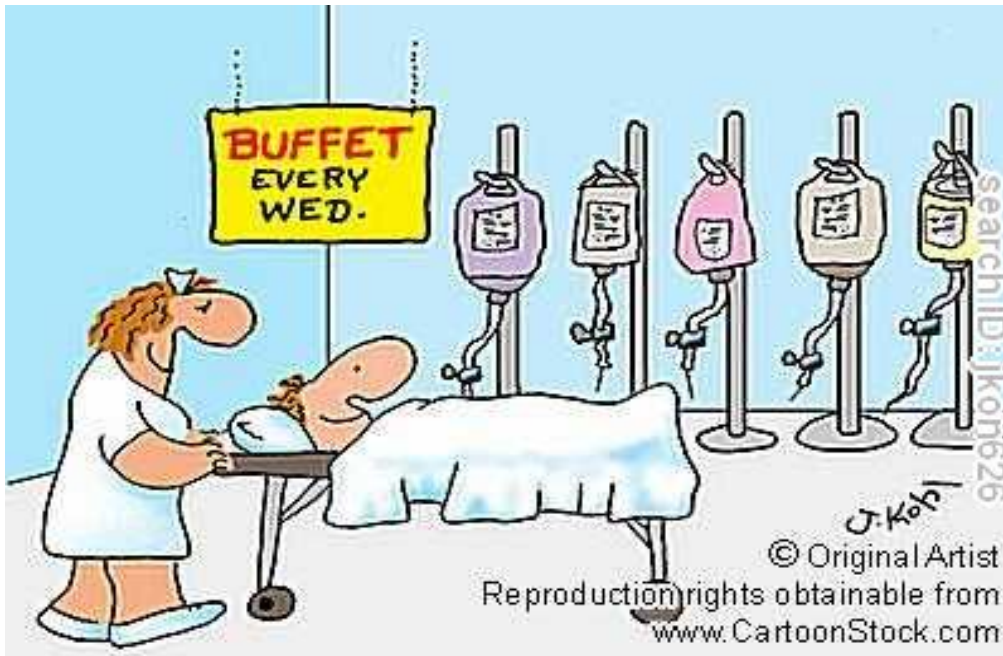


# Introduction to: **IV THERAPY**

(Third Edition, 2011)



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## Chapter 1 : Anatomy and Physiology of the Vascular System

The vascular system, also called the circulatory system, is made up of the vessels that carry blood and lymph through the body. The arteries and veins carry blood throughout the body, delivering oxygen and nutrients to the body tissues and taking away tissue waste matter. The lymph vessels carry lymphatic fluid (a clear, colorless fluid containing water and blood cells). The lymphatic system helps to protect and maintain the fluid environment of the body by filtering and draining lymph away from each region of the body. In using IV therapy, you will mainly be utilizing veins and occasionally the arteries. As a result, accessing veins will be discussed during the remainder of this course.

**Veins** are vessels that deliver unoxygenated blood to the heart. Because of the lack of O<sub>2</sub>, their color appears to be blue. Blood in veins appear to be a darker red in color, compared to the bright red colored blood found in arteries (which carry oxygenated blood from the heart to the rest of the body). Veins are located superficially in the skin's surface, thus making it easy for parenteral access. Its walls consist of 3 layers:

1. Tunica intima
  - Inner most layer
  - Composed of smooth flat endothelial cells which allows platelets to flow freely
  - In larger veins, the endothelial layer contains valves (especially where veins branch off) that ensure blood flow to the heart.
2. Tunica media
  - Middle layer
  - Composed of muscular, elastic tissue, and nerve fibers
  - This allows the vessels the ability to vasodilate and constrict as a result of impulses
  - In other words , veins can collapse or distend
3. Tunica Adventitia
  - Composed of areolar connective tissue
  - This surrounds and supports tissue.

Before we can move on to locating veins for IV use, it is important to understand the main difference between veins and arteries. In knowing the difference, the nurse will have an easier time accessing veins instead of arteries. *Table 1.1*

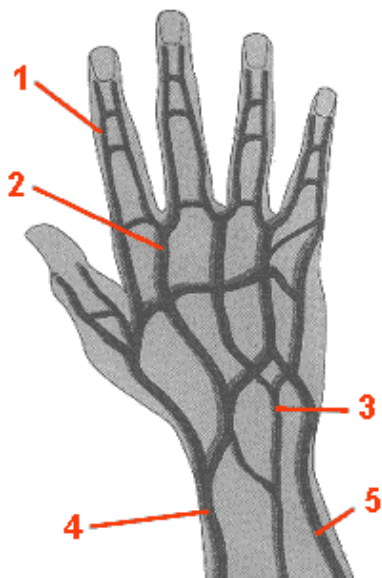
<b><i>VEINS</i></b>	<b><i>ARTERIES</i></b>
Carry unoxygenated blood to the heart ( Dark Red)	Carry oxygenated away from the heart to the rest of the body ( Bright red)
Have valves	Do not have valves
Can collapse	Do not collapse
Located in the surface	Located deep in the tissue, protected by muscle
Do not pulsate	Pulsate

***\* Based on the differences described above, if you think you have hit an artery instead of a vein, remove the needle and put pressure on sight for at least 5 minutes to stop the bleeding.***

### Location of Veins Used for Venapuncture and IV Therapy

Although veins are generally located in the same places in people, certain variations and situations can make it more difficult to find them such as, edema, excess fat, IV drug users, burns, scar tissue etc. Veins located in the lower extremities more commonly unite with deep veins, making deep veins more vulnerable to thrombosis. Thus, superficial veins in the upper extremities are preferred for IV therapy.

*Picture 1.1 Veins of the Hand*



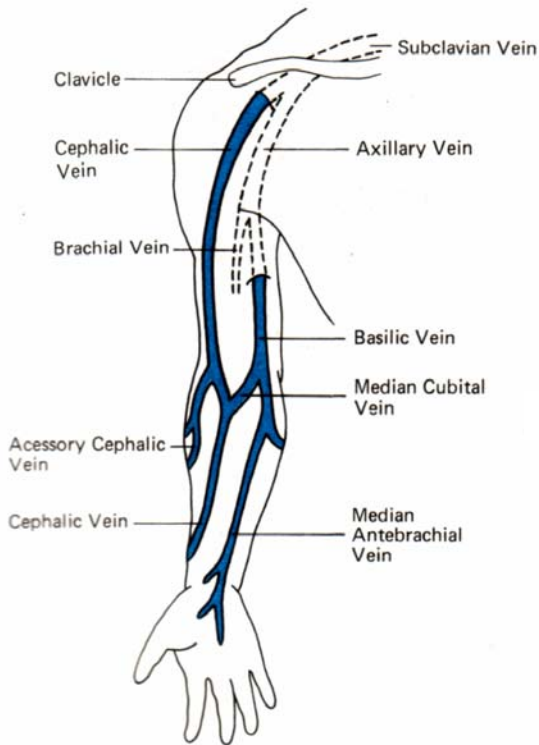
**1 Dorsal Digital Veins-** flow laterally on the fingers and are joined by communicating branches. They are used as a last resort because of their curvature and size.

**2-3 Dorsal metacarpal Veins-** formed by a union of the digital veins on the dorsum of the hand and between the knuckles. This makes them more suitable for IV therapy. Their use early in IV therapy saves the larger veins in the upper arm.

**4 Cephalic Vein-** continues to the ( see picture 1.2) forearm flows along the radial border of the thumb side. Its position and size makes it a great pick to infuse irritating medications and blood

**5 Basilic Vein-** Located along the ulnar border or pinky side of the forearm. Because of its position outside the antecubital fossa it has an increased risk of forming hematomas

*Picture 1.2 Veins of the Forearm*



Superficial veins of the right upper limb.

Located just below the elbow bend, Connects the cephalic and basilica vein

**Chapter 1 Review**

*On your own please answer the following questions*

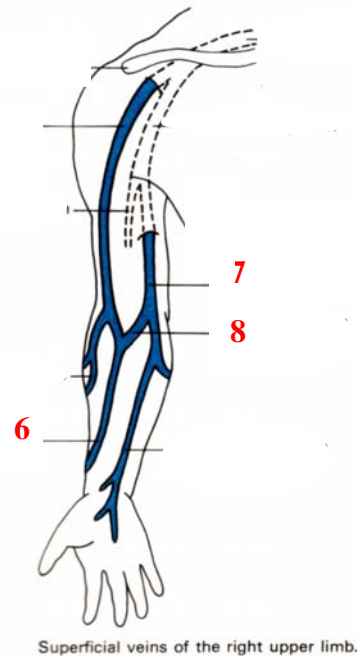
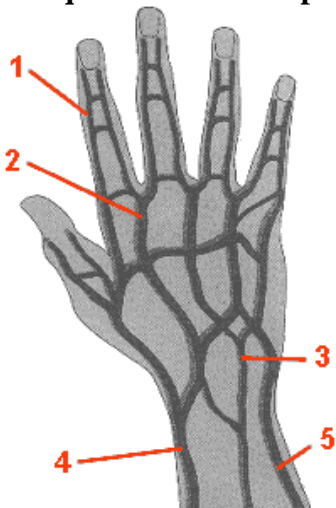
1. Veins located in the lower extremities more commonly unite with deep veins, making deep veins more vulnerable to thrombosis. Thus, superficial veins in the upper extremities are preferred for IV therapy.

- a. True
- b. False

2. Which of the following is **true** of veins and arteries?

- a. veins and arteries both carry oxygenated blood away from the heart.
- b. Veins and arteries pulsate
- c. Veins have valves, arteries do not
- d. Veins are located deep in the tissue

**For questions 3 and 4 please refer to the diagrams below:**



3. Give the right name for the following numbered

- Veins : 2. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_

4. Which of the veins labeled in #3 is the best sight for IV sight selection? \_\_\_\_\_

Which of the following is an indication for initiating intravenous therapy?

- a. Maintain fluid and electrolyte balance
- b. To administer medications
- c. Transfuse blood and blood products

d. All of the above

*Answers: 1 true, 2 c, 3 Dorsal metacarpal, cephalic, basilica, median antecubital 4 dorsal metacarpal, 5d*

## Chapter 2 : Maintaining Fluid and Electrolyte Balances

The adult body is approximately 50-60% water. Its fluid consists of water and dissolved particles that provide an environment where vital chemical and physical reactions take place and substances can be carried to and from cells. The charged particles dissolved in the fluid are also called *electrolytes* (electrolytes will be discussed later in this chapter). This is called the **Fluid and Electrolyte balance system**. This system maintains homeostasis of the body, therefore affects all bodily processes.

Body water is distributed in the following 3 compartments:

1. **Extracellular (ECF)**
  - Water outside the cell
  - Allows for free passage of electrolytes and water between compartments
  - Main electrolyte is Na<sup>+</sup>, sodium
2. **Intravascular (IVF)**
  - Fluid in the vascular space
  - Main electrolyte is K<sup>+</sup>, potassium
3. **Intracellular (ICF)**
  - Fluid inside the cells, Fluid in RBCs which is considered part of IVF is also thought as ICF

Each compartment can be interchangeable. A change in one will reflect a change in the other.

Although the ECF allows for free passage of water and electrolytes between compartments, it is the **semipermeable membrane** of the cell wall that limits free passage.

### Electrolytes

Cations are the positive electrolytes. Anions are the negative electrolytes.

They have 3 major functions:

1. Play a big role in water distribution by controlling osmotic pressure.
2. They are necessary for the transmission of impulses
3. They are big part of the acid base balance

Table 2.1

<b>Cations</b>	<b>(meq/L) (blood serum)</b>
Na <sup>+</sup>	135-145
K <sup>+</sup>	3.5-5
Ca <sup>++</sup>	9-11
Mg <sup>++</sup>	1.8-2.4

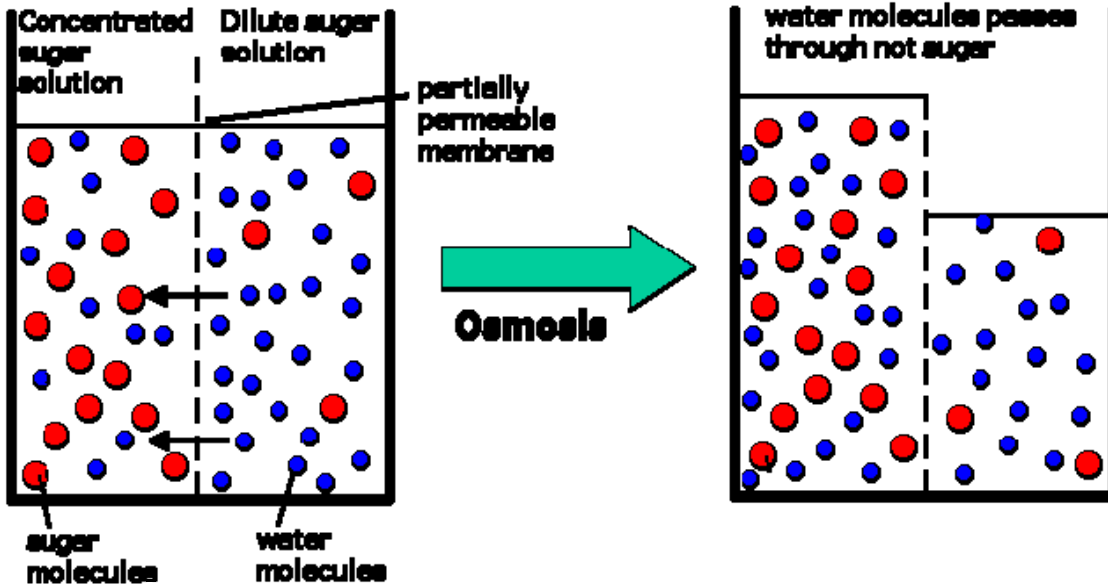
<b>Anions</b>	<b>(meq/L) (blood serum)</b>
Cl <sup>-</sup>	105-110
HCO <sub>3</sub> <sup>-</sup>	25
SO <sub>4</sub> and PO <sub>4</sub>	9
proteins	16

### Osmosis and IV solutions

Fluid and electrolytes are in continuous motion in the body, consistent with the constant exchange between the internal and external environment. Water moves across a semipermeable membrane via **osmosis**, from an area of lesser solute concentration to an area with greater solute concentration. The unit of measurement used to define the

number of milliosmoles (particles) per liter of solution is called *osmolarity*. Please see picture 2.1 to help better your understanding.

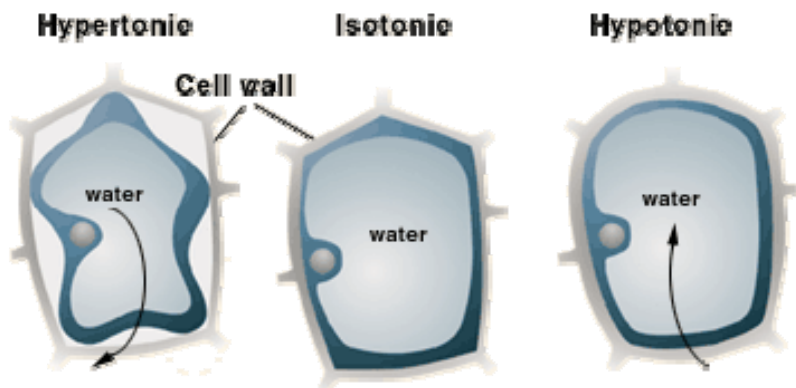
**2.1 Osmosis with semipermeable membrane.**



Osmotic characteristics of IV solutions depend on the osmolarity they have compared to the osmolarity to the cell fluid. This determines how they affect the RBCs in blood. The following are 3 main types of IV solution:

1. **Isotonic** – They have the same osmolarity as normal body fluid, therefore there would be no effect on the cell. Types of isotonic solutions : 0.9 NS, D5W, Lactate Ringers
2. **Hypotonic** - They have a lower osmolarity than normal body fluid, therefore, water will be pulled into the cell, causing them to swell. Types of hypotonic solutions: 0.45 NS, D2.5 W, 0.33 NS
3. **Hypertonic** – They have a greater osmolarity than normal body fluid, therefore water will be pulled out of the cell, causing them to shrink. Types of hypertonic solutions : D5NS, D5 1/3 NS, D10W

**2.2 Effects of each solution on the cell**



## Fluid and Electrolyte Therapy

The goal of this therapy is to correct the fluid and electrolyte imbalances caused by underlying pathologies, and /or to maintain the balance in the event of an illness. The body has 4 main regulating mechanisms used to maintain the consistence of body fluid volume, electrolyte composition and osmolarity. The mechanisms are:

### 1. Kidneys

- In conjunction with the cardiac system, kidneys maintain fluid balance by determining the amount and composition of urine that is made and released.
- Their distal tubules are important in regulating normal osmolarity and fluid volume. Renal Disease, cardiac failure, shock and postoperative stress can impair this system.
- Adrenal glands, located on top of the kidneys, secrete aldosterone, a hormone that increases the resorption of sodium from the tubules, thus maintaining normal sodium concentrations.

### 2. Lungs

- Major source of insensible fluid loss through respiration

### 3. Skin

- Major source of insensible fluid loss through perspiration

### 4. Pituitary Gland

- Releases (ADH) antidiuretic hormone, which prevents diuresis by increasing the reabsorption of water.

In order to treat fluid and electrolyte disorders you will need to do the following

1. Estimate the amount of fluid and/or electrolyte lost. Based on what you calculate, you will determine what type of fluid replacement is needed.
2. Monitor the intake and output

Based on what you have learned so far in this chapter, the following charts will show you how to treat dehydration, overhydration, and common electrolyte imbalances.

**Dehydration** - Occurs generally when fluid intake is less than fluid output

**Overhydration** - Occurs when there is an excess of total body water

*Table 2.2 Fluid Imbalances and Electrolyte Imbalance*

<b>Fluid Imbalance</b>	<b>Physical Mechanism</b>	<b>Cause</b>	<b>Symptoms</b>	<b>Treatment</b>
<i>Isotonic Dehydration</i>	Na and Water lost in equal amounts	Vomiting Diarrhea	Poor turgor drop in BP increase in PR weak pulse decreased output weight loss weakness and lethargy	0.9 NS
<i>Hypertonic dehydration</i>	Increase in NA with Loss of water Increase H&H and/or osmolarity	Excess insensible water loss, Insufficient fluid intake	Thirst Confusion Stupor Poor skin turgor	D5W first to hydrate, than 1/3-1/2 NS

			Irritability Coma	
<i>Hypotonic Dehydration</i>	Na loss > than water Decrease in serum sodium Decreased osmolarity in ECF	Diuretics Burns Vomiting Sweat	Poor skin turgor N and V HA Abdominal Changes Diarrhea weakness	0.9 NS D5NS
<i>Isotonic Overhydration</i>	No effect on osmolarity. Na remains the same,, Dilutes plasma	Large amount of fluid intake	Increase intake more than output Weight gain Bounding pulses Circulatory Overload Edema	Decrease fluid intake
<i>Hypertonic Overhydration</i>	Increase of fluid in the ECF	Hypertonic fluid infused too quickly	Signs of pulmonary edema	Diuretics (Lasics)
<i>Hypotonic</i>	Water intoxication or dilutional hyponatremia	Intake of large amounts of electrolyte free fluids Fluids lost by NGT suction Vomiting and Diarrhea Diuresis	CNS disturbances, signs of ICP	Decrease fluid intake Slow infusion of hypertonic solution
<i>Hyponatremia</i> <i>NA &lt; 135</i>		GI secretion loss Biliary and fistula secretions Fluid shifts so Na is not accessible ( edema, ascites, burns)	HA Muscle weakness, Anxiety Apathy Anorexia Seizures Mental Confusion	NS or D5 1/2 NS Slowly
<i>Hypernatremia</i> <i>NA &gt; 145</i>		Increase renal intake with poor renal function Decreased fluid intake Diarrhea Sweating Dehydration	Thirst Dry mucus membranes Decreased urine output Flushed skin	D5W
<i>Hypokalemia</i> <i>K &lt; 3.5 mEq/L</i>		GI losses Urine loss from Diuretic Therapy K-free diet PH changes Kidney Disease Increase Na intake	Muscular Cramps Flaccid paralysis Mental Confusion Postural hypotension Weak irregular pulse EKG- Flattened T wave with increased QT and U wave	PO or IV Potassium <b><u>NEVER GIVE K+ IV PUSH</u></b> Can cause Cardiac arrest ( Give at least over 20 minutes) <b><u>NEVER</u></b> exceed 20mEq/L of K+ in 1 hour in unmonitored patient <b><u>NEVER</u></b> exceed 40 mEq/L per liter of IV Solution
<i>Hyperkalemia</i> <i>K &gt; 5.5</i>		Acidosis Decreased Urine excretion Tissue Injury Salt substitute Blood transfusions	Parasthesia of face, tongue, hands and cheek Cardiac arrhythmias Bradycardia EKG- tall T Waves, short QT interval, widening QRS	Potassium sparing food Kayexalate Calcium Gluconate NaHCO <sub>3</sub> Insulin Dialysis Diuresis
<i>Hypocalcaemia</i>		Decreased Ca intake Loss by Kidneys	Muscle tremors, Spasms with numbness	Ca gluconate or Ca chloride

$Ca < 8.5$		Vitamin D deficiency Diarrhea Hypothyroidism Receiving large amounts of stored blood products	and tingling around mouth nose and fingers Decreased muscle contractility Emotional disturbances Lengthened QT interval. Depression Coma Trousseau and Chvostek signs +	Increase intake of milk products
<i>Hypercalcemia</i> $Ca > 10.5$		Increased intake of vitamin D and A , Hyperthyroidism Sarcoidosis Bone metastasis	Anorexia Nausea Fatigue Constipation Polyuria Dehydration EKG- shortened QT interval, depress T wave Bradycardia Heart block	Restrict Ca intake to 4000 mL/ day to prevent calculi Give IV fluids by loop diuretic to help excretion of Ca Calcitonin to promote renal excretion of Ca Determine pathology r/o tumor Guard against pathological Fx
<i>Hypochloremia</i> $Cl < 95$		Value relates to K <sup>+</sup> and Na <sup>+</sup> Vomiting and Diarrhea Diuretic	Mimics Na	Treat Cause
<i>Hyperchloremia</i> $Cl > 106$		Bicarbonate deficiency Dehydration Nephritis Eclampsia Anemia Cardiac disease	Rarely presents symptoms	Treat cause
<i>Hypomagnesemia</i> $Mg < 1.8 \text{ mEq/L}$		Often found in patients with IBD, bowel resection Seen with patients with hypocalcaemia, hypokalemia Chronic alcoholism Severe Diarrhea	Same as hypocalcaemia Leg and foot cramping Tremors Cardiac arrhythmias Difficulty swallowing Paralytic Ileus	Give IV MgSO <sub>4</sub> at a slow rate. <b>DO NOT IV PUSH</b>
<i>Hypermagnesemia</i> $Mg > 2.4$		Renal failure Ingestions of antacids containing magnesium DKA Leukemia	Muscle weakness Diaphoresis Bradycardia Flushing decreased deep tendon reflexes Decreased (LOC)	IV Ca gluconate

**Chapter 2 Review** Please answer the following Questions

1. Osmolarity is:
  - a. Energy expended by the cell's active transport system.
  - b. Number of particles in the solution
  - c. Filtration capacity of the cell
  - d. Pressure exerted by the heart

2. A semi permeable membrane allows particles of any size to pass through it
  - a. True
  - b. False
  
3. Insensible fluid loss occurs in which of the following:
  - a. Diarrhea and vomiting
  - b. Frequent blood sampling
  - c. Skin and Lungs
  - d. Urine and feces

For questions 4-6, match the types of IV fluid to the correct effect that it will have on the cell

- |                                     |                     |
|-------------------------------------|---------------------|
| a. Draws fluid from cell            | 4. _____ Hypotonic  |
| b. Has no effect on the cell volume | 5. _____ Hypertonic |
| c. Pulls fluid into the cells       | 6. _____ Isotonic   |

7. Which of the following solutions given intravenously is least likely to cause tissue injury?
  - a. Saline 0.9%
  - b. Lactated ringers
  - c. Dopamine
  - d. Lidocaine
  
8. You receive, Mrs. Smith, a 76-year-old female patient S/P abdominal exploratory laparoscopy from the recovery. She is receiving lactate ringers continuously IV at 150mL/hr. Upon your initial assessment, you find that she has shortness of breath, bilateral rales, distended neck veins and blood pressure of 180/96. Based on her symptoms which complication is Mrs. Smith experiencing?
  - a. Hyperkalemia
  - b. Phlebitis
  - c. Fluid Overload
  - d. Medication adverse reaction
  
9. Which intervention would you choose to manage Mrs. Smith?
  - a. Remove IV sight, apply warm moist compress, monitor sight 48 hours post removal for post infusion phlebitis
  - b. Slow infusion of hypertonic solution
  - c. Administer Bolus of 0.9 NS 20ml/kg over 30min
  - d. Slow infusion to KVO, notify MD, Elevate HOB, give O2, medications ( diuretics, vasodilators, inotropic, morphine), monitor vitals, Weigh patient,

- 10 Electrolytes are
- are charged particles in solution
  - are present only in the extra cellular fluid
  - are most frequently cations
  - need not be present in specific concentrations and normal body function
11. Mr. Oliver has been admitted your unit with severe vomiting and 8-10 liquid bowel movements per day. An IV has been initiated - D5W one liter + 20 mEq KCL + multivitamins to infuse over six hours. His blood work reveals: Cr-1.0, Na-160, K-4.3, BUN-20, And CL-108. Identify his electrolyte imbalance:
- Hypernatremia
  - Hyponatremia
  - Hypokalemia
  - Hyperchloremia

*Answers: 1b, 2 False, 3 c, 4 c, 5a, 6b,7a, 8c, 9d,10a, 11a*

### Chapter 3: Administering IV Medications

Intravenous (IV) medication administration is the process of giving medication directly into a patient's vein. Methods of administering IV medication may include giving the medication by rapid injection (IV push) into the vein using a syringe, giving the medication intermittently over a specific amount of time using an IV secondary line, or giving the medication continuously mixed in the main IV solution. IV medications are usually given through a peripheral line or saline IV lock, but may also be administered direct IV, through a central venous catheter (which will be discussed later in this module).

The primary purpose of giving IV medications is to initiate a rapid response to medication. The drug is immediately available to the body. The IV route for medication administration may be used if the medication to be delivered cannot be taken by mouth and/or are absorbed poorly through tissue (IM, SC).

#### 3.1 Ways on how to give IV Medications



*A. IV Push. Should be followed by NS Flush*

*B. IV piggy back (IPB) with secondary line*



#### Nursing Considerations when Administering IV Medications

Since patient's system response to IV medication is immediate, it is imperative that the following is done before any IV medication is given:

1. Check patient allergy history. The immediate response can lead to an immediate reaction, from slight body rash to anaphylaxis.

## 3.2 Drug Reactions

### Anaphylaxis



A severe type of allergic reaction that involves two or more body systems (e.g., hives and difficulty breathing).



*Hives Rashes*

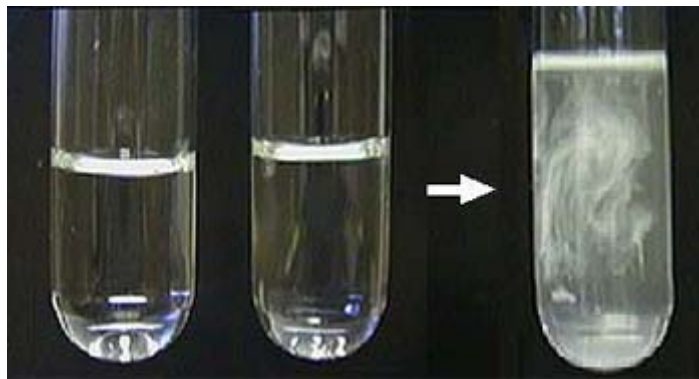
### 2. 5Rights

- Patient
- Medication
- Dose
- Route
- Time

### 3. Compatibility of medications and/or other medications and IV solution

- *Physical*- When 2 or more medications are mixed together, a physical substance, or precipitate, is formed.

### Precipitate



- *Therapeutic* effects happen when 2 drugs are given too close to together it may change the affect of 1 or both drugs. There are several ways the medications will be affected. Here are 2 types:
  - a. Synergistic- occurs when drugs can interact in ways that enhance or magnify one or more effects, or side effects, of those drugs. Example: *When treating MRSA, gentamycin is given in conjunction with vancomycin because it enhances vancomycin's antimicrobial action.*
  - b. Opposition (Antagonism) - Two drugs with opposing actions can interact, thereby reducing the effectiveness of one or both. Example: *Certain beta-blockers (such as propranolol, indural), taken to control high blood pressure and heart disease, counteract beta-adrenergic stimulants, such as albuterol [taken to manage asthma. Both types of drugs target the same cell receptors—beta-2 receptors but one type blocks them, and the other stimulates them.*
  
- Chemical happens when one drug may change the chemical compound of the other. Example: *When amphotericin B is to be given IV, it must be administered with a secondary line primed with D5W ONLY*

**Chapter 3 Review**     *Please answer each question*

1. Overlapping effect of two drugs given too close together, such as increase in anticoagulation effect of Heparin when given with Penicillin, is an example of which type of incompatibility?
  - a. Therapeutic
  - b. Physical
  - c. Chemical
  - d. None of the above
  
2. Which of the following is the **BEST** intervention that can prevent allergic reactions before administering IV medication ?
  - a. Check the 5 rights
  - b. Ask the patient the allergy Hx
  - c. Flush IV sight with NS 0.9
  - d. Nothing, just give the medication

*Answers: 1a, 2b*

**Chapter 4: Transfusion of Blood Products**

Why is Transfusion Therapy needed?

- To maintain and restore blood volume
- To increase oxygen carrying capacity of blood
- To supply coagulation factors
- To supply protein
- To supply white blood cells
- To supply passive immune protection and treat hypogammaglobulinemia

<i>Type</i>	<i>Components</i>	<i>Indication</i>	<i>Amount</i>
<b>Whole Blood</b>	RBCs Plasma, Plasma proteins	Massive bleeding, Expanding volume	Up to 500mL Within 4 hours
<b>Packed RBC's</b>	RBCs and small amount of plasma	Increase organ oxygenation with minimal volume expansion	250-300mL Within 4 hours
<b>Platelets</b>	Platelets in small amount of plasma	Thrombocytopenia, Platelet dysfunction	50-400mL 20-60 minutes
<b>FFP</b>	Clotting factors, plasma proteins and water	Blood loss, clotting disorders, DIC over- anticoagulation, clotting factor deficiencies	200-250mL 15-30 minutes 20 min to thaw Use within 6 hours
<b>Cryoprecipitate</b>	Clotting factors, fibrinogen in plasma	Hemophilia, Von Willebrand's disease	10-20 mL 3-15 minutes
<b>Colloid Solutions</b>	Albumin 5% or 25%, immunoglobulins	Volume expanders, Congenital or acquired autoimmune deficiency syndromes	Depends on order
<b>Granulocytes</b>	Granulocytes and lymphocytes	Serious microbial infections in a patient with severe neutropenia	200-400mL 1-2 hours

❖ *Because of the potentially life threatening consequences of blood type incompatibilities it is imperative to do a type and screen of the patient's blood in the event that a blood product is ordered. According to Cinahl Information Systems (2009), in the United states 1 in 600,000 blood transfusions results in the death of a patient as a result of a transfusion reaction. Majority of these reactions were caused by incorrect identification of the patient, cross checking of the blood product, and mislabeling of the blood at the blood bank*

<b>BLOOD COMPONENT COMPATIBILITY CHART</b>				
<b>ABO COMPATIBILITY</b>				
<b>PATIENT</b>			<b>DONOR UNIT</b>	
Patient's ABO Group	Antigen on Red Cells	Antibody(s) In Serum	Red Blood Cells	Plasma
O	No A or B	Anti-A Anti-B	O	O A B AB
A	A	Anti-B	A O	A AB
B	B	Anti-A	B O	B AB
AB	A and B	None	AB A B O	AB
<b>Rh COMPATIBILITY (Does not apply to Plasma, Cryoprecipitate or Platelets)</b>				
Rh positive	D		Rh positive or Rh negative	
Rh negative	Absence of D		Rh negative	

## Responsibility of the RN

- Check that there is an order to transfuse
  - Type of blood component
  - Number of units to be infused
  - When patient is to be infused
  - If multiple blood products are to be infused, ask MD to prioritize
- Verify Patient Identity
- Confirm that the consent is signed
- Be sure IV is patent or start if needed
  - Blood must be administered via a separate IV line
  - Angiocath should be a 20g or larger (#18 preferred)
  - 0.9% NaCl only
- Send someone with appropriate paper work to pick up blood from lab **NEVER** keep blood product on the unit for more than 30 minutes prior to starting transfusion.
  - Return unit to the blood bank if not used in 30 minutes
  - Specially designated refrigerators may be used in specialty areas (e.g. OR)
- Obtain and record baseline vital signs prior to starting transfusions
  - If patient has a fever notify MD first (may mask reaction)
- Assess patients understanding of the procedure
  - Instruct patient to notify nurse of:
    - Chills and fever
    - Back pain
    - Flushing
    - Palpitations
    - Difficulty breathing
- Proper and complete patient identification is extremely important during the entire process of transfusion therapy, from the initial acquisition of a blood sample for compatibility testing, to the actual transfusion of blood.
  - Verify patient's medical record number on the chart and unit of blood
  - Verify that the donor blood type and Rh factor is compatible with the patient's blood.
  - Confirm the blood bank's identification number is the same to that on the transfusion bag
  - Document in the chart the date and time that you and another licensed staff member that verified that this is the correct blood for the correct patient. You and the staff member should both sign this entry. ***NO SHORT CUTS!***
- Inspect blood for, expiration date, any discolorations, and/or frothiness Monitor
- Vital signs and document as per hospital policy usually:
  - Within one hour before starting the transfusion
  - 15 minutes after starting the transfusion
  - Every 30-60 minutes (determined by institution's policy)
  - Whenever patients condition requires
- Observe patient frequently for any adverse reactions
- Observe site frequently for signs of infiltration
- Administer at prescribed rate
  - (No longer than 4 hours)

## Adverse Reactions

Type	Cause	Symptoms	Management
<b><i>Febrile</i></b>	sensitivity to donor white cells, platelets, or plasma proteins (antigen-antibody reaction)	Chills and fever, headache, flushing, anxiety, muscle pain, chest tightness, palpitations, N and V	Give antipyretics Notify MD do no restart keep line open

		<i>Onset-Immediate- 6 hrs post</i>	with NS
<b>Anaphylactic</b>	Infusion of plasma containing IgA proteins to an IgA deficient recipient who developed IgA antibodies from pregnancy or previous transfusion	Respiratory symptoms- bronchospasm, wheezing, dyspnea, tachypnea, cyanosis Cardiovascular- tachycardia, hypotension, shock, cardiac arrest GI- N and V, cramping diarrhea  <i>Onset- Immediate</i>	CPR and Administer Epinephrine do not restart
<b>Acute Hemolytic</b>	Infusion of incompatible blood that stimulates an antigen-antibody response causing the destruction of RBCs	Chill, fever, lower back pain, flushing, tachycardia, tachypnea, hypotension, cardiovascular collapse, hemoglobinuria, bleeding, NV, SOB, chest pain, shock, cardiac arrest, death  <i>Onset- Usually in the first 15 minutes but can occur at any time</i>	Treat shock is present, measure hourly output, administer diuretics as needed.
<b>Bacterial Contamination</b>	Infusion of contaminated blood components	Rapid onset of chills and fever vomiting and diarrhea	Draw blood cultures send bag back to blood bank  Give IV antibiotics, vasopressors steroids

#### What to do in the event of a Transfusion Reactions

1. STOP THE TRANSFUSION
2. Using a different IV line, keep the vein open with NS 0.9
3. Notify the physicians
4. Report to the blood bank
5. Check identification, bag and bag label
6. Draw blood for a red top and lavender top tube ( which will be tested for coombs) and have it sent to the blood bank with "Post transfusion" indicated on the label
7. Send a urine sample to the blood bank with " Post Transfusion" Indicated on the label
8. Complete the transfusion reaction section of the form
9. Complete an incident report
10. Return the remaining blood to the blood bank with the tubing
11. Monitor vital signs
12. Follow orders as written
13. document the following in progress notes
  - Date and time reaction occurred
  - Clinical presentation of the reaction
  - Time the transfusion was stopped
  - Amount of blood that was given
  - The time when physician was notified
  - The time blood bank was notified
  - Blood, urine, blood bag, tubing sent to the blood bank

- Any other interventions that were done and response of patients

**Chapter 4 Review** Please answer each question.

1. Ms. Flores, a 23-year-old female, was admitted to the hospital following a MVA. On physical assessment she was found to have a fracture of the R radius, a distended tender abdomen and facial contusions. Vital sign and significant lab values were T-97.5, P-115, R-25, B/P-80/50, WBC-5.0, RBC-3.0, Hct-24, Hgb-8, and U/A-gross hematuria. Two units of the packed cells were ordered. Which solution should the IV tubing be primed with?

- a. D5W
- b. NSS.9%
- c. Plasmalyte
- d. Lactated Ringers

2. The nurse hangs the first unit packed of cells on Ms. Flores. 10 minutes after the blood is started she shivers and states she has severe lower back pain. Her vital signs are: T-102, P-98, R-35, and BP-75/50. The first action taken by the nurse should be to:

- a. Decrease the blood flow rate and re-check vital signs
- b. Start a second IV of D5 .45% Saline
- c. Increase the blood flow rate and re-check vital signs
- d. Discontinue the blood immediately and restart an IV of 0.9% Saline

3. The sign and symptoms Ms. Flores is having are indicative of:

- a. Febrile reaction
- b. Urticarial reaction
- c. Acute hemolytic reaction
- d. Viral transmission

4. The documentation of Ms. Flores' reaction should include:

- a. Time reaction occurred, signs and symptoms, blood stopped, lab and physician notified
- b. Signs and symptoms indicating type of blood reaction
- c. Identification of the blood reaction
- d. Identification of the blood reaction and preventative measures that could have been used

5. Four hours after Mr. Smith's blood was started there is still 75ml left in the bag? The nurse should:

- a. Allow the blood to continue at its present rate
- b. Assess the site and document the site appearance and rate of flow
- c. Speed up the rate of flow
- d. Stop the blood

*Answers: 1.b, 2d, 3c, 4a, 5d,*

## Chapter 5: Peripheral IV Insertion

The peripheral IV cannula enables the delivery of fluid therapy, medications, blood products and parenteral nutrition directly to the vein. The procedure is done by inserting a small flexible plastic cannula through skin, into the vein. This must be done using aseptic technique to prevent infection around and in the site.

The primary goal of site selection is to choose one that will be least vulnerable to infiltration as well as allow the patient the most freedom to continue with A.D.L.'s. The RN must choose the right cannula size based on type and duration of treatment in order to help prevent phlebitis, 20 gauge and above (smaller gauges are used in pediatric and elderly patients). Start low and move your way up. There is a lower risk of the development of phlebitis in hand veins than in veins of the wrist or upper arm. Find a vein that is visible and palpable. Avoid areas of movement, joint flexion, affected by mastectomy, CVA, or A-V fistula. It is recommended that there be a limit of 2 attempts per nurse on a patient in order to prevent trauma. **ALWAYS** verify physician's order and explain procedure to the patient. **DO NOT** attempt insertion or phlebotomy on patient if patient is refusing or else it would be considered battery.

### Assemble Supplies

- Alcohol or chloraprep swab (for skin prep)
- IV extension set
- Saline flush
- Tape and/or occlusive dressing
- clean gloves
- angiocath
- local anesthetic (optional)

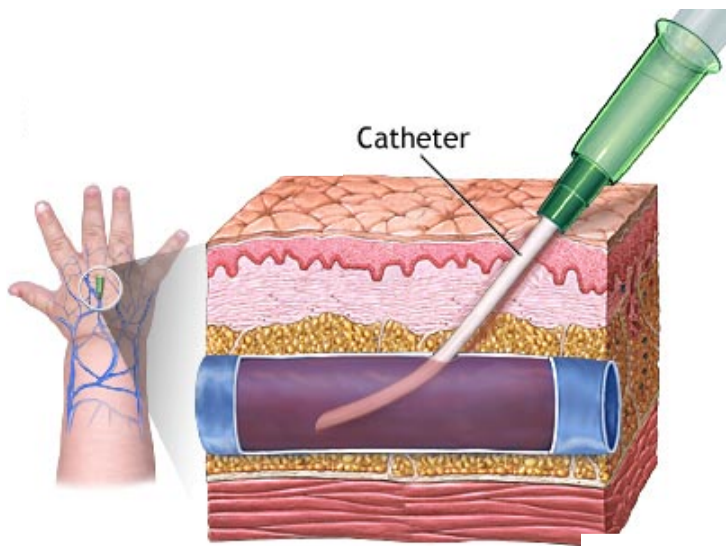
### 5.1 IV Supplies



### How to Insert Cannula

- Apply anesthetic agent to sight ( optional). Allow medication to set on skin for 30-60 minutes, then wipe off excess medicine before attempting insertion
- Wash hands
- Apply clean gloves
- Clean sight with alcohol swab and allow to dry. Do not touch after cleaning.
- Apply tourniquet 4-6 inches above sight.
- With the mouth of the needle facing up insert the needle with cannula at a 19-30 degree angle. Advance cannula into the vein as needed while slightly with drawing needle.
- Stabilize the hub of the cannula gently as you withdraw needle completely and remove the tourniquet.
- Attached primed extension set into angiocath
- Draw syringe back slightly until blood return is present, then flush with at least 1mL of NS.
- Secure with occlusive dressing and tape.
- Flush with the remainder of saline flush to ensure patency after taping.
- Label and date sight. IV sight should be changed every 72 hours in order to avoid, infiltration, phlebitis, and infection

### 5.2 IV Insertion



## Complications

- *please note that when describing and documenting complications such as infiltrations or phlebitis, do not document the observation as “ Grade 1” or “Stage 2” .*
- **DO NOT document in your nursing notes that an incident report is filed**

<b>Type</b>	<b>What is it?</b>	<b>Symptoms</b>	<b>Management</b>
<i>Hematoma</i>	Accumulation of blood in the tissues at and around sight	Immediate swelling, bruised area, blood leaking at sight, pain, unable to advance cannula	Remove needle and apply pressure, elevate extremity, recheck for bleeding, document in nursing notes assessments, and interventions
<i>Infiltration</i>	Leaking of IV fluid into the tissue caused by dislodgement or oversized catheter	Swelling at sight, may or may not be painful, IV fluid leakage at sight, no blood return at sight, flow obstruction, delayed capillary refill  <b>Grade 0-</b> No symptom <b>Grade 1-</b> Blanching, cool to touch, pain or no pain, swelling at sight is less than 1 inch in any direction  <b>Grade 2-</b> same as grade 1 except swelling is 1-6 inches any direction from sight.  <b>Grade 3-</b> Blanching, translucent, cool to touch, mild to moderate pain, gross edema >6 inches, possible numbness  <b>Grade 4 -</b> same as 1-3 plus discoloration, pitting tissue edema, impaired circulation, moderate to severe pain  <i>* if working with pediatric or neonatal patients, include the following grading system:</i>  <b>1<sup>st</sup> Degree -</b> Swelling less than 2cm from sight, 0-1 joint is involved  <b>2<sup>nd</sup> Degree –</b> Swelling greater than 2cm from site, blanched skin, involvement of 1-2 joints  <b>3<sup>rd</sup> Degree –</b> Swelling involving more than 2 joints, localized tissue damage.  I	Early detection is imperative, stop infusion and d/c IV site, assess circulation and pulses, apply warm compress and elevate extremity to help distribute fluids. Explain interventions to patient. Re-evaluate every 8 hours. If improved, no other intervention is needed. If there is no improvement, redness and equal or more swelling, tissue injury/ extravasation, inform the MD for further interventions  Document all assessments, interventions  File incident report
<i>Extravasation</i>	Tissue injury caused by leakage of toxic medication into the surrounding tissue causing necrosis and even sloughing of the vein.	Skin is blanched or reddened, cool or warm, tender at insertion sight, minor to severe swelling, burning or pain at sight, sluggish capillary refill, weak pulses, tissue sloughing	Early detection is important, use interventions for infiltration as needed , notify MD, depending on the medication that has infiltrated follow MD’s orders for treatment, Apply cold compress followed by warm soaks to help absorption, check circulation and pulses

			Document all assessments, interventions  File incident report
<i>Phlebitis</i>	Inflammation of the vein that can be caused by mechanical, or chemical irritation or infection	Sluggish flow rate, reddened warm are at sight and along the path of the vein, pain and tenderness at sight and path of the vein, might have edema, if prolonged venous cord can be palpable, elevated temp, purulent drainage at sight Phlebitis  <b>Grade 0-</b> No symptom <b>Grade I-</b> redness with or without pain <b>Grade II-</b> redness at sight, pain and puffiness at sight.  <b>Grade III-</b> redness at sight, pain and puffiness at sight <b>palpable venous cord</b> <b>Grade IV-</b> same as III with palpable venous cord > then 1 inch  (may incorporate staging mentioned in infiltration if working with pediatric or neonatal patients)	Remove IV sight, apply warm moist compress, monitor sight every 8 hours for 48 hours post removal for post infusion phlebitis  Inform MD  Document all assessments, interventions  File incident report
<i>Thrombosis</i>	Formation of a clot in the vein obstructing circulation without inflammation due to damaged intima, deposit of fibrin clot formation, and occlusion of vessel.	Little or no pain present, slow to occluding flow. Can go undetected until secondary complications occur: swelling, tenderness and redness	DO NOT FLUSH! The thrombus may dislodge and become embolus. Remove IV, notify MD of any secondary complications, warm compress. Watch for signs of infection (they provide a good medium of bacterial growth)  Document all assessments, interventions
<i>Thrombophlebitis</i>	Phlebitis and thrombosis occur together	Severe pain, discomfort,, redness, warmth and swelling at sight and along the path of the vein, Fever, malaise leukocytosis, slowing of IV rate	Treatment is similar to thrombosis, elevate extremity
<i>Venous Spasm</i>	Vasoconstriction of vein due to irritation ( cold fluid) or trauma	Severe pain along vein, redness blanching, sharp painful sensation with numbness at the sight radiating to the extremity	Five fluid and medications at room temperature, dilute irritating medications, , infuse at ordered rate, apply warm compress, if the spasm happens, remove IV, Monitor Document all assessments, interventions  Document all assessments, interventions
<i>Punctured Artery</i>	Artery punctured by needle	Bleeding with bright red blood, difficult to stop bleeding	Apply immediate firm pressure for a least 5 minutes, until bleeding stops, apply sterile dressing after the

			bleeding has stopped, then reassess for bleeding later,  Document all assessments, interventions
<i>Puncture of nerve, tendon, and ligament</i>	Nerve, tendon, or ligament is penetrated	Loss of feeling around sight, unable to move extremity, pain, cyanosis, deformity if limb, paralysis of limb	Remove needle, assess for return of feeling,, notify MD if feeling has not returned,  Document all assessments, interventions
<i>Septicemia</i>	Caused by introduction of microorganisms at time if insertion, or infusion of contaminated solutions,	Fevers, chills, vital sign changes, changes in level of consciousness, NV and HA, purulent drainage at sight, may have phlebitis, or thrombophlebitis	Observe hourly ( transfer to critical care), report signs an symptoms to MD, d/c IV and restart in another area, culture drainage from IV, Follow hospital policy when culturing the tip, Administer antibiotics and other treatment as ordered.  Document all assessments, interventions
<i>Fluid overload</i>	Rapid infusion of IV fluid or blood causing circulatory over load	Respiratory distress : moist rales, crackles, tachypnea, dyspnea, orthopea, cough, cyanosis  Tachycardia, hypertension, distended neck veins, Elevated central venous pressure, agitation, puffy eyes	Slow infusion to KVO, notify MD, Elevate HOB, give O2, medications ( diuretics, vasodilators, inotropics, morphine), monitor vitals, Weigh patient,  Document all assessments

### 5.3 Complications



Phlebitis



Thrombophlebitis



Infiltration

Question

A 45-year-old male patient on an IV infusion of Acyclovir for a urinary tract infection. The patient reports, "I noticed swelling on the back of my left hand where the IV is starting to sting now on my left hand". Which of the following is the best intervention?

- a. Observed stage 2 phlebitis on left hand of patient. Stopped infusion of IV Acyclovir. Informed Dr. Tate. Filed incident report.
- b. Observed stage 2 phlebitis on left hand of patient. Stopped infusion of IV Acyclovir. Informed Dr. Tate. Place warm compress on PT's left hand
- c. Observed PT to have swelling 1 inch from PIV site on left hand. Site is blanching. PT stated "It's starting to sting now on my left hand." Stopped infusion of Acyclovir. Removed PIV from left hand and applied warm compress to swelling. Will re-assess left hand in 1 hour.

2. When performing IV insertion or phlebotomy, what is the correct angle that the needle should be inserted?
- 90-100 degrees
  - 45-50 degrees
  - 75-80 degrees
  - 10-30 degrees
3. Which of the following are the right interventions for managing infiltration?
- Early detection imperative
  - stop infusion and d/c IV site

- c. assess circulation and pulses
  - d. apply warm compress for isotonic solution and cold for hypertonic
  - e. All of the above
4. All of the following represent proper nursing documents in the event of IV insertion **EXCEPT**
- a. The specific location of the vein
  - b. Patient tolerated procedure well
  - c. Date, time and name of the nurse starting the IV
  - d. The number of attempts (even if one)
  - e. Quotes from the patient regarding the procedure
5. A nurse who starts an intravenous infusion on a patient who has refused therapy could be charged with:
- a. battery.
  - b. invasion of privacy.
  - c. négligence.
  - d. false emprisonnement.

Answers : 1c, 2d, 3e, 4b, 5a

### **Chapter 6: Central Venous Catheters.**

CVCs Large bore catheters that are placed in the large veins of the venous system (e.g., subclavian, brachiocephalic, innominate or iliac veins, or at the junction of one of these veins with the superior or inferior vena cava. CVCs allow you to infuse fluids directly into the central venous circulation when treatment options that are not generally accessible through standard peripheral intravenous access :

- Minimal or no peripheral access
- Continuous Vesicant Infusions (chemotherapy)
- Infusion of fluids with a Dextrose concentration grater then 10%
- Length of prescribed therapy is 6 days or longer
- Drug pH is below 5 or greater than 9
- Continuous high pressure flow (rapid transfusion)

There are several types of catheters:

- PICC
- Non Tunneled Catheters – CVP, subclavian lines
- Tunneled (surgically burrowed through tissue )- Broviac
- Implanted Ports

### Role of the RN

- Ensure aseptic/sterile technique is maintained during insertion
- inspection of the catheter, dressing, and insertion site . Dressing is to be changed no less than once every 7 days, when soiled or with gauze.
- evaluate the integrity of the catheter and monitor for microbial infection.
- If line is accessed for blood sampling, caps are to be changed after blood is drawn.
- changing the dressing and end caps flushing the lumen of the catheter, if required by facility protocol
- Ensure that Chest X-Ray is done to check proper placement of catheter tip in the *super vena cava* before it is used as a central line
- Check institution's policy and the flushing of lines , dressing and line changes.

Watch for signs and symptoms of pneumothorax:

- Cyanotic
- Drop in BP
- HR increased
- Lethargic
- ***Place patient in left Trendelenberg position, give O2 and call MD (Rapid Response)***



### Chapter 6 Review

2. Mr. Smith is diagnosed with Osteomyelitis. A PICC is inserted through his left cephalic vein ,before initiating 6 weeks of IV antibiotic therapy.. A chest X-ray is done to confirm proper placement of the catheter tip. Where should the tip of the catheter be located ?
  - A. Midline
  - B. Subclavian
  - C. SVC or IVC
  - D. Right Atrium

Answers : 1C

**References**

Zerwekh, J., Claborn, J., Gaglione, T. Mosby's Fluids and Electrolytes Memory Cards. Second Edition Mosby 2009

Consortium of New Jersey Nurse Educators, Adult IV Therapy Course, 5<sup>th</sup> Edition 2008

Perivascular Nurse Consultants. Peripherally Inserted Central Catheters: Monitoring and Complication Management Program  
Perivascular Nurse Consultants, Inc. 2010

Smith, N. Central Venous Catheters: n. Cinahl Information Systems. 2010

Smith, N. Peripheral Intravenous Cannula: Insertion. Cinahl Information Systems. 2010

Smith, N. Blood Transfusion: Administration.. Cinahl Information Systems. 2010

Infusion Nurse Society : *Parenteral Nutrition* Vol. 33 No 4, July/Aug 2011.

Amjad, I., Murphy, T., Nylander-Housholder, L., Ranft, A. *New approach to Management of Intravenous Infiltration in Pediatric Patients: Pathophysiology, Classification, and Treatment.* Journal of Infusion Nursing. Vol. 34, No 4 , July/August 2011

