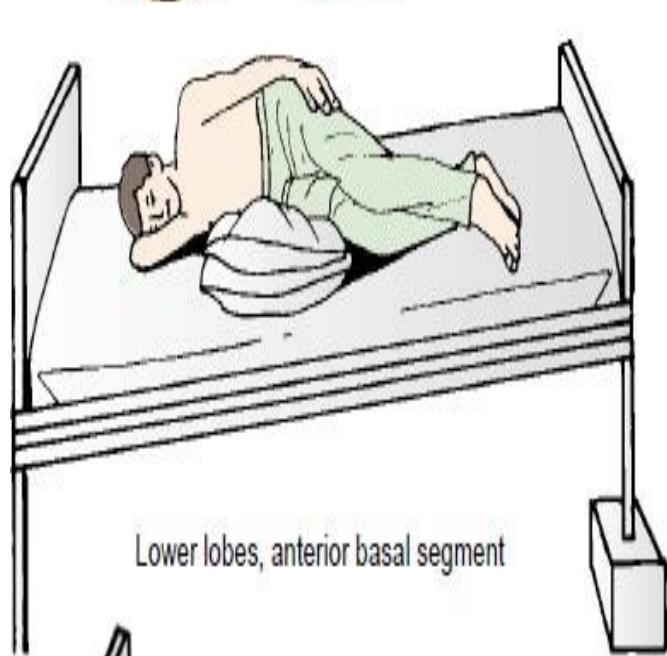
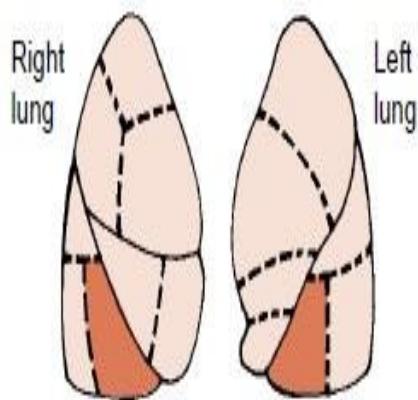


8. Patients are instructed to remain in each position for 10 to 15 min and breath in slowly through his nose and then breath out slowly through pursed lips.	8- Allow more air for long time that mobilizes secretions.
9. When the patient changes positions, he is instructed to cough and remove secretions.	9-coughing is most effective when the excessive secretions are accumulated in the large, centrally located airways
10. Following the procedure, the amount color viscosity and character of the ejected sputum is noted, patients color.	10- Determine characters of chest infection and the patient's prognosis by treatment.
11. If the sputum is foul smelling, postural drainage is performed in a room away from other patients or family members. Deodorizers may be used to counteract the odor.	11- However, because aerosol sprays can cause bronchospasm and irritation, deodorizers should be used sparingly and with caution.
12. After postural drainage, the patients may find it refreshing.	12- Brush his teeth and to use mouth wash before rest in bed.
13. The secretion may need to be suctioned mechanically if the patient is unable to cough.	13- Accumulation of secretion without mechanical removing by suction lead to airway obstruction.
14- Use chest percussion and vibration.	14- For more effective removing chest's secretion.
15-Remove the gloves and hand washing.	15-Prevent cross of infection.
16-Documentation.	16- Continuing of care



Positions of postural drainage





II- Percussion

Definition

- It is technique performed by clapping on the chest wall with a cupped hand over an affected area of the lung to strikes the chest



N.B:

Percussion should be done around areas shown on each postural drainage picture and should always be done over the rib cage. Never percuss over the spine, breasts, breastbone (sternum), or IV, chest tube or fresh surgical sites on the chest.

Purpose:

- 1- Enhance loosening of trapped secretions.
- 2- Increase the movement of secretions.
- 3- Decrease atelectasis.

Contraindication

- *Vigorous chest percussion is relatively contraindicated in the following conditions:*
 1. Lung cancer.
 2. Bronchospasm
 3. Pain in area being treated
 4. Hemorrhage
 5. Hemoptysis
 6. Increased intracranial pressure

7. Gastric reflux
8. Extreme agitation or anxiety.
9. High risk for rib fracture.

Procedure for percussion:

Steps	Rationale
1) Hand hygiene and wearing gloves.	1. Prevent transmission of microorganisms.
2) Review of patient's file to identify if presence of contraindication. Identify the patient; explain the procedure and answer any questions.	2. Providing necessary information will reduce client anxiety.
3) Put the patient in supine lying position or according to affected area. In addition, Specialized beds may be used. These beds feature programmable mattresses that deliver vibropercussion and may rotate the upper torso up to 45 degrees.	3. Help mobilize pulmonary secretions.
4) The chest should be auscultated before&after the procedure	4. Determine areas needing drainage and the effectiveness of the treatment
5) If prescribed, bronchodilators may be taken before the procedure. And medication for pain, as prescribed, before applying the techniques of vibration.	5. Reduce bronchospasm decreases thickness of mucus and sputum.
6) Place a towel over the client chest on the area in which the percussion is being performed (or a thin layer of clothes).	6. Towel absorbs more pain result from percussion.
7) Perform the percussion over the affected area of the lung Holding the fingers together your elbow should be	



flexed&wrist relaxed don't stap the chest wall.	7. To prevent injury to chest wall
8) Instruct the patient to perform deep breathing.	
9) While you perform percussion a hollow deep sound produced.	
10) Treatment should be stopped if any of the following occur: increased pain, increased shortness of breath, weakness, lightheadedness, or hemoptysis.	
11) Remove the gloves and hand washing.	8. Prevent cross of infection.
12) Documentation.	9. Continuing of care.

III- Vibration

Definition

- Vibration or shaking is a practice applied on the chest from the hand during the expiration phase of respiration.



Purpose

1. Enhance loosening of trapped secretions.
- 2- Increase the movement of secretions upward to facilitate its removing.
- 3- Decrease atelectasis.

An inflatable HFCWO vest (Fig. 20-9) may be used to provide chest therapy. The vest uses air pulses to compress the chest wall 8 to 18 times/sec, causing secretions to detach from the airway wall and enabling the patient to expel them by coughing. Patients prescribed vest therapy are generally more satisfied with this mode of treatment delivery than patients who receive manual CPT.

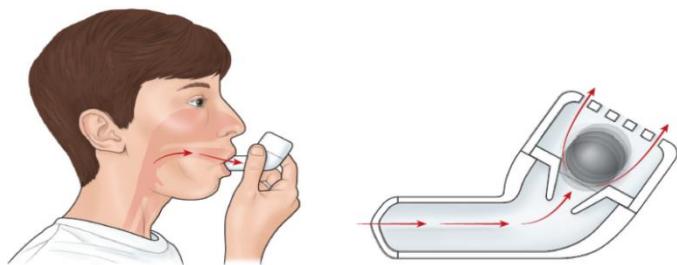


Figure 20-10 The flutter valve

To increase the effectiveness of coughing, a flutter valve may be used. It looks like a pipe but has a cap covering the bowl, which contains a steel ball. When the patient exhales actively into the device, movement of the ball causes pressure oscillations, thereby decreasing viscosity of the mucus, facilitating mucous clearance (Fig. 20-10).

Procedure of Vibration

Steps	Rationale
1) Hand hygiene.	To prevent transmission of microorganism
2) Explain the procedure to the patient.	To gain cooperation
3) Put the patient in supine lying position or according to affected area. The positions are varied, but focus is placed on the affected areas also provides pillows for support as	This position allows increased diaphragmatic excursion secondary to downward shift of internal organs from gravity.

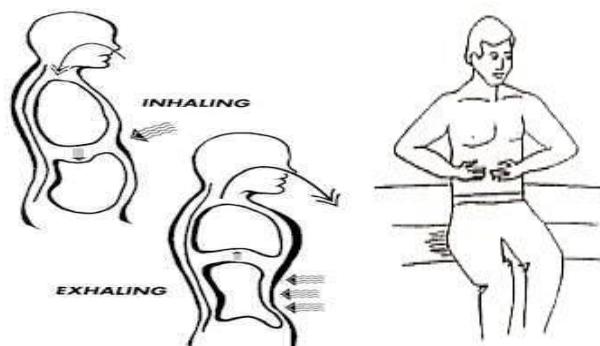


needed.	
4) The nurse ensures that the patient is not wearing restrictive clothing, and has not just eaten.	To ensures that the patient is comfortable
5) The chest should be auscultated before&after the procedure.	To allow for following assessment
6) If prescribed, bronchodilators, may be taken before the procedure. And medication for pain, as prescribed, before applying the techniques of vibration.	To facilitate mobilizing of secretion
7) Place a towel over the client chest on the area in which the percussion is being performed (or a thin layer of clothes).	
8) Flatten your hands&position them one on top of the other over a lung segment with straight arms into the patient chest during moderate pressure.	
9) Alternately contract&relax your shoulder&upper arm muscle.	
10) Vibrate for 10 sec per exhalation when patient exhales slowly.	
11) After three or four vibrations, the patient is encouraged to cough, contracting the abdominal muscles to increase the effectiveness of the cough. Repeated number depends on the patient's tolerance and clinical response.	To get rid of secretion
12) Vibrations should be stopped if any of the following occur: increased pain, increased shortness of breath, weakness, lightheadedness, or hemoptysis.	To check for any injury or problem happen
13) Hand hygiene.	To prevent transmission of microorganism

Deep breathing & coughing exercises

Definition:

- Are exercises used to improve pulmonary gas exchange and maintain respiratory function especially after prolonged activity or general anesthesia.



Purposes:

- 1- Promote relaxation and decrease anxiety.
- 2- Helps expand the lungs and forces better distribution of the air into lungs.
- 3- Clear the airways of mucus, thereby improving gas exchange, preventing atelectasis and pneumonia, and promoting maximal lung expansion and chest wall movement.
- 4- Strengthen and improve the efficiency of respiratory muscle.
- 5- Keep airway clearance.
- 6- Prevent postoperative pulmonary complications.

Indications:

1. In patients with acute and chronic obstructive ventilator disorders.
2. Stress
3. In patients having upper abdominal or thoracic surgery

Contraindications:

1. Increased intracranial pressure
2. Acute unstable head, neck, or spinal injury

Teaching patient about deep breathing and coughing exercises

- 1- The back of the patient should be straight to promote full expansion of the lungs.
- 2- An analgesic may be given before exercises (30 minutes) if pain is present.
- 3- If patient has incisional wound in the chest or upper abdomen, support the wound with the pillow, hands or the book held against abdomen

Procedure of pursed lips breathing, and coughing exercise:

Steps	Rationale
1. Hand hygiene.	1-To prevent transmission of microorganism.
2. Explain to the client that diaphragmatic breathing can help the person breathe more deeply and with less effort.	2-To gain cooperation
3. Assist the client to assume either a comfortable position: a) Semi-flower's position with knees, flexed back supported and one head pillow. b) Supine position with one head pillow and knees flexed.	3-This position allows increased diaphragmatic excursion secondary to downward shift of internal organs from gravity.
4. If the client has an abdominal or chest incision that will cause pain during coughing, instruct the client to hold a pillow firmly over the incision (splinting). When coughing.	4- Coughing uses abdominal and accessory respiratory muscles, which may have been cut during surgery. - Splinting supports the incision and surrounding tissues and reduces pain during coughing.

5. Have client place hands palm down, with middle fingers touching, along lower border of rib cage.	5-This position allows client to feel movement of diaphragm, indicating a deep breath.
6. Ask client to inhale slowly through the nose, feeling middle fingers separate. Hold breath for 2 or 3 seconds.	6-Inhaling through the nose allows air to be filtered, warmed, and humidified. Holding breath allows lungs to expand fully.
<p>7. Instruct the client to purse the lips as if about to whistle.</p> <ul style="list-style-type: none"> - Teach the client how make double cough techniques. - Breath in through the nose and inflate the lungs to the mid inspiration point. <p>Simultaneously exhale and cough two or more abrupt sharp coughs in rapid session.</p>	
8. Have client exhale slowly through mouth. Repeat three to five times.	8-Slow expulsion of air frequently initiates the coughing reflex, which facilitates expectoration of secretion
9. Document procedure.	9-Maintains legal record and communicates with healthcare team.

Incentive Spirometer

Definition:

- It is a device that provides a visual goal and measurement of inspiration.
- Or It is a medical device used to help patients improve the functioning of lungs.

Purposes:

1. Improve pulmonary ventilation and oxygenation.
2. Loosen respiratory secretions.
3. Prevent or treat atelectasis by expanding collapsed alveoli.



Indications:

1. Respiratory surgery as lung surgery
2. Patients recovering from rib damage to help minimize the chance of fluid build-up in the lungs
3. Patients recovering from cardiac surgery

Equipment:

- Incentive spirometer
- Mouthpiece (if not already connected to the device).
- Nose clip (optional).

Procedure of incentive spirometer:

Steps	Rationale
•Verify the physician order	
•Perform hand hygiene, identify the patient&explain procedure to the patient	<ul style="list-style-type: none"> - Hand hygiene reduces transfer of microorganisms. - Identification prevents potential errors - Explanation to gain patient cooperation and reduce fear and / or anxiety
•Assist patient in high fowler's or sitting positions.	These positions facilitate optimal lung expansion
•Determine the volume to set incentive spirometry goal based on calculated lung volumes.	People of different sizes have different lung capacities.



Instructing patient to: a- Keep the incentive spirometer straight. b- Seal lips tightly around mouthpiece. c- Inhale slowly and deeply through mouth. Hold breath for 2 or 3 seconds	A sealed mouthpiece prevents leakage or air around mouthpiece. Holding the breath maintains maximal inflation of alveoli.
• Evaluate patient progress by watching the balls elevation or lights go on depending on types of equipment or type of equipment used.	To obtain optimal goal
• Exhale slowly around mouthpiece and breathe normally for several breaths.	To prevent hyperventilation
• Repeat procedure 5 to 10 times every 1 to 2 hours, or according to physician orders.	Frequent use prevents alveoli collapse.
• Assess respiratory status and evaluate patient response to spirometer	Provide a basis for repeated use
• Maintain cleanliness of spirometer by keeping mouthpiece covered when not in use	Reduces transmission of microorganisms
• perform hand hygiene.	Reduces transmission of microorganisms

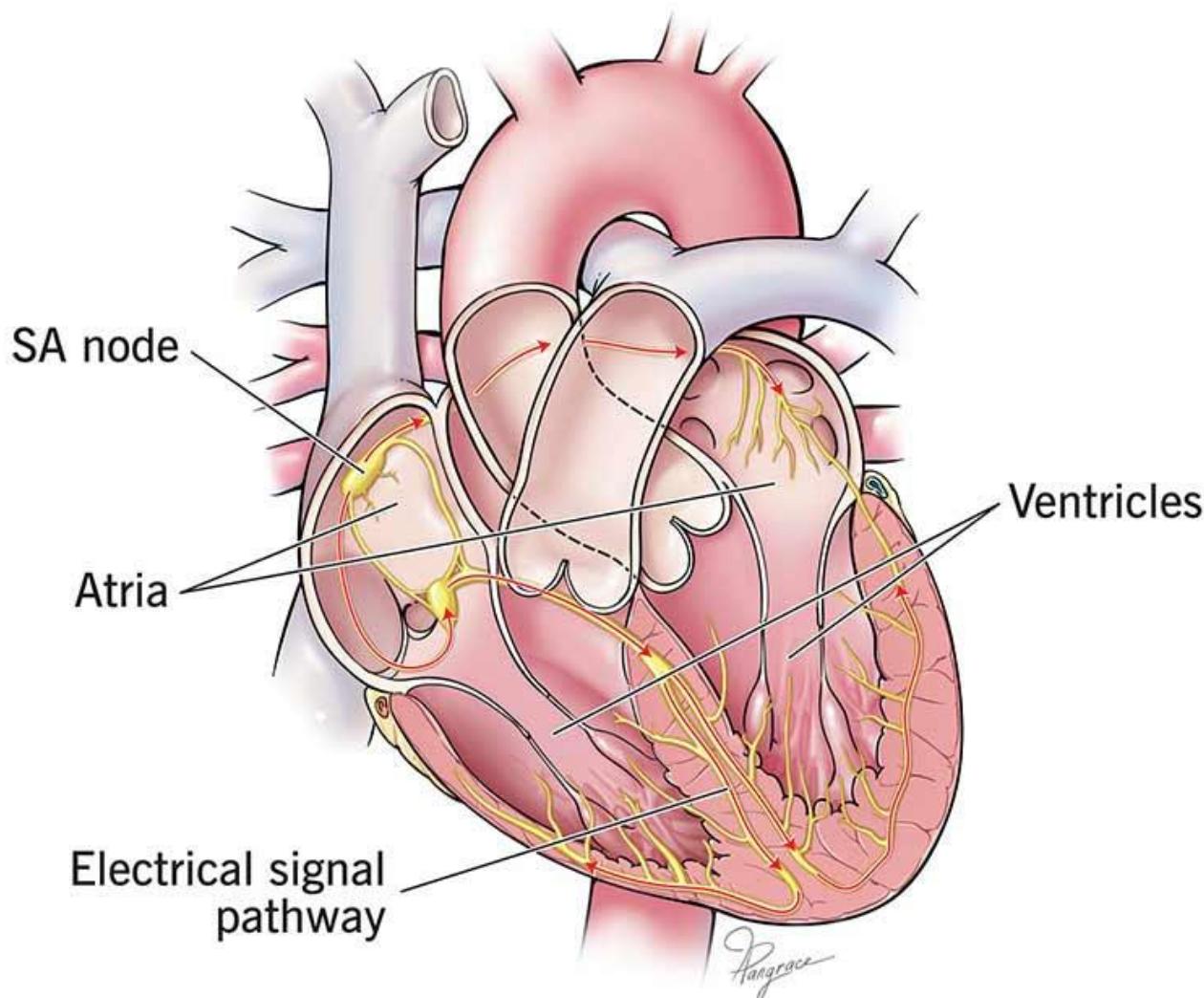
• Document procedure	Maintains legal record and communicates with healthcare team.
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Patient health teaching about incentive spirometers:

- After performing incentive spirometer exercise, the patient performs coughing technique.
- Teach the patient to notice the sputum for consistency, amount, and color changes.
- Before discharge, ask the patient to demonstrate the correct procedure for use of incentive spirometer.
- Perform breathing exercises before the patient's meals to prevent nausea and vomiting.
- To encourage patient compliance, place the spirometer close to him.

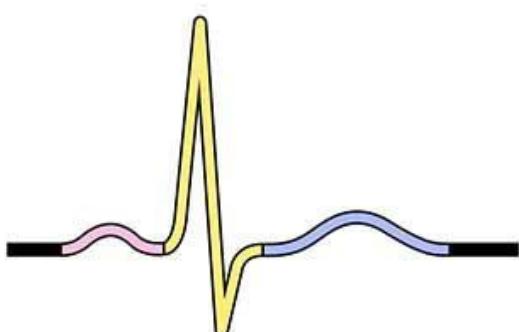


Electrocardiogram (EKG)



Normal EKG

60-100 bpm



- P wave (atria)
- QRS complex (ventricles)
- T wave (rest)

Electrocardiogram

- **The electrocardiogram (ECG)** - is a non-invasive diagnostic test that evaluates the heart's electrical system, assessing heart disease through flat metal electrodes placed on the chest to detect the electrical charges generated by heart.

Indications of ECG: -

1. As part of a yearly medical examination to screen for heart disease.
2. Before heart surgery as pacemaker placement.
3. In the following cases:
 - History of heart disease, to evaluate the progress or deterioration of disease.
 - Medical condition such as hypertension, diabetes, high cholesterol, or inflammatory disease.
 - To detect significant risk factors for cardiac disease or abnormal heart rhythm.
 - ECG may also be recommended if the person has signs or symptoms of heart disease, such as chest pain, shortness of breath, light headiness, or dizziness.
 - General health assessment in certain occupations, including aviation, diving and the military

➤ **Four main approaches to monitoring cardiac rhythm**

- 1) 12-lead ECG: the standard for cardiac monitoring, it provides information about the heart's electrical activity in three dimensions.
- 2) Basic continuous ECG: less detailed but provides ongoing information about heart rate and rhythm.
- 3) Holter-tape ECG: uses a portable device to enable continuous monitoring of various electrical activities over 1-7 days as a diagnostic tool.
- 4) Exercise ECG: used to assess the heart's response to exercise or stress and useful in diagnosing ischemia.

➤ Equipment

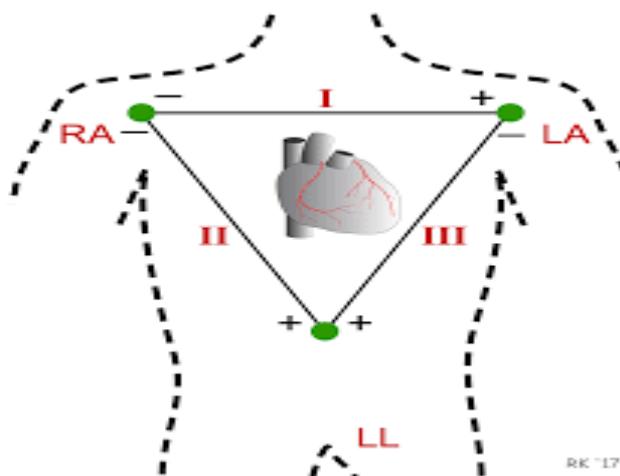
1. ECG machine.
2. Electrodes (sensors).
3. Gauze and skin preparation solution (as approved by your facility).
4. ECG Paper.

ECG leads consist of 12 leads as follows: -

- Augmented limb leads are: - AVR, AVL, AVF
- Precordial chest leads are: - V1, V2, V3, V4, V5 and V6
- Standard limb leads are I, II, III

Standard limb leads

- **Lead (I)** ----- is between the left arm and the right arm.
- **Lead (II)** ----- is between the right arm and the left leg.
- **Lead (III)** ----- is between the left arm and the left leg.



➤ Instructions for obtaining an accurate ECG:

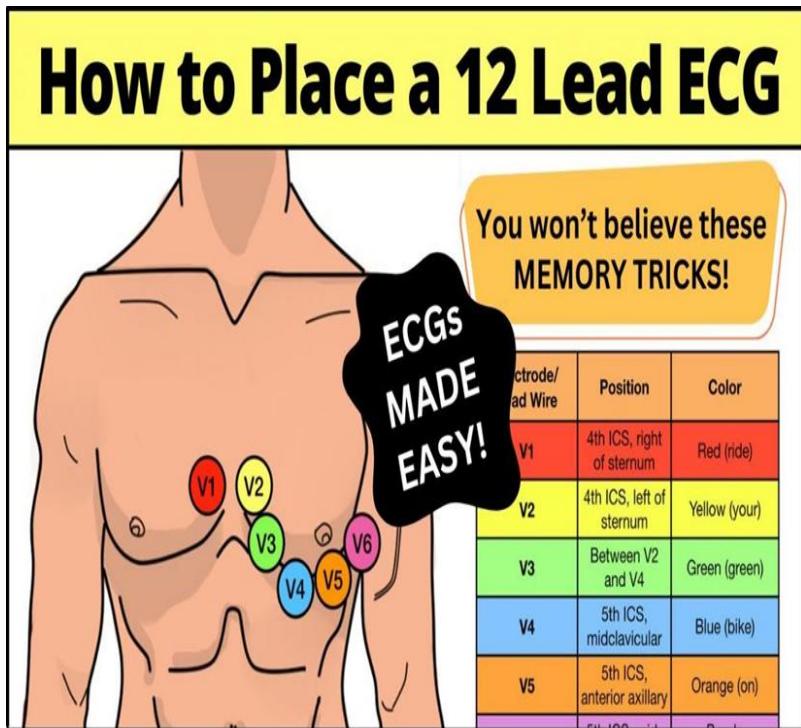
1. The patient must be lying on back.
2. The patient must be free from any jewelry or any metal object.
3. Remove any metal denture that can be removed.
4. The electricity must be attached to the machine.
5. The patient must be calm and breathe normally.

Procedure

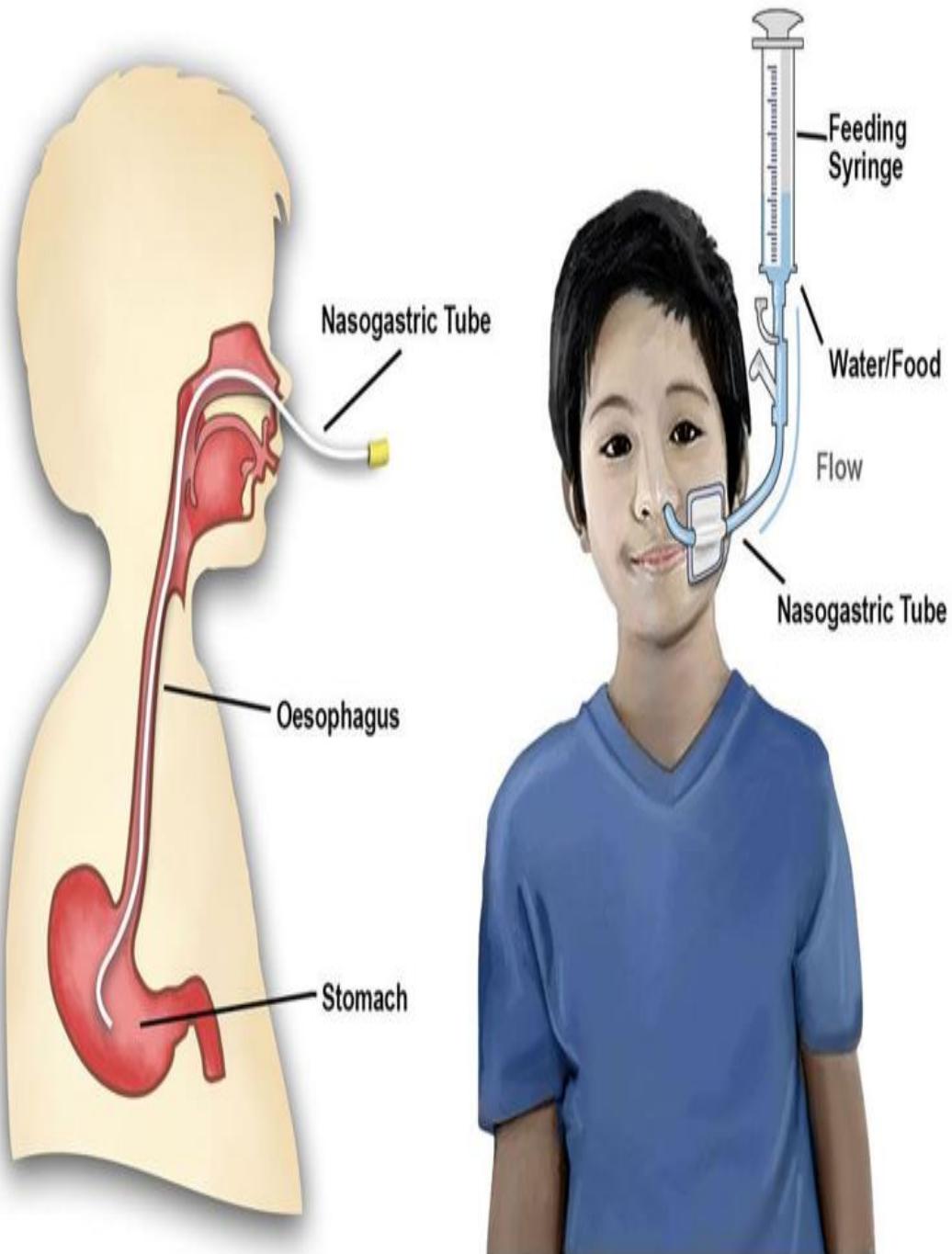
Steps	Rationale
1. Perform hand hygiene.	1. To reduce the transfer of microorganism.
2. Prepare the equipment.	2. To facilitate the execution of the procedure.
3. Explain the procedure to the patient.	3. To reduce anxiety.
4. Attach the leg electrodes just above the wrist and lubricate inner aspect of the arm.	4. To facilitate contact with the skin.
5. Attach the leg electrodes just above the ankle after lubricating inner aspect of the leg.	5. To facilitate contact with the skin.
<u>Augmented limb leads</u>	
<ul style="list-style-type: none"> - Left leg ----- (green). - Left arm ----- (yellow). - Right arm ----- (red). - Right leg ----- (black). 	
6. Connect the electrodes to the ECG machine via the clip attached to the adhesive tapped electrodes.	6. To attach with the impulse.
7. Attach the 6 chest leads in position.	7. To attach with the impulse.
<u>Precordial chest leads</u>	
<ul style="list-style-type: none"> - V1: - is placed in the fourth intercostal space to the right of the sternum. - V2: - is placed in the fourth intercostal space to the left of the sternum. - V3: - is placed between V2 and V4. - V4: - is placed in the fifth intercostal space in the mid-clavicular line near the nipple. - V5: - is placed between V4 and V6. 	



- **V6**: - is placed in the fifth intercostal space in the mid-axillary line.



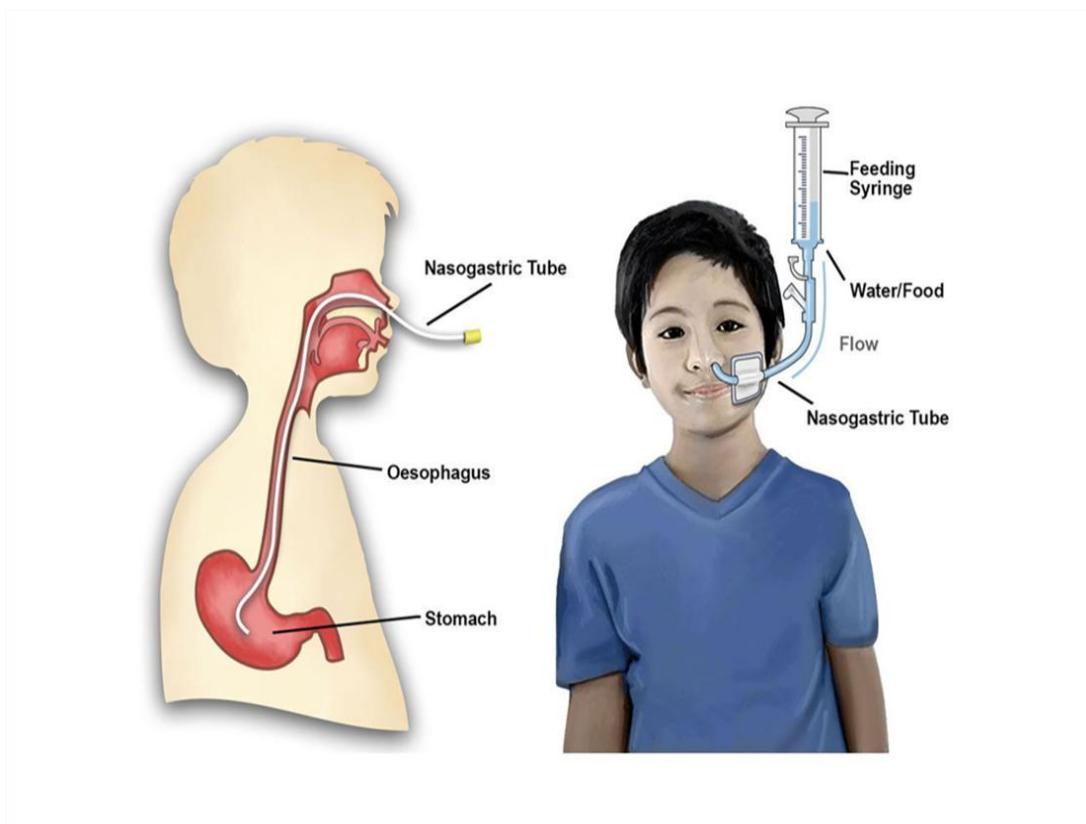
8. Operate the ECG machine.
8. To record the 12 leads.
9. Remove the leads and wipe the gel.
9. To promote the patient's comfort.
10. Place the ECG results on the chart and note the time and condition of the findings and contribute to the legal aspects by documenting the care given to the patient.
10. This helps with communicating with the other health care team members.



Nasogastric tube (NGT) feeding (Gavage)

Definition

- It is giving of liquid food through a tube that is inserted into the stomach through the nose.
- It is recommended for a person who is unable to chew or swallow



Purposes:

1. To restore or maintain nutritional status
2. To administer medications

Technique: Four modalities of delivering enteral tube feeding have been developed:

- 1- Constant infusion.
- 2- Cyclic.
- 3- Intermittent.
- 4- Bolus

Assessment

- 1- Type, amount, frequency of feeding&tolerance of previous feeding
- 2- Signs of malnutrition or dehydration
- 3- Assess allergies to any food
- 4- Presence bowel sound
- 5- Any tolerance of previous feeding (delayed gastric empty, abdominal distention and constipation)

Equipment

- Correct type and amount of feeding solution
- Measuring container from which to pour the feeding (if using open system)
- Stethoscope.
- Disposable gloves.
- Toomey syringe 20 to 50 ml with adaptor.
- Water at room temperature
- for irrigation or normal saline.
- Emesis basin
- Feeding pump as required
- PH test strips or meter

Procedure

Steps	Rationale
Preparation	
<ul style="list-style-type: none"> Assist the client to a Fowler's position or a sitting position. If a sitting position is contraindicated, a slightly elevated right side-lying position is acceptable. 	<ul style="list-style-type: none"> These positions enhance the gravitational flow of the solution and prevent aspiration of fluids into the lungs.
Performance	
<ol style="list-style-type: none"> Introduce yourself, verify the patient's identity & explain the procedure to the patient. Inform the client that the feeding should not cause any discomfort but may cause a feeling of fullness. Perform hand hygiene Provide privacy for this procedure Assess tube placement: Attach the syringe to the open end of the tube and aspirate. Assess residual feeding contents. <ul style="list-style-type: none"> If the tube is placed in the stomach, aspirate all contents and measure the amount before administering the feeding. Check pH: Wait 1 hour after giving medication before checking gastric pH; use a pH meter for continuous feeding and follow facility policy if pH is 6 or higher. 	<ol style="list-style-type: none"> Check gastric residual to assess absorption of the last feeding; if the tube is in the small intestine, aspiration isn't possible. Delay feeding or re-instill contents based on policy or doctor's order, as removal may affect electrolytes. For continuous feeding, check residual every 4–6 hours and then proceed with feeding.



<p>6. Before administering feeding:</p> <ul style="list-style-type: none">- Check the expiration date of the feeding.- Warm the feeding to room temperature.- When an open system is used, clean the top of the feeding container with alcohol before opening it.- Flush tube with 30 ml of water for irrigation.- Disconnect syringe from tubing. <p>7. Administer feeding amount as prescribed as small portions at set intervals. Do not push formula with syringe plunger.</p> <p>8. Regulate rate, by height of the syringe.</p> <p>9. After feeding; flush the NG tube with sterile saline to prevent blockage.</p> <p>10. Clamp tube, Disconnect syringe from tube&Cover end of tube.</p> <p>11. Clean skin around the nose and mouth</p> <p>12. Keep client in upright position for at least 30 minutes to 1 hour after feeding.</p> <p>13. Perform hand hygiene and document: Amount of feeding, Patient response (nausea, vomiting, abdominal discomfort), residual amount</p>	<p>6.</p> <ul style="list-style-type: none">- An excessively cold feeding may cause abdominal cramps.- This minimizes the risk of contaminants entering the feeding syringe
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Gastric lavage

➤ Definition

- Gastric lavage, also known as gastric irrigation, is a medical procedure performed to evacuate the contents of the stomach. It is primarily indicated in cases of acute poisoning, drug overdose, or preoperative preparation for certain surgical interventions.

➤ Indications for gastric lavage

1. Acute poisoning or overdose (within 1–2 hours)
2. Preoperative stomach emptying
3. Gastrointestinal bleeding (to clear blood for endoscopy)
4. Diagnostic sampling (e.g., for TB in children)
5. Gastric decompression (in obstruction or ileus)
6. Severe hyperthermia (as a cooling method when external methods are insufficient)
7. Irrigation

➤ Contraindications

1. Ingestion of corrosive substances (e.g., acids, alkalis)
2. Hydrocarbon ingestion (e.g., gasoline)
3. Unprotected airway in unconscious patients
4. GI perforation or obstruction

➤ Equipment

- Lubricant
- Syringe or lavage kit
- Warm saline or sterile water (250–300 mL per cycle)
- Suction setup
- Personal protective equipment (gloves, gown, mask)
- Emesis basin, gloves, apron, protective eyewear

➤ Procedure

1. Preparation

- Verify physician's order for gastric lavage.
- Assess patient's condition: level of consciousness, airway protection, contraindications (e.g., ingestion of corrosives, GI perforation).
- Perform hand hygiene and explain the procedure to the patient
- Prepare equipment

2. Patient positioning

- Place the patient in left lateral position with head lowered (Trendelenburg if tolerated) to reduce aspiration risk.
- Ensure airway protection—intubate if unconscious or at risk of aspiration.

3. Confirm placement:

- Aspirate gastric contents
- Inject air and auscultate over stomach

4. Lavage procedure

- Attach syringe or lavage system to the tube.
- Instill 200 mL of warm saline or sterile water slowly.
- Allow fluid to dwell briefly, then aspirate back.
- Repeat until return fluid is clear or desired effect is achieved.
- Monitor patient for signs of discomfort, aspiration, or complications.

5. Post-procedure care

- Remove tube if no longer needed or connect to suction if required.
- Clean and reposition the patient.
- Document:

Time and volume of fluid instilled/returned

Patient's response

Vital signs

Any complications or observations

Nasogastric removal procedure

➤ Equipment

- Non-sterile Gloves
- Tissues, Protective Sheet
- Remove' Swabs
- Towel

➤ Procedure

1. Check physician's order for removal of nasogastric tube.
2. Perform hand hygiene. Don clean disposable gloves.
3. Prepare equipment.
4. Explain procedure to patient and assist to semi-Fowler's position.
5. Place towel or disposable pad across patient's chest.
6. Disconnect and unsecure the nasal suction tube
7. Attach syringe and flush with 10 mL normal saline solution or clean with 30 to 50 cc of air. (optional).
8. Instruct patient to take a deep breath and hold it.
9. Clamp tube with fingers by doubling tube on itself. Quickly and carefully remove tube while patient holds breath.
10. Place tube in disposable plastic bag. Remove gloves and place in bag.
11. Offer mouth care to patient and facial tissues to blow nose.
12. Remove all equipment and dispose according to agency policy. Perform hand hygiene.
13. Record removal of tube, patient's response, and measure of drainage. Continue to monitor patient for 2 to 4 hours after tube removal for gastric distension, nausea, or vomiting

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