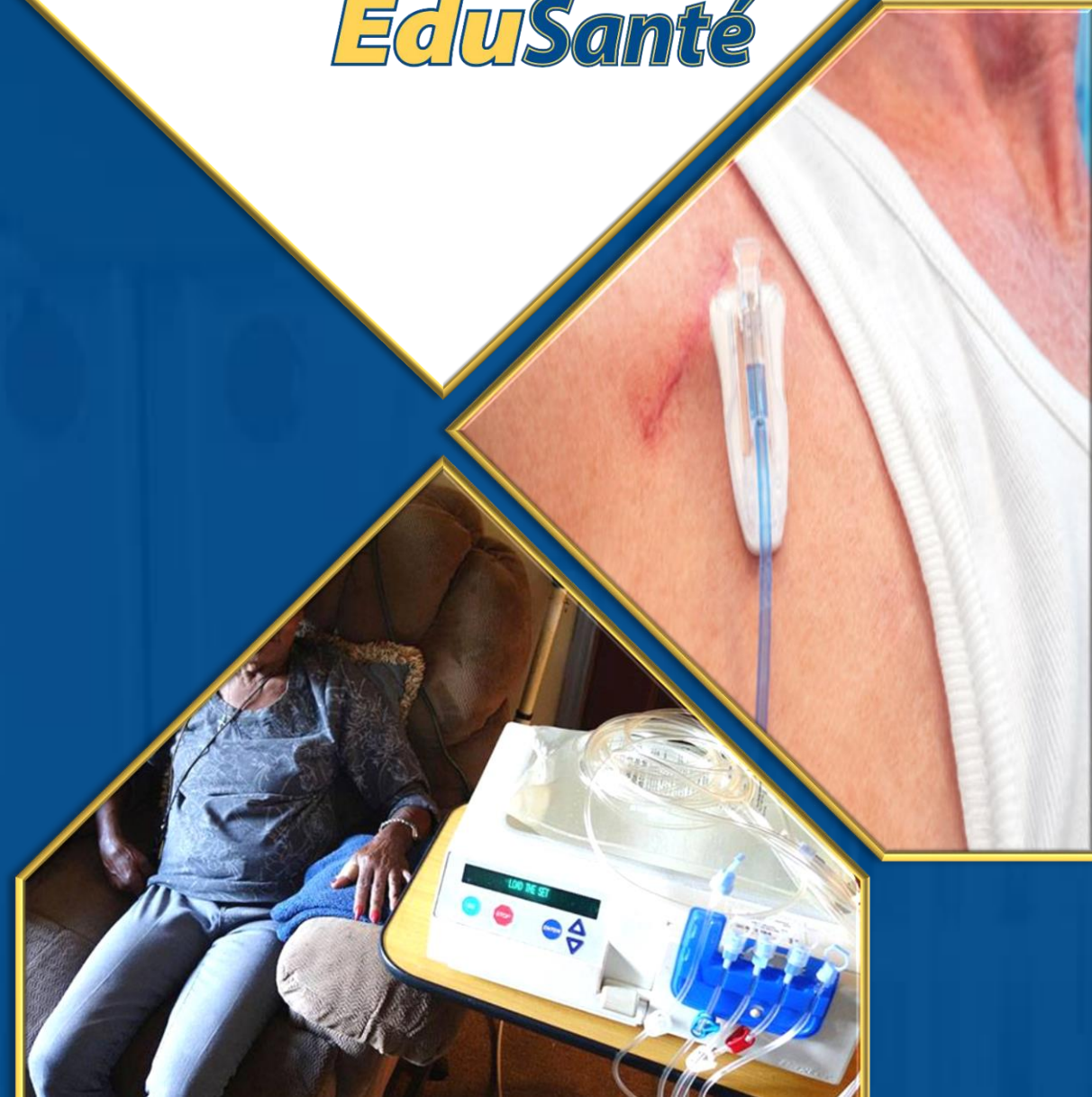


MEDICAL DEVICES

Primary Care Paramedicine

Module: 21

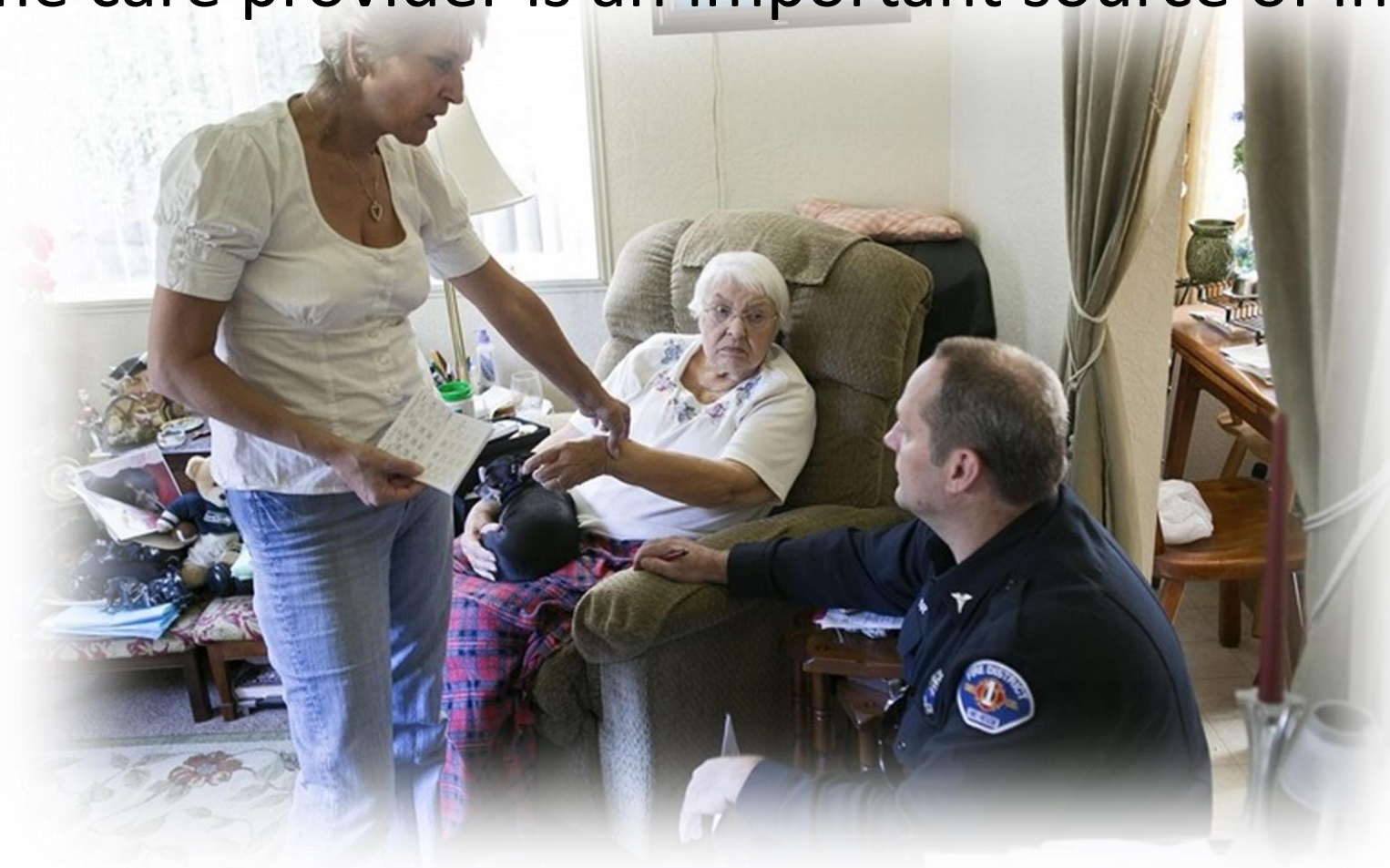
Section: 05



- A major trend of health care involves the shifting of patients out of the hospital and back into their homes as soon as possible.
- The result has been a huge increase in home health care services.

- Number of factors contribute to the growth of home care
 - Improved medical technology
 - Improved recovery rates
 - Lower cost
- Increased likelihood of paramedics attending to chronic-care patients

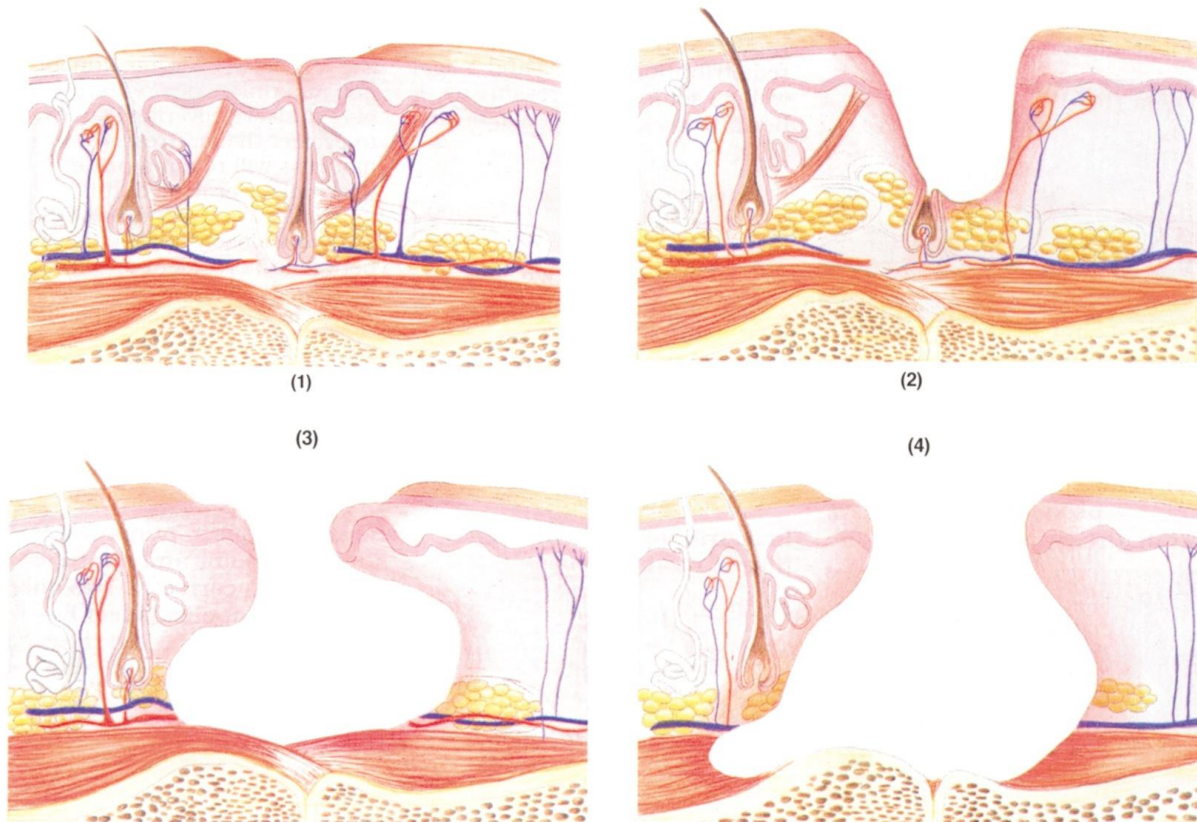
- The home care provider is an important source of information

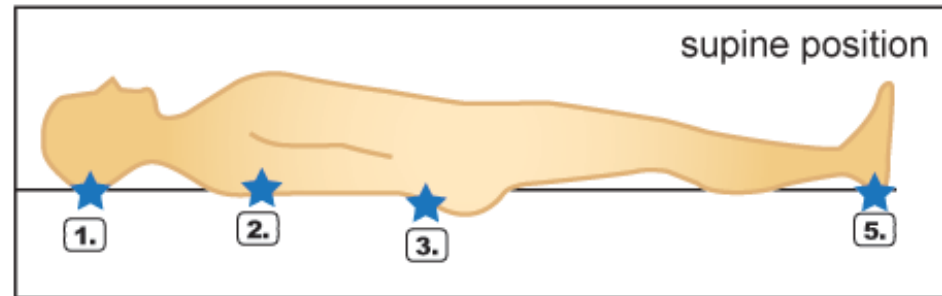


- Equipment failure
- Unexpected complications
- Absence of a caregiver
- Need for transport
- Inability to operate a device

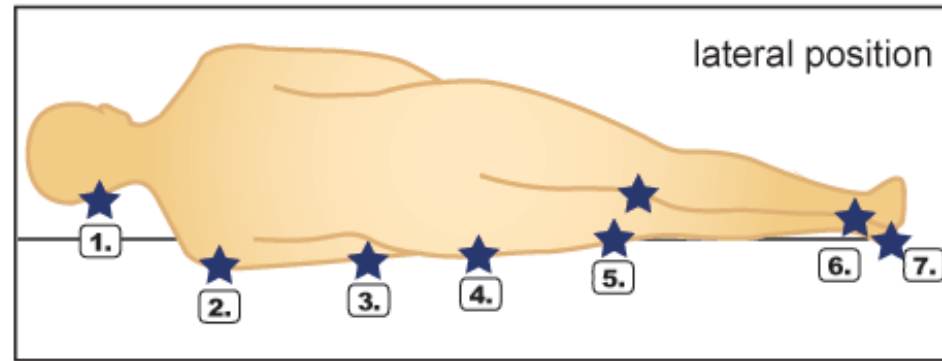
- Pathologies in a home-care setting are the same as others
- Home care patient is in a more fragile state
 - Airway complications
 - Respiratory failure
 - Cardiac decompensation
 - Alterations in peripheral circulation
 - Altered mental status
 - GI/GU crises
 - Infections/septic complications

- Pressure sores are classified by the depth of tissue destruction

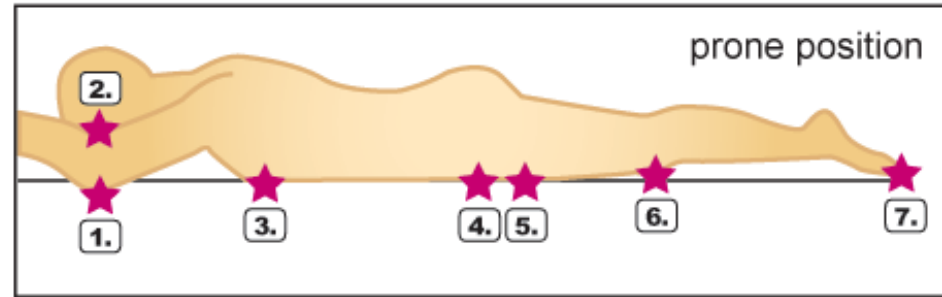




1. occiput
2. scapula
3. sacrum
4. heels



1. ear
2. acromion process
3. elbow
4. trochanter
5. medial & lateral condyle
6. medial & lateral malleolus
7. heels



1. elbow
2. ear, cheek, nose
3. breasts (female)
genitalia (male)
4. iliac crest
5. patella
6. patella
7. toes

- Glucometers
- IV infusions and in-dwelling IV sites
- Nebulized and aerosolized medication administrators
- Shunts, fistulas, and venous grafts
- Oxygen concentrators, oxygen tanks, and liquid oxygen systems
- Oxygen masks and nebulizers

- Tracheotomies and home ventilators
- G-tubes, colostomies, and urostomies
- Surgical drains
- Apnea monitors, cardiac monitors, and pulse oximeters
- Wheelchairs, canes, and walkers

Medical Devices

GENERAL SYSTEM PATHOPHYSIOLOGY, ASSESSMENT, & MANAGEMENT

- Assessment of the home-care patient follows the same basic steps as any other patient.
- The one thing home-care calls have in common is their diversity.
- Try and ascertain from the primary care provider the patient's baseline health status.

- Is there a wheelchair ramp?
- Is there oxygen equipment?
- Is there a trail of oxygen tubing?
- Are there infection control devices?
- Is there a sharps container?
- Is the patient in a hospital bed?

- Patient with limited movement may be soiled
- Weeping wounds and ulcers
- Sharps present
- Collection bags for urine and feces
- Tracheostomy patients clear secretions by coughing
- Electrical equipment

- Hospital beds or walkers may be contaminated
- Oxygen in the presence of an open flame (cigarette)
- Cluttered equipment may cause you to stumble
- Medical wastes may not properly be disposed

- Tailor your questions to the home-care setting



Transportation and Management Treatment Plan

- You should critically assess the risks of discontinuing the home health care intervention versus transporting the mechanism.



- Respiratory disorders
 - COPD
 - Bronchitis and emphysema
 - Asthma
 - CHF
 - Cystic fibrosis
 - Bronchopulmonary dysplasia (BPD)

- Neuromuscular degenerative diseases
 - Muscular Dystrophy
 - Poliomyelitis
 - Guillain-Barré Syndrome
 - Myasthenia Gravis
- Sleep apnea
- Patients awaiting lung transplants

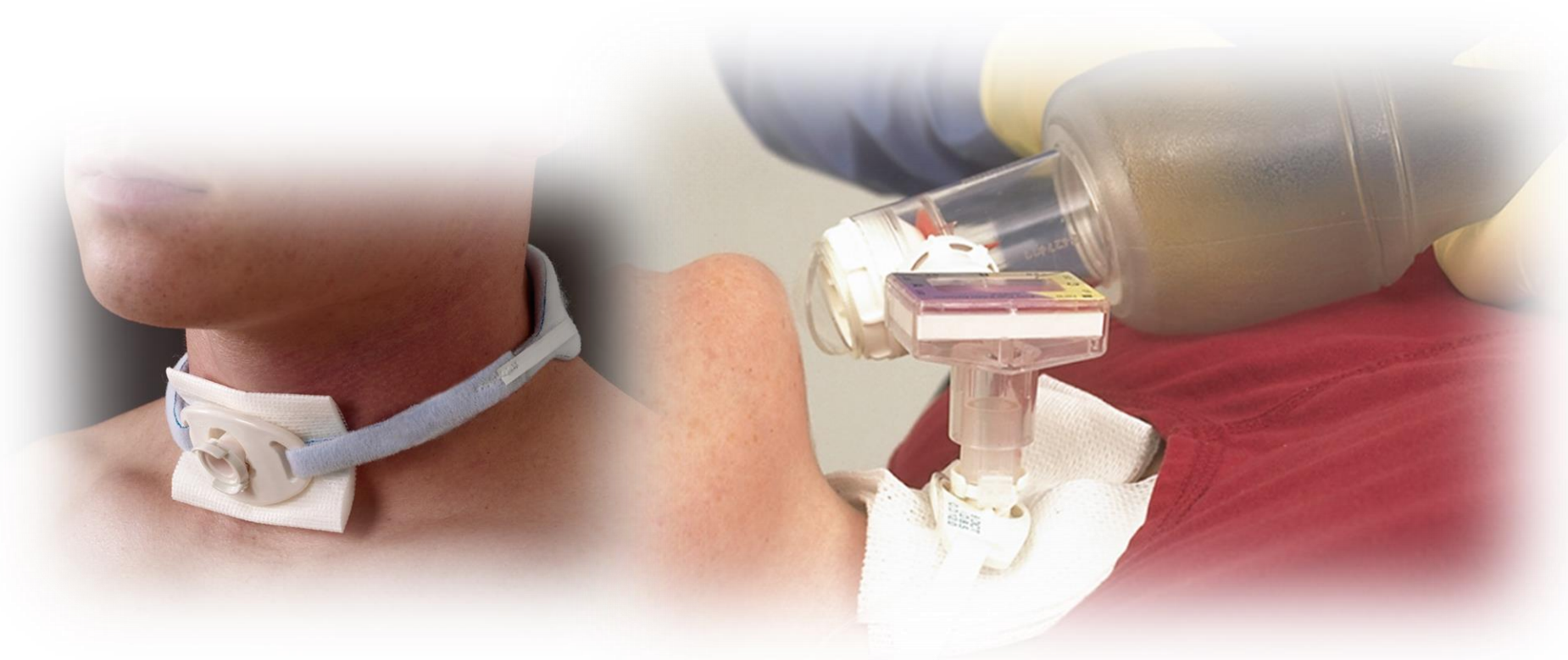
Medical Therapy Found in the Home Setting

- Home oxygen therapy
- Artificial airways/tracheostomies
- Vascular access devices
- Ventricular assist devices



Medical Therapy Found in the Home Setting

- Artificial ventilation in a patient with a tracheostomy tube



Medical Therapy Found in the Home Setting

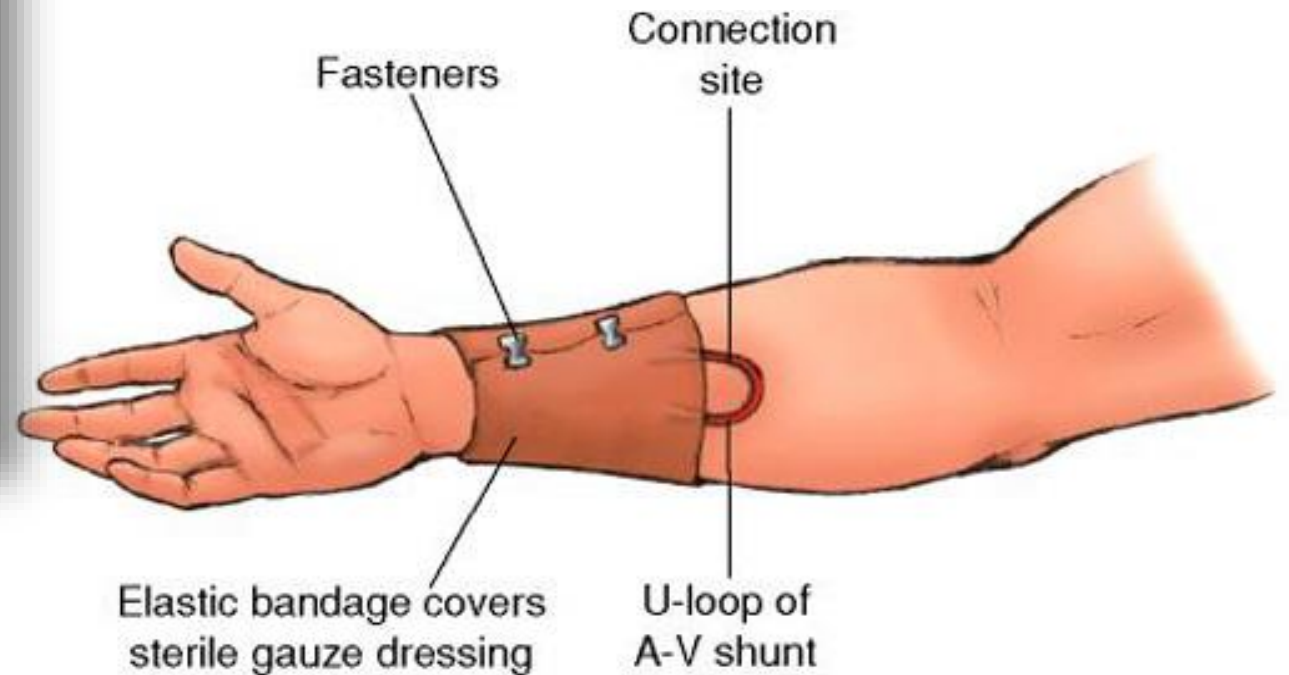
- Use of CPAP for sleep apnea patients



- Hickman, Broviac, Groshong
- Peripherally inserted central catheters
- Surgically implanted medication delivery systems
- Dialysis shunts



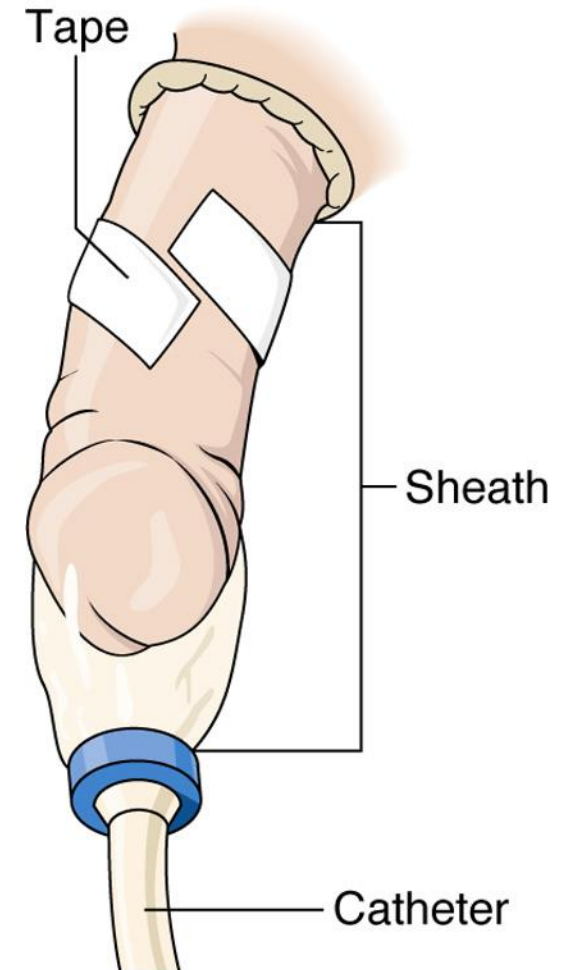
- An A-V shunt is used in home-care patients requiring dialysis



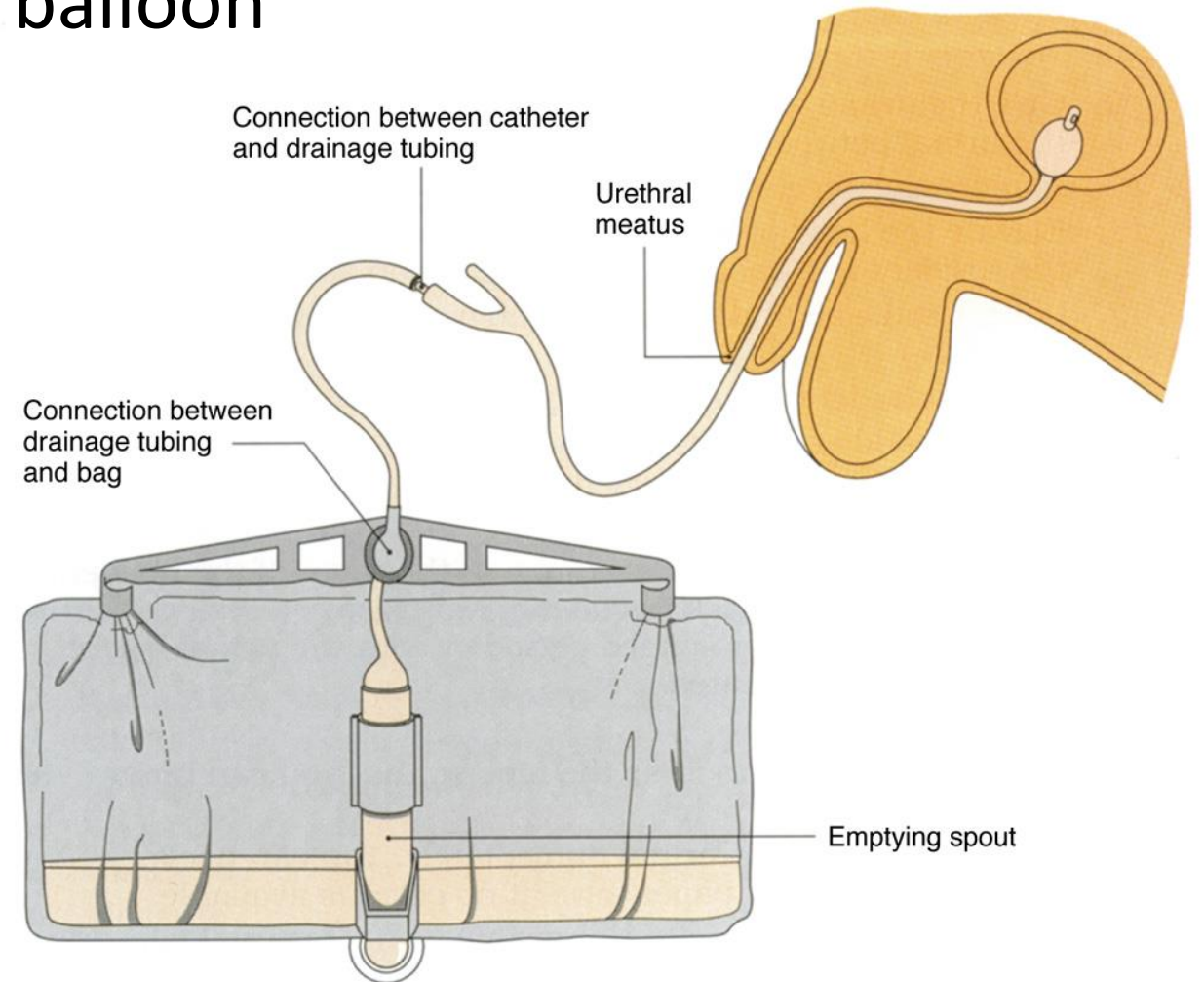
- Never access a surgically implanted port unless protocols allow you to do so
- Avoid vascular access and blood pressure in the extremity of a shunt

- Devices to support GI/GU function are common.
- Be familiar with the various devices and their complications

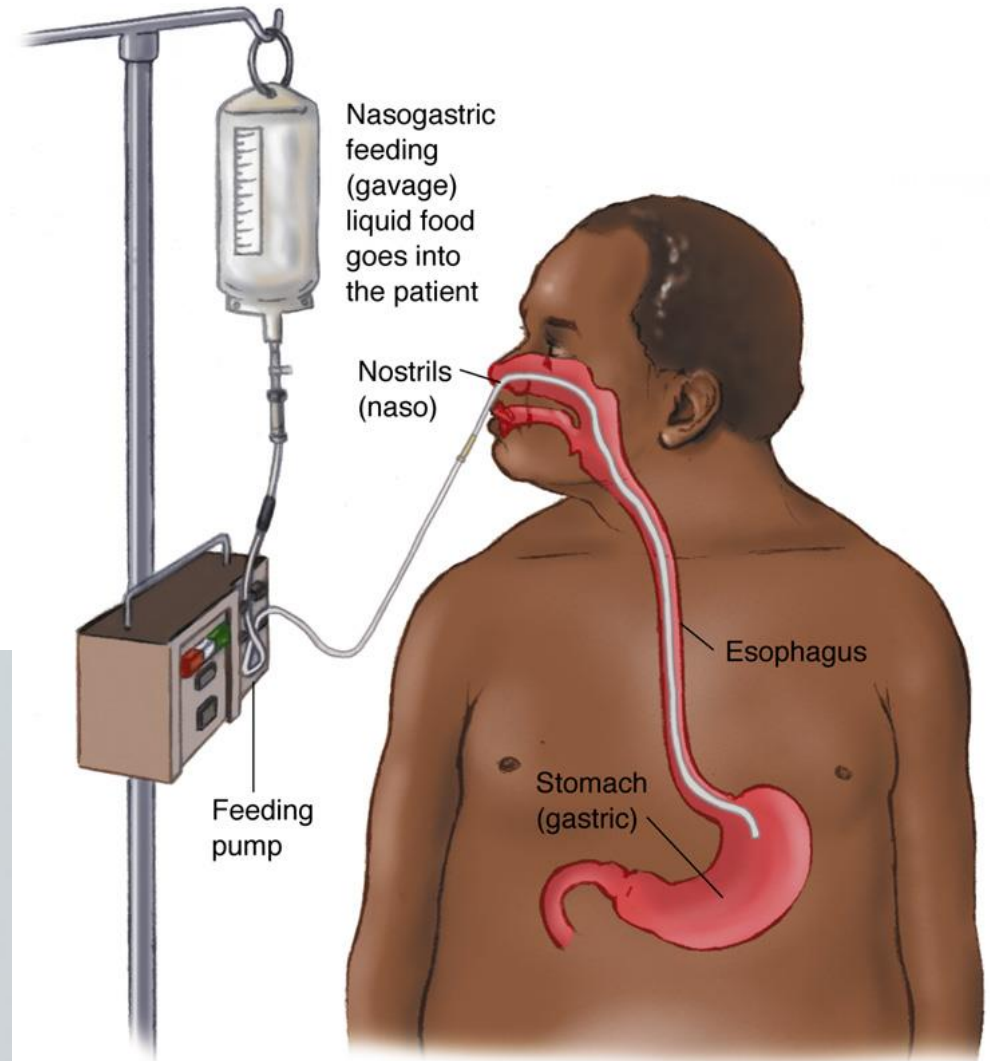
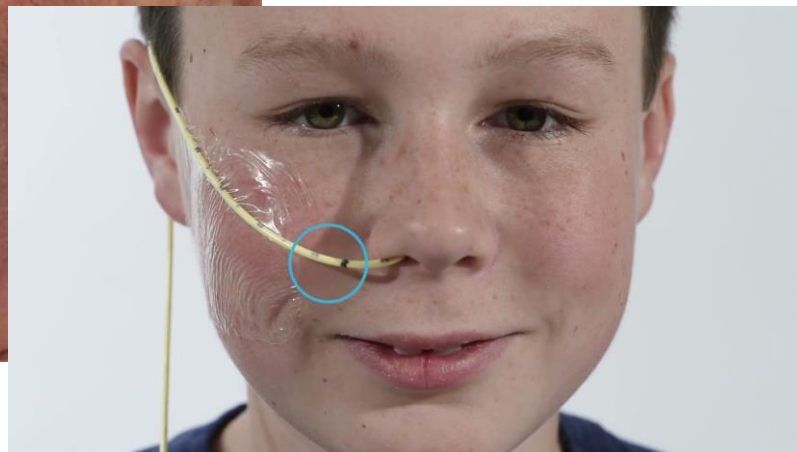
- An external urinary tract device



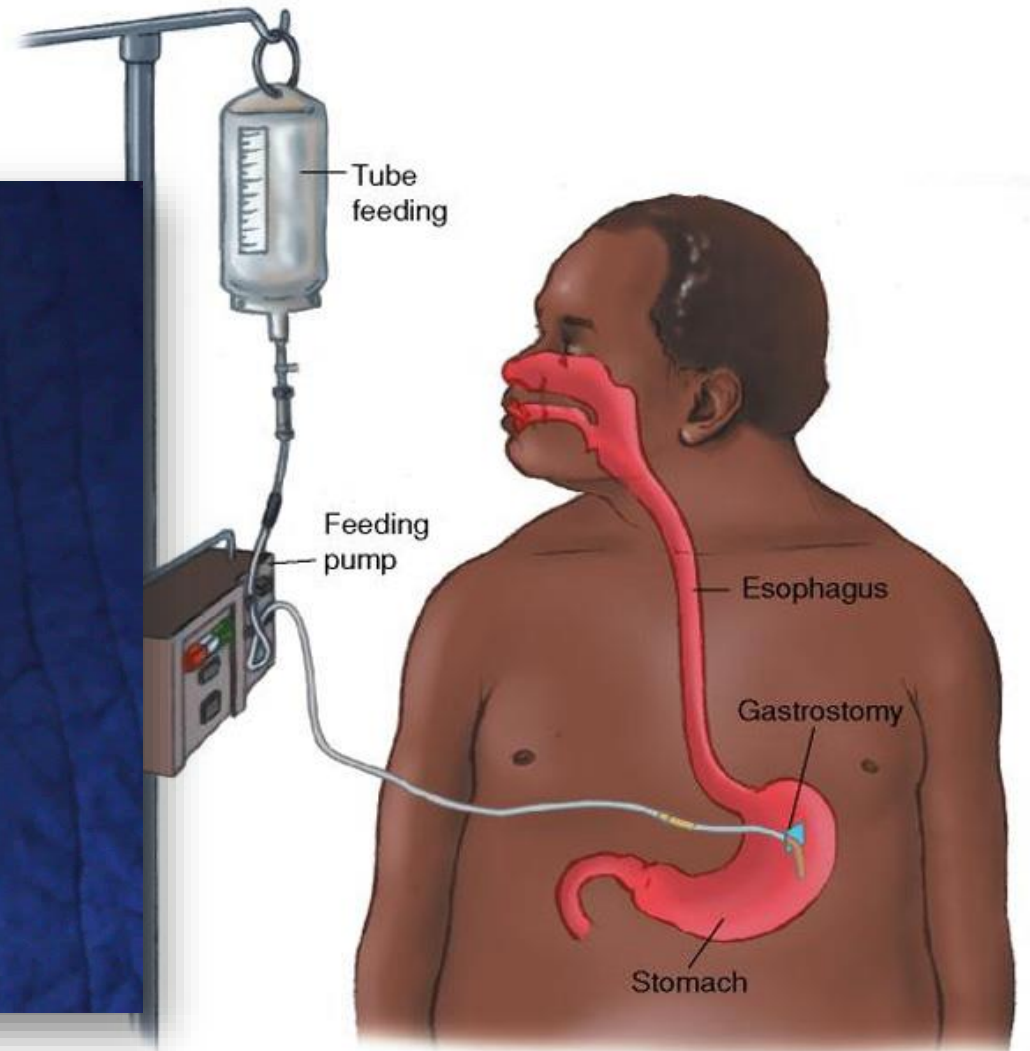
- Internal urinary catheter with balloon



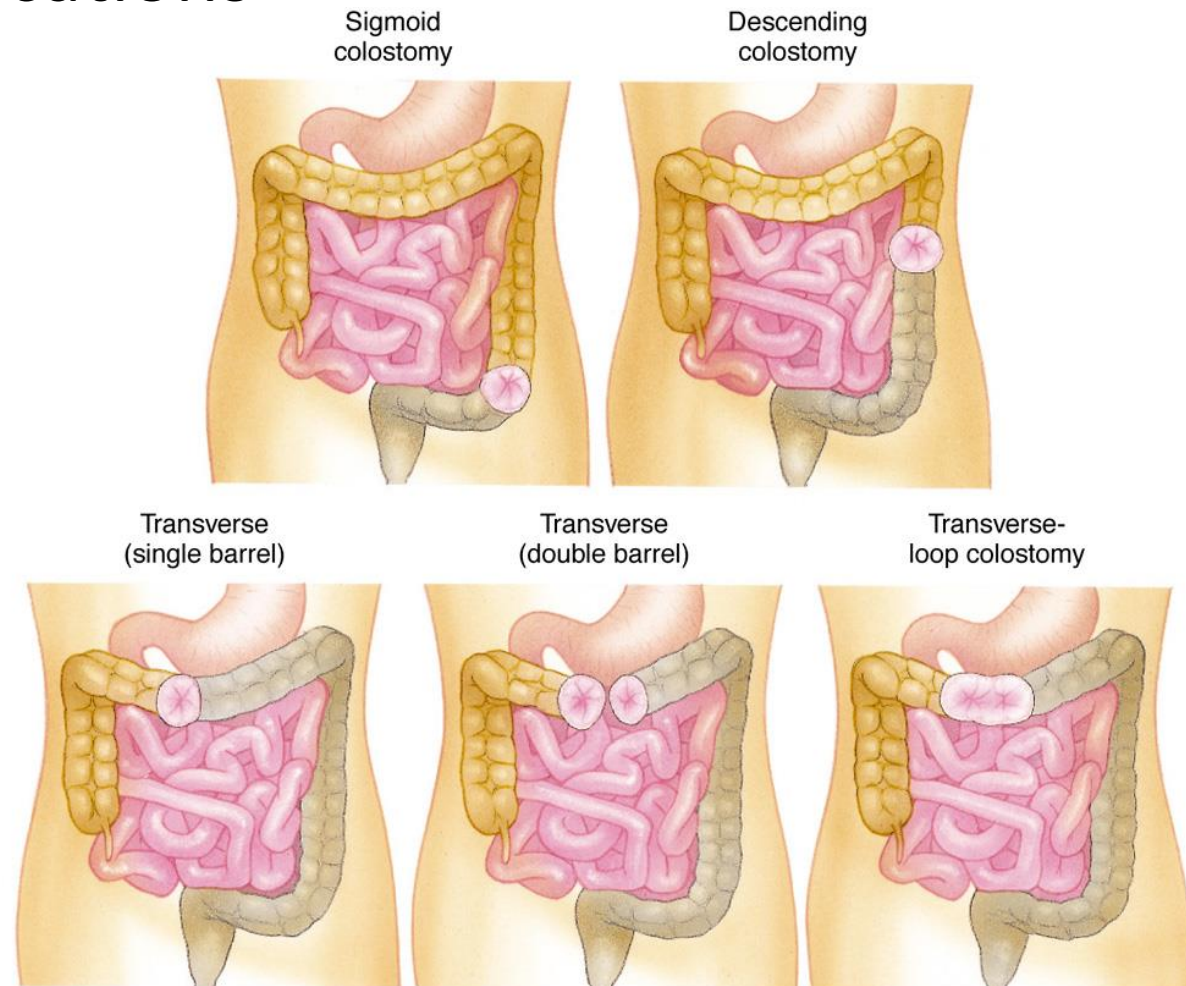
- A nasogastric feeding tube



- A gastrostomy feeding tube



- Examples of colostomy stoma locations



- Many women who deliver their babies in the hospital will be discharged in 24 hours or less.
- ALS providers may be called upon to assist new parents in caring for newborns or post-partum complications.

- Post-partum bleeding and embolus are common complications
- Management includes:
 - Massage of uterus
 - Administration of fluids
 - Administration of pitocin
 - Rapid transport, if necessary

- Signs/symptoms of cardiorespiratory insufficiency include:
 - Cyanosis
 - Bradycardia
 - Rales
 - Respiratory Distress

- Mechanical ventilators
- IV medications
- Oxygen therapy
- Tracheostomies
- Feeding tubes
- Pulse oximeters
- Apnea monitors

- The goal of hospice care is to provide palliative or comfort care rather than curative care.



- Common diseases that you can expect to see in hospice include:
 - Congestive Heart Failure (CHF)
 - Cystic fibrosis
 - COPD
 - AIDS
 - Alzheimer's
 - Cancer



Table 46-1

PERCENT OF HOSPICE PATIENTS BY AGE

Age	Percent
Under 45 years	8.1
45-54 years	7.9
55-64 years	14.8
65-69 years	8.7
70-74 years	15.6
75-79 years	14.5
80-84 years	12.3
85 years and older	16.4

Source: National Center for Health Statistics

Medical Devices

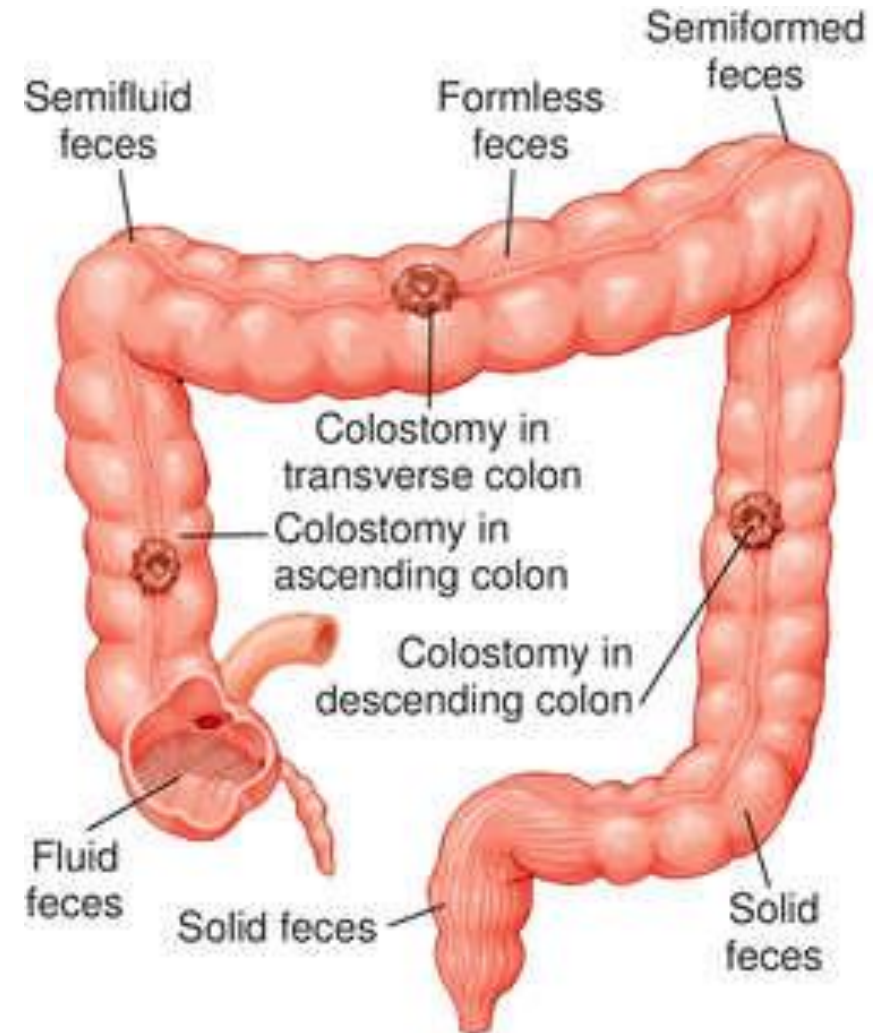
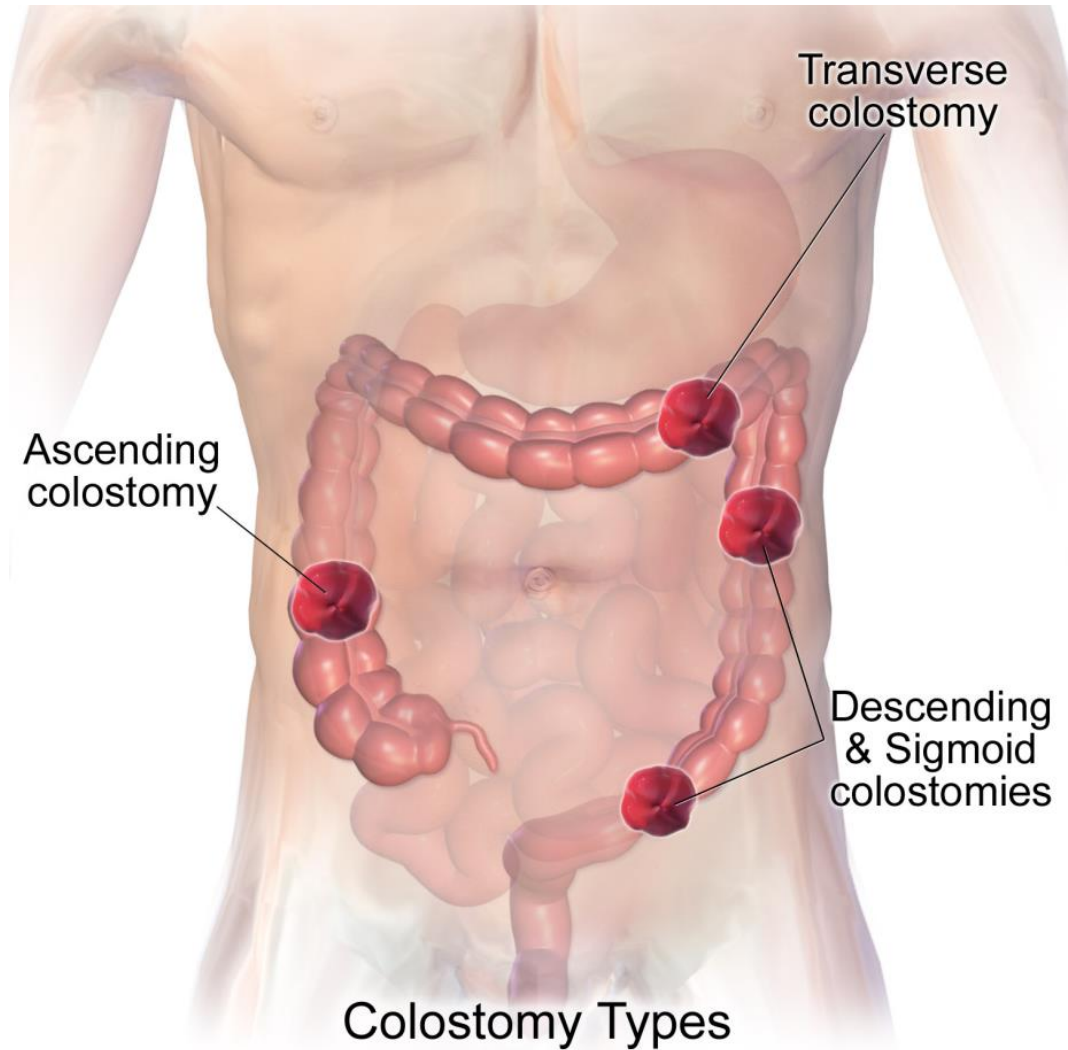
OSTOMY DRAINAGE SYSTEMS

- As a Primary Care Paramedic you should be able to:
 - Describe the purpose of an Ostomy drainage System
 - Identify the equipment necessary for Ostomy drainage
 - Relate the site of an ostomy to the patients condition
 - Describe the components of a drainage bag
 - Discuss common complications associated with colostomies

- **Colostomy**
 - The surgically created opening of the colon (large intestine) which results in a stoma.
 - A colostomy is created when a portion of the colon or the rectum is removed and the remaining colon is brought to the abdominal wall.
- **Temporary Colostomy**
 - Placed to allow a portion of the colon to heal. May have 1-2 openings
- **Permanent Colostomy**
 - Usually involves the loss of part of the colon, most commonly the rectum.
 - The end of the remaining portion of the colon is brought out to the abdominal wall to form the stoma.

- Diverticulitis
- Perforated bowel
- Bowel obstruction
- Crohn's disease
- Ulcerative colitis
- Cancer
- Birth defects
- Accidental injury
- Incontinence
- Chronic constipation
- Spinal injury
- MS

Locations of Colostomy





- Convex Inserts
- Ostomy belts
- Pouch covers
- Skin barrier liquid/ wipes or powders
- Skin barrier paste
- Tapes
- Adhesive remover



- Ballooning
- Constipation/Diarrhea
- Granulomas
- Odour
- Pancaking
- Parastomal Hernia
- Prolapse
- Rectal discharge
- Rectal pain
- Sore skin/leakage

Medical Devices

CATHETERS (URINARY COLLECTION SYSTEMS)

- As a Primary Care Paramedic you will be responsible for transporting patients that have a catheter in place
- You should be aware of:
 - Indications, Contraindications and complications of indwelling urinary catheters.
 - Equipment, indications, contraindications and complications of external urinary collection systems.
 - Equipment, indications, contraindications and complications of Suprapubic catheterization

- Keep in mind
 - Dirty
 - An object or a person who has had microorganisms
 - Contaminated
 - A clean or sterile object becomes contaminated when it touches a dirty object
 - Clean
 - An object or a person is considered clean when many of the microorganisms on it has been removed
 - Sterile
 - An object that is completely microorganism and spore free

- Principles of Sterile Technique
 - Medical Asepsis
 - Also called clean technique
 - Reducing the number of microorganisms and preventing the transmission of microorganisms from one source to another
 - Most effective method to maintain medical asepsis is by hand washing
 - Surgical Asepsis
 - Also called surgical technique
 - Destruction of all microorganisms before they enter the body
 - This is the method used in catheterizations

- Surgical Asepsis
 - Objects stay sterile if it comes in contact with another sterile object
 - Sterile objects that come in contact with a clean or dirty object are considered contaminated
 - If in doubt about the sterility of an object or field, change it.

- Surgical Asepsis
 - Sterile Field
 - Only sterile objects go on a sterile field
 - A sterile field or object that is out of view or below waist level is considered contaminated
 - Prolonged exposure to air will contaminate a sterile field
 - Moving air caused by shaking bed linens or moving hands over a sterile field
 - If a sterile object or field becomes wet or damp, it is considered contaminated
 - Border of a sterile field or container are considered sterile 2.5 cm in from the edge of the border.

- Surgical Asepsis
 - Body
 - Should not bend over a sterile field
 - Unless its considered sterile (gloves, mask and gown)
 - Sterile gloved hands should stay in front of the body, in sight and above the waist

- Catheters
 - There are many different types of urinary catheters.
 - Each has a particular purpose



- Catheters
 - Coude Catheter
 - A catheter with a tapered tip that is designed to be easier to insert when enlargement of the prostate is suspected.



- Catheters
 - Pezzer (Mushroom) catheter
 - Catheters that have triangular or knotted-looking tips
 - Designed to be used to drain urine from the renal pelvis, or can be used for a suprapubic catheterization



- Catheters
 - Simple urethral catheter
 - A straight catheter designed for in and out procedure



- Catheters
 - Three way indwelling catheter.
 - Has a balloon in its tip that is inflated after its inserted.
 - Also has another lumen that can be used for continuous bladder irrigation.



- Catheters
 - Foley Catheter
 - AEC catheter of choice
 - Has a balloon in its tip that is inflated after insertion so it remains in the bladder
 - Can be left in place in the bladder for a period of time
 - Held in place with a balloon at the end, which is filled with sterile water to hold it in place



- Foley Catheter

- Indications:

- Urinary retention
- Bladder outlet obstruction
- Need for output measurements
- Improve comfort at end of life
- Prolonged immobilization

- Contraindications:

- Blood at meatus
- Perineal bruising
- Blood in scrotum
- Suspected pelvic fracture

- Catheterization kits:
 - 1 Tray 1200 mls
 - 1 Container 8 oz
 - 5 Absorbent balls
 - 2 Vinyl gloves
 - 1 Fenestrated towel
 - 1 Underpad
 - 1 Sterile water syringe 10 cc
 - 1 Forceps
 - 1 PVP - Iodine solution
 - 1 Lubricant pouch



- Balloon breaking during insertion
- The balloon does not inflate once placed
 - Check the balloon inflation before inserting
 - If still does not inflate after its placement, remove and insert new one
- Urine stops flowing into the bag
 - Check for correct positioning of the catheter and bag or for obstruction of urine flow within the catheter tube.
- Urine flow is blocked
 - May have to change the bag or the Foley catheter or both

- Urethra begins to bleed:
 - Traumatic catheterization
 - Hematuria
 - False urethral passage
- Infection into the bladder
 - The risk of infection in the urine increases with the number of days the catheter is in place (ex. cystitis, pyelonephritis)



- Potential Complications
 - Long term use be aware
 - The urine has a strong smell or
 - becomes thick and or cloudy
 - Fever or chills
 - Urethral swelling around the catheter
 - Bleeding into or around the catheter
 - Catheter draining little or no urine despite adequate fluid intake
 - Leakage of large amounts of urine around the catheter



- Identify the equipment required for External Urinary Drainage Systems
- Identify the indications and relative contraindications for External Urinary Drainage Systems
- Describe common problems and solutions with external urinary collection systems

- The condom style sheath on the penis.
- The plastic drainage tube which is coiled on and attached to the bed to avoid tension on the sheath.
- The urine collection bag which is attached to the bed frame below the level of the man's bladder.
- The female version is an external pouch used for non-ambulatory women.

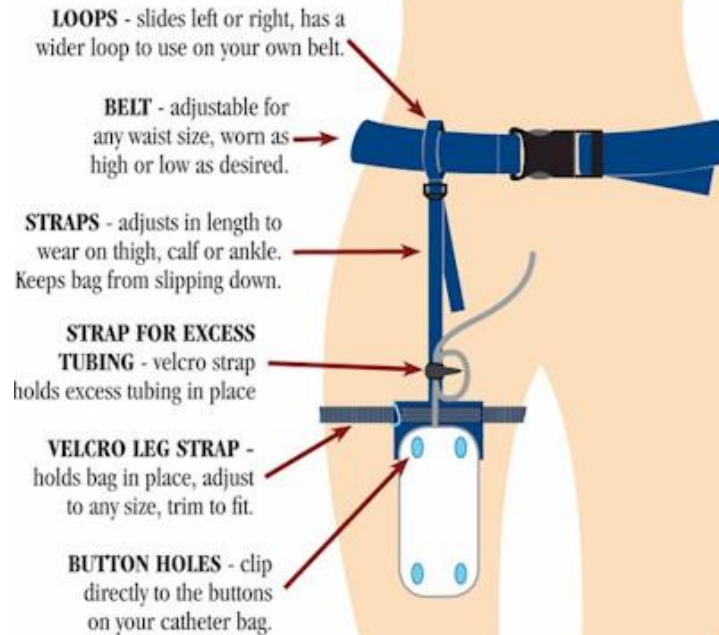
- Overactive bladder incontinence
- Incontinence with day or night loss of urine with or without urge to void.
- Urological problems associated with neurological syndromes
- Orthopaedic surgery of the pelvis in men with normal voiding patterns.

- Significant post void residual urine
- Complete acontractability (areflexia)
- Sphincter dyssynergia with retention of urine
- Obstructive urological disease

- Incorrect sizing or placement
- Leakage
- Irritation immediately once applied or within several hours
- Immediate Hypersensitivity within 5-30 min
- Delayed Hypersensitivity up to 48 hours later with formation of blisters
- Skin necrosis
- Penile strangulation
- Pressure sores

Problems	Possible reasons	Possible solutions
Pressure sores	Condom is too small	Select a larger size
	Pressure from rim is too strong	Cut the rim
Leg bag drainage/ disruption of urine flow	Catheter tubing is blocked	Trace tubing and ensure nothing is constricting or bending tube
	Bag is positioned incorrectly or contains air	Check bag placement and condition
Leakage	Improper fit	Ensure correct fitting condom
	Not enough or incorrect adhesive	Check adhesive

Urinary Bags and Collection Systems



Urinary Bags and Collection Systems

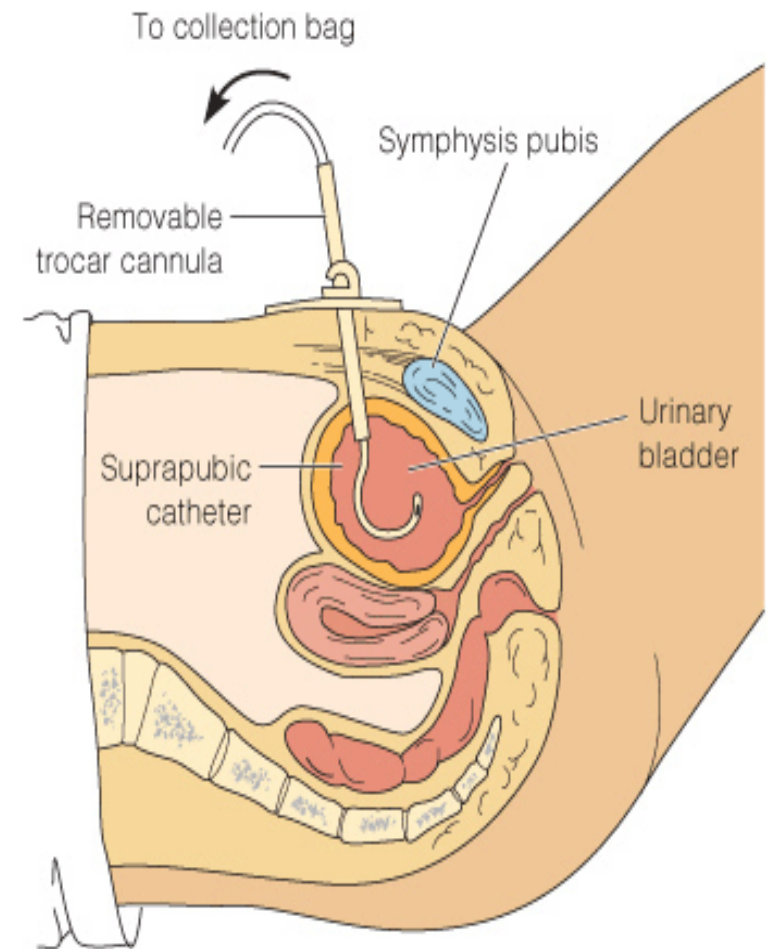
- Document
 - Fluid output (note starting amount prior to transport)
 - Colour of the urine and note any changes
- Keep bag below the level of the pelvis to allow for effective drainage
- Watch the bag when inserting and removing the stretcher from the ambulance



- Explain the procedure and gain consent;
- Wash hands and wear disposable gloves;
- Clean the outlet port according to local policy and allow to dry;
- Empty the drainage bag into a clean, dry appropriate container.
- Ensure that the outlet tap does not touch the side of the container;
- Once urine has ceased draining, close and clean the outlet tap;
- Cover the container and dispose of contents in sluice or toilet;
- Remove and dispose of gloves.
- Wash hands

- Identify indications and complications associated with suprapubic catheterization

- Utilized when placement of a urethral catheter is contraindicated or unsuccessful.
- Indications for a suprapubic catheter are:
 - Urethral injuries
 - Urethral obstruction
 - Bladder neck masses
 - Benign prostatic hypertrophy
 - Prostate cancer



- Hematuria
- Infection or cellulitis
- Bowel perforation or intra abdominal injuries with insertion

Medical Devices

CHEST TUBES

- Review of the pleural space
- Indications for chest tubes
 - Pleural Effusions
 - Types of pleural effusions
 - Transudate
 - Exudate
 - Empyema
 - Pneumothorax
 - Treatments
 - Thoracentesis
 - Tube thoracostomy
 - Surgical thoracotomy

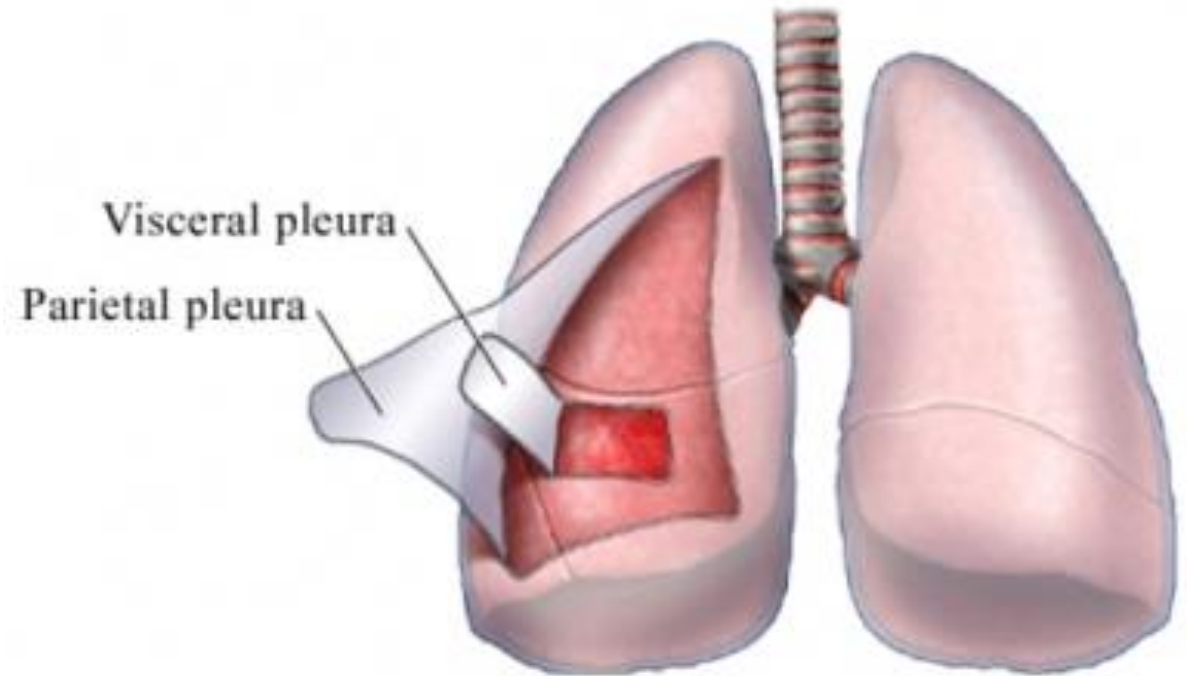
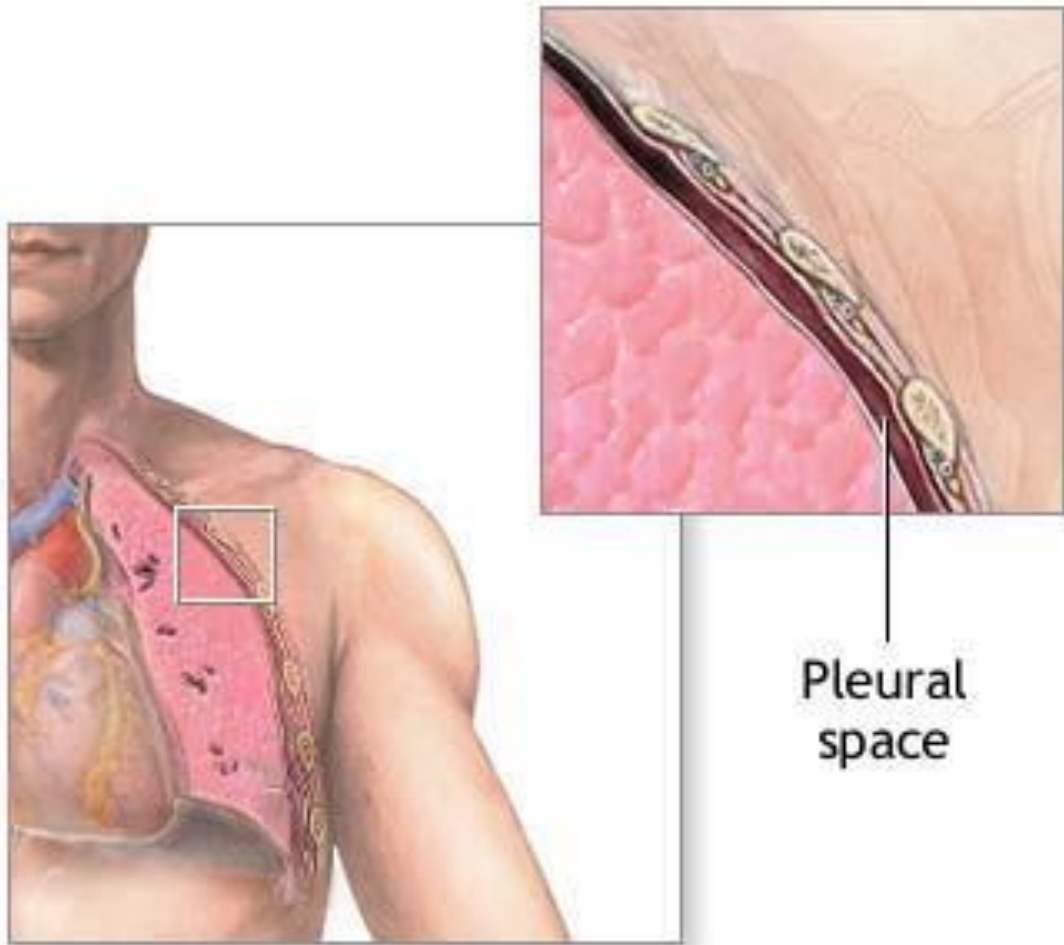


- Pleural Membrane
 - Visceral Pleural
 - Attaches to the lungs surface and doubles back at the hilard region.
 - Parietal Pleural
 - Starts at the hilard region where the visceral pleural doubles back
 - It covers the ribs, diaphragm and the mediastinum.
- The Pleural space
 - Space between the pleural membranes
 - 10-20 mm in width and it is filled with serous fluid

- Typically pale yellow and transparent, and of a benign nature, that fill the inside of body cavities such as the pleural space.
- Secreted by small blood vessels in the pleural lining
- The serous fluid between the two layers acts as a lubricant and reduces friction from muscle movement.
 - The average amount of fluid in each hemithorax is about 8ml
 - The normal protein concentration is 1.3-1.4g/dl

What makes the plural fluid flow?

- Pressure within the pulmonary capillaries and lymphatic system
- Bulk Flow
 - Bulk flow is how fluid with proteins without “sorting signals” travels from compartment to compartment.
 - Once the fluid had reached the “bulk” concentration of proteins, the osmotic pressure changes allowing the fluid flow.
 - The pleural fluid is then removed via bulk flow from the pleural space to small holes in the parietal pleura called stoma.
 - The fluid flows from the stoma to the intercostal lymphatic vessels, to the mediastinum, lymph nodes, thoracic duct and empty into the subclavian vein where the fluid is removed.
- The System is continuously producing and reabsorbing pleural fluid



- Insertion of a needle into the pleural space to:
 - Aspirate and/or drain fluid, blood, air
 - Inject medication
- May be for diagnostic-reasons, or for therapeutic reasons to “reduce respiratory distress”
- If a continuous drainage is required use a chest drainage system like a “Pleur-Evac” closed chest drainage system.

- The chest tube is inserted into the pleural space between the ribs on the patient's side
- The skin and underlying tissue to the pleural membrane is anesthetized using a small needle, very similar to thoracentesis
- An incision is made into the skin, and the underlying tissue is separated until the pleural space is entered
- A tube, is inserted in the pleural space.
- This tube is sutured into place

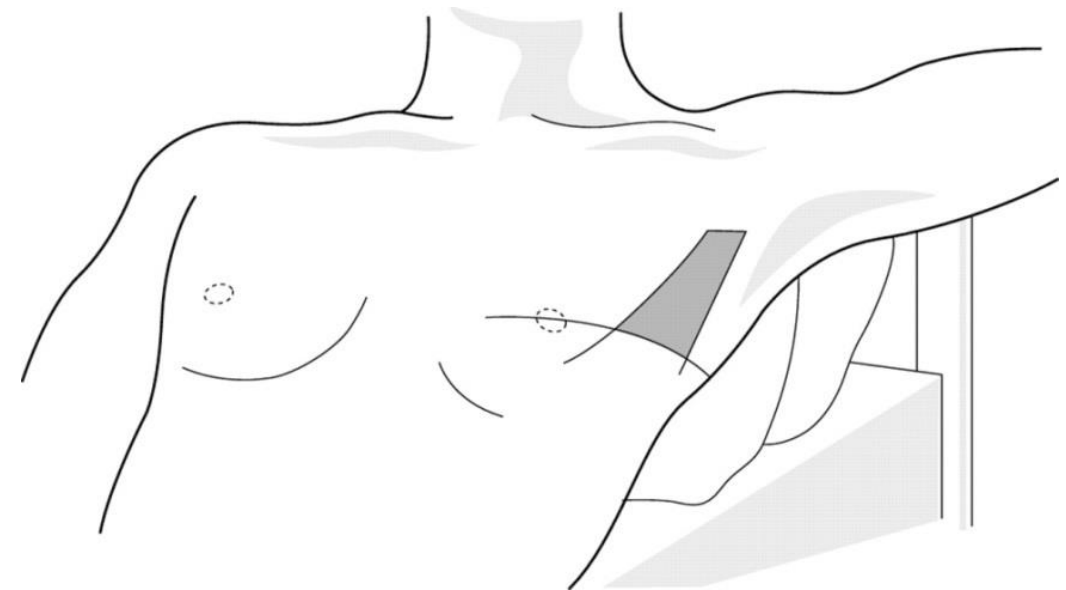
Indications for Chest Drainage

- Pleural Effusion
- Pneumothorax
- Hemothorax
- Emphysema



- Coagulopathies
- Lack of Patient Compliance
- Diaphragmatic Hernia

- Tubes are generally placed in the “safe Triangle”
 - The anterior border of the latissimus dorsi
 - Lateral border of the pectorals major muscle
 - A line superior to the horizontal level of the nipple
 - An apex below the axillary



- The tube is sutured in and can be attached to a:
 - Water seal
 - Heimlich valve



- At the right side of the unit is the collection chamber
- The patient tubing connects the drainage unit directly to the chest tube
- Any drainage from the chest flows into this chamber



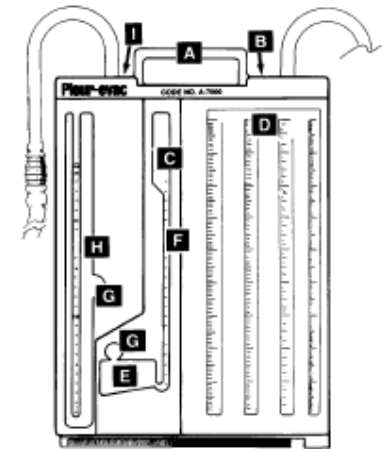
- Main purpose
 - Allows air to exit from the pleural space on exhalation and prevent air from entering the pleural cavity or mediastinum on inhalation
- When the water seal chamber is filled with sterile fluid up to the 2 cm line, a 2 cm water seal is established
 - To maintain an effective seal, it is important to keep the chest drainage unit upright at all times and to monitor the water level in the water seal to check for evaporation



- Bubbling in the water seal chamber indicates an air leak
- The patient air leak meter indicates the approximate degree of air leak from the chest cavity
- 1 (low) to 7 (high)
 - The higher the numbered column through which bubbling occurs, the greater the degree of air leak



- The water seal chamber also has a calibrated manometer to measure the amount of negative pressure within the pleural cavity (F)
- Rises as intrapleural pressure becomes more negative
- Should rise and fall with the patient's respirations, reflecting normal pressure changes in the pleural cavity ("Tidaling")



Pleur-evac' A-7000/A-8000

- A Carrying Handle
- B High Negativity Relief Valve
- C High Negativity Float Valve and Relief Chamber
- D Collection Chamber
- E Patient Air Leak Meter (A-7000 only)
- F Calibrated Water Seal
- G Self-Sealing Diaphragm in Water Seal Chamber and Suction Control Chamber
- H Suction Control Chamber
- I Positive Pressure Relief Valve

- Dial to set the suction control setting is located on the upper left side of each unit
- To set the suction setting, rotate the dial until the red stripe appears in the semi-circular window at the prescribed suction level and clicks into place
- Connect the short suction tubing or suction port to the suction source
 - Increase suction source until the orange float appears in the suction control indicator window



- Things To Watch For During Transport
 - Air Leaks
 - Intermittent bubbling from water seal
 - Frequently evident if air is being evacuated from the patient. Get them to Cough
 - No Bubbling
 - Air may be completely expelled from the patient or a kink or plug in the tube.
 - Continuous bubbling
 - Clamp the tube next to the patient. If the bubbling stops then it is a leak in the tubing, connectors or water seal. Work backward to find the leak.

- Blood clots may block the tube
 - Ensure that the tube is straight and has no areas of pooling.
 - “Milking” the tube is controversial.
- Water Seal
 - Needs to be lower than the patient and kept upright

- General guidelines:
 - Check system for any brakes, cracks, kinks in tubing, or broken connections
 - Auscultate lung sounds
 - Tight occlusive dressing intact? Clamps at bedside?
 - No dependent loops tubing?
 - Is the drainage system below chest level?
 - Check water seal chamber and or suction chamber for the correct amount of water in chambers? Any vigorous bubbling? Leaks?
 - Record drainage as output

- During transport:
 - Suction is usually off and air is vented out
 - Tubing is not clamped for transport
 - If a tube accidentally pulls out
 - Quickly place a tight occlusive dressing over the insertion site on the chest to prevent air from re-entering

- Epidemiology
- Paramedic response
- General system pathophysiology, assessment and management
- Specific acute home health situations