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ABSTRACT

This Idaho instructor's guide lists tasks and enabling objectives, outlines instruction, and provides handout masters, overhead masters, and tests for intravenous therapy (IV) instruction for licensed practical nurses. Following an introduction and a list of criteria for successful completion of IV therapy courses, the document lists tasks and associated enabling objectives for IV therapy. Next, part I covers instruction for essential responsibilities in intravenous therapy, designed to teach the student to do the following: (1) describe the principles, purposes, and types of IV therapy; (2) administer intravenous solutions, medications, and blood or blood products; (3) provide care of patients receiving IV therapy; (4) provide care of IV therapy equipment; and (5) describe general precautions in administering IV therapy. An appendix contains checklists, a test, and answer key. Part II covers the following: (1) initiating, maintaining, and monitoring intravenous infusions; and (2) monitoring and maintaining central venous lines. Among the skills taught by the first section of part 2 are to prepare the patient for the IV infusion and to perform venipuncture and initiate the intravenous infusion. Among the skills taught by the second section of part 2 are to perform selected IV therapy functions for the stable patient with IV lines and to administer peripheral and/or central line parenteral nutrition and lipids. An appendix contains course equipment and supplies list, checklists, test, answer key, and course requirements for IV therapy for licensed practical nurses. (CML)

Vo.Ed. 271

INTRAVENOUS THERAPY INSTRUCTION FOR LICENSED PRACTICAL NURSES

INSTRUCTOR'S GUIDE

Invest in Success

IDAHO VTE VOCATIONAL TECHNICAL EDUCATION

STATE DIVISION OF VOCATIONAL EDUCATION

1993

INTRAVENOUS THERAPY INSTRUCTION

FOR

LICENSED PRACTICAL NURSES

INSTRUCTOR'S GUIDE

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Boise, Idaho

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INTRODUCTION

The Instructor's Guide was written to assist instructors who need to teach Part I or Part II of the approved curriculum for Intravenous Therapy for LPNs. The layout of the guide follows the curriculum with the format being: Task, Enabling Objective, and Content. Overheads are included where appropriate. Check sheets for RNs to check off LPNs in clinical skills in the institutions are included. Sample tests at the end of Part I and Part II cover each entire section.

When preparing to teach a class, instructors will want to reorganize the content so it "flows" well for instruction. To enable reorganization each objective starts on a new page. Please feel free to rewrite, add or delete test questions and change content to be current with practice in your area.

Recommended Textbook:

IV Therapy
Clinical Skillbuilders, 1992
Springhouse Corporation
Springhouse, Pennsylvania
ISBN: 0-87434-350-X

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Health Occupations Education

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We thank Springhouse Corporation of Springhouse, Pennsylvania for permission to print materials from the recommended textbook I.V. Therapy. Materials used are cited throughout the guide.

A special thank you is given to Joyce Graves, secretary for Health Occupations and Program Services, Idaho Division of Vocational Education, who edited and typed the final edition of this guide.

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CRITERIA FOR SUCCESSFUL COMPLETION OF IV THERAPY COURSES

Completion of Part I

Students must complete the post test covering all 5 tasks and accompanying enabling objectives with a recommended score of 80% or greater.

Students must be checked off in a lab situation and/or in a clinical agency doing the following: (number of times student must complete the following to demonstrate competency is up to instructor discretion). We encourage check off in simulated lab and in the clinical agency where possible.

a: Hang IV solution to existing peripheral IV line
b: Hang IVPB medication to existing peripheral IV line
c: Hang blood or blood components
d: Convert peripheral IV to heparin/saline lock
e: Discontinue peripheral IV infusion and catheter
f: Change dressing and provide site care to existing peripheral IV

Completion of Part II

Students must complete post test covering all 9 tasks and accompanying enabling objectives with a recommended score of 80% or greater.

Students must be checked off in a lab situation and/or in a clinical agency doing the following skills: (number of times student must complete the following to demonstrate competency is up to instructor discretion).

a: Venipuncture to start a peripheral over the needle catheter.
b: Change a central line dressing
c: Hang TPN and/or lipids
d: Change tubing on a central line

If Part I and Part II are not done together, Part I material needs to be reviewed by the students. Students must then pass a test covering material on Part I with a recommended score of 80% or greater to take Part II. (see sample Part I test).

TASK LISTS AND

ENABLING OBJECTIVES

FOR

I.V. THERAPY FOR LPNs

PERFORMANCE AREA: Health Occupations

PROGRAM TITLE: I.V. Therapy

Course of instruction in IV therapy for LPNs (Required by the Rules and Regulations of the Board of Nursing for LPNs who perform functions related to IV Therapy)

The course of instruction in Intravenous Therapy for Licensed Practical Nurses has been divided into two parts. The licensed practical nurses who did not receive Part I in his/her basic course of instruction to become a Practical Nurse or did not have this instruction at any other time must complete both parts of the course. Persons who completed Part I need to take only Part II. People who completed Part I must show documentation of successful completion.

PART I - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

01.0 ESSENTIAL RESPONSIBILITIES IN INTRAVENOUS THERAPY
The student will be able to:

- 01.01 Describe the principles, purposes and types of IV therapy.
- 01.02 Administer intravenous solutions, medications, and blood or blood products.
- 01.03 Provide care of patient receiving IV therapy.
- 01.04 Provide care of IV therapy equipment.
- 01.05 Describe general precautions in administering IV therapy.

PART II - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

02.0 INITIATE, MAINTAIN AND MONITOR INTRAVENOUS INFUSIONS:
The student will be able to:

- 02.01 Describe role of the LPN relative to IV initiation.
- 02.02 Prepare the patient for the IV infusion.
- 02.03 Implement nursing interventions for the patient within any level of growth and development.
- 02.04 Select the intravenous infusion site.
- 02.05 Perform venipuncture and initiate the intravenous infusion.
- 02.06 Provide for on-going assessment of patient.

03.0 MONITOR AND MAINTAIN CENTRAL VENOUS LINES:
The student will be able to:

- 03.01 Perform selected IV therapy functions for the stable patient with CV lines.
- 03.02 Administer peripheral and/or central line parenteral nutrition and lipids.
- 03.03 Perform legal, accurate documentation of all related functions, observations, patient responses/reactions.

ENABLING OBJECTIVES FOR I.V. THERAPY FOR LPNs

In the Practical Nursing curriculum, only the Task Statement (what is to be learned) precedes the unit of instruction. The other two components of the Performance Objective (conditions and criteria) are understood. This means the conditions of learning are met when the Practical Nursing curriculum includes all necessary information and skills, and is offered in approved classroom and clinical settings using required equipment and supplies. The criteria of learning are met when students achieve a pre-determined level of learning (or above) which is established by the faculty/school offering the instruction. It is essential that students in this competency-based program are informed prior to instruction the competencies to be learned, the conditions of training, and the criteria or standard to be achieved. Students should be provided the necessary time (within reason) to acquire a competency and should not be graded on semester/clock hours.

PART I - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

01.0 ESSENTIAL RESPONSIBILITIES IN INTRAVENOUS THERAPY

01.01 TASK: Describe the Principles, Purposes and Types of IV Therapy

ENABLING OBJECTIVES:

1. Describe the role of the circulatory and urinary systems in maintaining fluid and electrolyte balance.
2. Identify the major electrolytes and their function in the body.
3. Discuss conditions requiring IV therapy
4. Identify the three types of IV solutions
5. Identify blood types and blood type compatibility
6. Identify blood products commonly administered and their compatibility.
7. Relate the purposes of the IV infusion to the individual patient.

01.02 TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products

ENABLING OBJECTIVES:

1. Assess data base including physician order, intake and output record, and blood values.
2. Assess patient's need and provide for psychological support and/or teaching.
3. Assess established peripheral IV site for patency and complications.
4. Obtain correct solution, medication, and tubing.
5. Prepare IV system using plastic bag, glass bottle, prefilled syringe, and infusion devices using established facility protocols.
6. Calculate the rate of infusion using standard formulas.
7. Administer commercial and/or pharmacy pre-mix solutions and piggy back medications at the prescribed rate using established facility protocols.
8. Administer blood and/or blood products using established facility protocols.
9. Record administration of IV solutions, medications, blood/blood product on appropriate chart form.
10. Maintain IV infusion at prescribed rate by either gravity flow or IV infusion devise/pump.
11. Measure and record intake and output.

01.03 TASK: Provide Care of Patient Receiving IV Therapy

ENABLING OBJECTIVES:

1. Describe signs and symptoms of complications of IV therapy including: infiltration, phlebitis, over hydration, air embolism.

2. Describe signs and symptoms of adverse drug reaction.
3. Describe signs and symptoms of blood transfusion reaction.
4. Assess body systems affected by IV therapy for signs and symptoms of complications, or adverse reactions.
5. Assess peripheral IV site for signs and symptoms of complications including infiltration, infection, inflammation.
6. Provide IV site care and IV site dressing change using established facility protocol.
7. Convert and flush heparin/saline lock using established facility protocol
8. Discontinue peripheral IV using established facility protocol.
9. Report fluid imbalance, signs and symptoms of complications, adverse drug reaction or blood transfusion reaction to RN/MD.
10. Record data related to intravenous therapy including site care, signs and symptoms of complications, adverse drug reaction or blood transfusion reaction on the appropriate chart form.

01.04 TASK: Provide Care of IV Therapy Equipment

ENABLING OBJECTIVES:

1. Assess equipment for proper operation
2. Change IV tubing using established facility protocol
3. Record equipment operation on the appropriate chart form.
4. Adjust infusion pump to maintain infusion at prescribed rate.

01.05 TASK: Describe General Precautions in Administering IV Therapy

1. Relate general precautions that need to be applied to IV therapy: universal precautions, patient comfort/safety and fluid management.

PART II - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

02.0 INITIATE, MAINTAIN AND MONITOR INTRAVENOUS INFUSIONS

02.01 TASK: Describe Role of the LPN Relative to IV Initiation

ENABLING OBJECTIVES:

1. Identify and explain the legal and ethical aspects of his/her role in IV therapy.
2. Identify his/her responsibility to the patient, the institution and the nursing profession.
3. Define "legal scope of practice."
4. Research related policies/procedures of employing institution and correlate with the Idaho Nurse Practice Act.

02.02 TASK: Prepare the Patient for the IV Infusion

ENABLING OBJECTIVES:

1. Identify reasons for an IV infusion.
2. Determine concerns the patient and/or the nurse may have regarding the procedure.
3. Describe nursing responsibilities/interventions related to patient comfort, privacy and safety.
4. Discuss body fluid precautions as identified by the Centers for Disease Control.

02.03 TASK: Implement Nursing Interventions for the Patient Within Any Level of Growth and Development (LPNs are limited to IV therapy of children seven years and older)

ENABLING OBJECTIVES:

1. Discuss special needs of the pediatric patient (seven years of age or older) needing IV therapy relative to:
   A. Structure and function of the cardiovascular and integumentary systems.
   B. Emotional and cognitive development.
2. Describe physiological and psychosocial changes and needs of the elderly patient which might impact the IV procedure.

02.04 TASK: Select the Intravenous Infusion Site

ENABLING OBJECTIVES:

1. As applicable to an intravenous infusion, review the structure and function of the skin, circulatory system, and cardiovascular system.

2. Identify the anatomical structures and functions of veins utilized as venipuncture sites.
3. Differentiate among various venipuncture sites.
4. Describe criteria to be considered when selecting a venipuncture site.
5. Identify growth and development factors pertinent to venipuncture site selection.

02.05 TASK: Perform Venipuncture and Initiate the Intravenous Infusion

ENABLING OBJECTIVES:

1. Assess data base information including physician orders, patient vital signs, and special needs.
2. Identify the steps of venipuncture and of initiating infusion.
3. Identify and assemble all equipment needed; explain the use of each item.
4. Differentiate among the various venipuncture devices; include gauge and size of each and use.
5. Describe IV site skin preparation.
6. Perform venipuncture.
7. Perform the infusion procedure maintaining aseptic technique.
8. Accurately calculate the flow rate.
9. Document procedures and patient reactions.

02.06 TASK: Provide for On-Going Assessment of Patient

ENABLING OBJECTIVES:

1. Recognize signs/symptoms of local and/or systemic complications of IV fluid or drug therapy.
2. Take appropriate nursing actions in the event of IV complications.
3. Document assessment and nursing actions.

03.0 MAINTAIN AND MONITOR CENTRAL VENOUS LINES

03.01 TASK: Perform Selected IV Therapy Functions for the Stable Patient with CV Lines

ENABLING OBJECTIVES:

1. Identify the LPN's legal scope in caring for patients with CV lines.
2. Identify and describe different types of CV lines.
3. Add medicated/unmedicated solutions.
4. Change the site dressings.
5. Change IV tubing.
6. Recognize complications and adverse reactions; take appropriate nursing actions.
7. Identify appropriate nursing interventions for the patient with a central line.
8. Identify the unique characteristics and precautions associated with CV lines and how these differ from standard IV lines.
9. Document procedures and patient's reactions.

03.02 TASK: Administer Peripheral and/or Central Line Parenteral Nutrition and Lipids

ENABLING OBJECTIVES:

1. Define total parenteral nutrition (TPN) and hyperalimentation (HA) and lipids.
2. Enumerate reasons for and the purpose of TPN.
3. Identify components of the TPN solution.
4. Identify nursing responsibilities related to TPN infusion.
5. Administer central line and TPN.
6. Recognize potential/actual complications of TPN infusion; take appropriate nursing actions.
7. Document procedures and patient's reactions.

03.03 TASK: Perform Legal Accurate Documentation of all Related Functions, Observations, Patient Responses/Reactions

ENABLING OBJECTIVES:

1. Enumerate criteria for legal documentation.
2. Identify what is to be documented and how often.

PART I

INTRAVENOUS THERAPY COURSE

FOR

LICENSED PRACTICAL NURSES

PART I - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

01.0 ESSENTIAL RESPONSIBILITIES IN INTRAVENOUS THERAPY

01.01 TASK: Describe the Principles, Purposes and Types of IV Therapy

1. Describe the role of the circulatory & urinary systems in maintaining fluid & electrolyte balance.

   A. Terms and definitions.

      1. Edema: abnormal accumulation of fluid in tissues.
      2. Pathophysiology: disease state that changes the structural of functional state of an organ.
      3. Tricuspid: having three cups or points
      4. Valve: any contrivance or arrangement that regulates the amount and direction of flow of liquid, gas, vapor, or loose material.

   B. Anatomy of the heart.

      1. Description: hollow, muscular organ in mediastinum; base directed upward to right, apex down to left.
      2. Structural features: heart chambers and valves.
         a. Right atrium receives blood from vena cava and coronary sinus; empties into right ventricle.
         b. Right atrioventricular (tricuspid) valve prevents back flow from right ventricle to right atrium.
         c. Left atrium receives blood from pulmonary veins; empties into left ventricle.
         d. Left atrioventricular (bicuspid, mitral) valve prevents back flow from left ventricle to left atrium.
         e. Right ventricle pumps blood into pulmonary artery; back flow prevented pulmonary semilunar valve.
         f. Left ventricle pumps blood into aorta; back flow from aorta prevented by aortic semilunar valve. Left ventricular walls thicker than right; must generate more pressure to pump into larger circuit.

   C. Blood supply to myocardium.
      1. Right and left coronary arteries give off intramuscular branches to capillaries in heart wall; blood flow decreased by compression of vessels during ventricular contraction, increased during relaxation.
      2. Coronary veins drain capillaries; most empty into coronary sinus.
      3. Interference with blood supply may cause heart attack.

D. Physiology of the heart: sole function is to pump into arterial system blood returned to it from venous system.

1. Right side of heart receives poorly oxygenated blood; pumps to lungs.
2. Left side of heart receives highly oxygenated blood from lungs; pumps to other parts of the body.

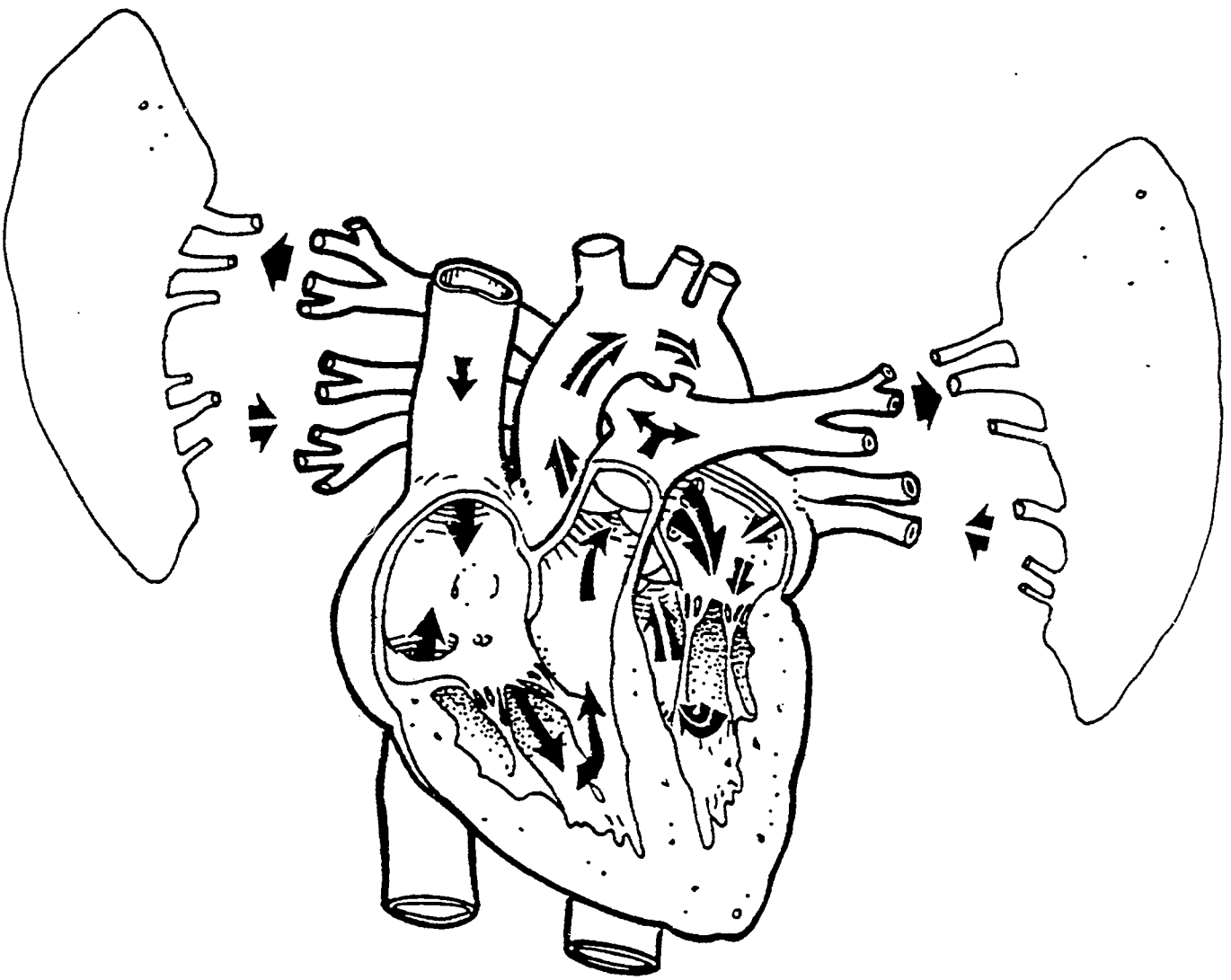
E. IV therapy related factors causing variations in heart function.

1. Medications.
2. Fluid/electrolyte imbalances.
3. Fluid overload
4. Speed shock
5. Septicemia
6. Emboli
7. Vasovagal reaction

F. The Pulmonary System

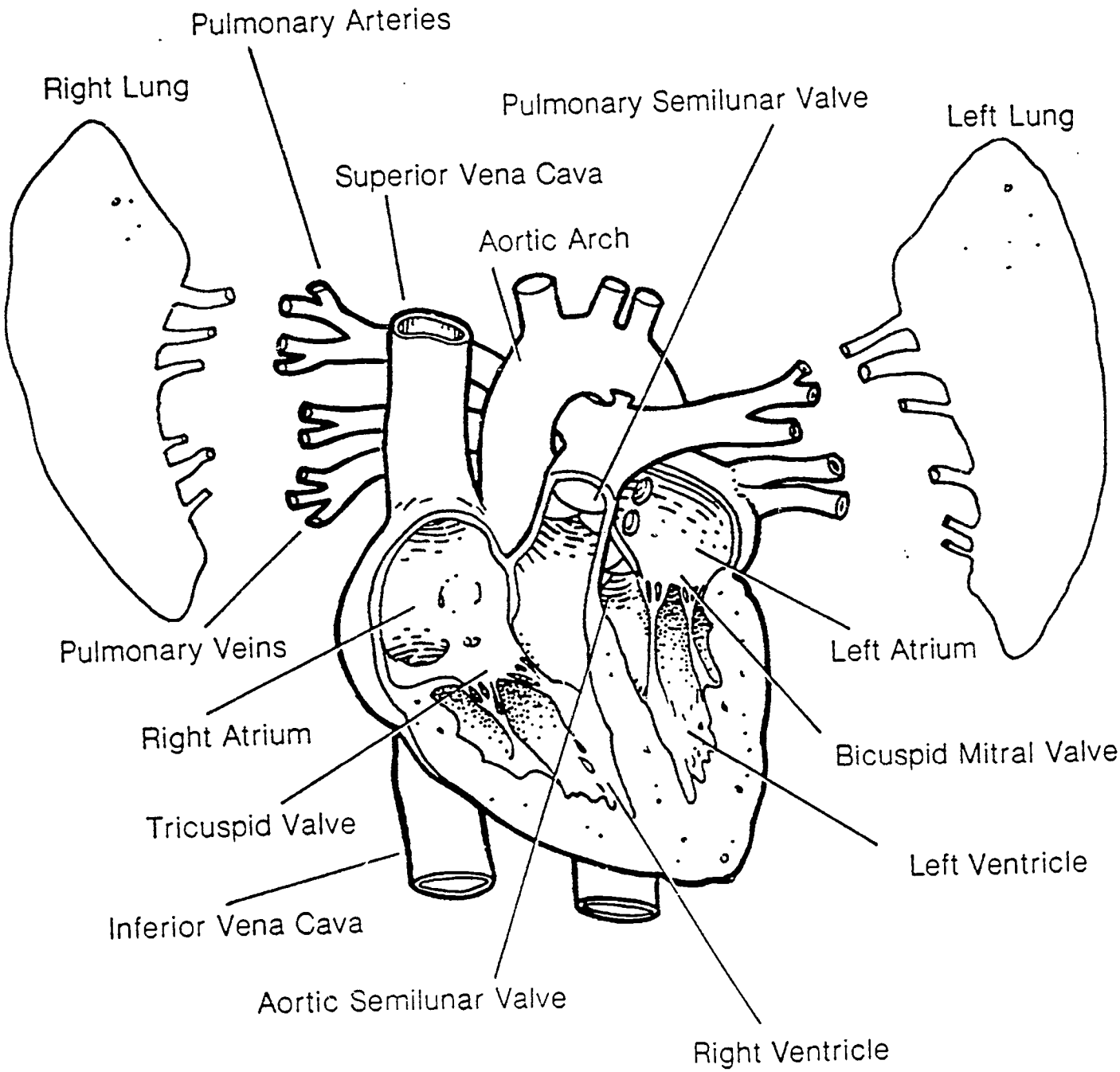
1. Function - exchange of gasses between organism and environment supplying oxygen to the body and eliminating carbon dioxide.
2. Importance relative to IV therapy maintenance of acid-based balance.
3. IV therapy related factors affecting respiratory rates.
   a. Chemical - pH
      (1) Stimulation of central chemoreceptors by carbon dioxide (CO_2) and hydrogen ions in cerebrospinal fluid of fundamental importance.
      (2) resultant increase in rate and depth of breathing enables one to blow off CO_2 which reduces carbonic acid in blood.
      (3) limits voluntary control.
   b. Peripheral chemoreceptors reflexes
      (1) impulses from aortic and carotid bodies when O_2 level falls.
      (2) increased breathing rate.
4. Physical
   a. medication
   b. fluid overload
   c. fluid and electrolyte imbalances
   d. temperature of transfused blood
   e. emboli

The Heart: Circulation of Blood



From Intravenous Fluid Therapy Course For The LPN Instructor Guide, Columbia, MO, 1988. Reprinted courtesy of I.M.L., Univ. of Missouri-Columbia.

Cardiopulmonary System: The Anatomical Structures



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01.01 TASK: Describe the Principles, Purposes and Types of IV Therapy (cont.)

2. Identify the major electrolytes & their function in the body.

   A. Body fluid compartments.

      1. Intracellular = 2/3 of fluid - 28 liters in adults (40% TBW)
      2. Extracellular = 1/3 of fluid - 14 liters in adults (20% TBW)
      3. Interstitial fluid - 25% is plasma

   B. Electrolyte distribution.
      1. Membrane separating intracellular fluid & extracellular fluid is selective and only allows certain electrolytes through.
         a. Intracellular - K^+, phosphorus
         b. Extracellular - Na^+, Cl
      2. Na^+ serum level = 135 - 147 mg/liter
         a. Influences H_2O distribution
         b. Hyponatremia = muscle weakness, decreased skin turgor, headache, tremors, seizures.
         c. Hypernatremia = thirst, fever, flushed skin, oliguria, and dry, sticky membranes.
      3. K^+ Serum level = 3.5 - 5 mg/liter
         a. Hypokalemia = decreased GI, skeletal muscle and cardiac muscle function; decreased reflexes; rapid, weak, irregular pulse; muscle weakness or irritability; decreased blood pressure; nausea and vomiting; paralytic ileus.
         b. Hyperkalemia = muscle weakness, nausea, diarrhea, olguria
      4. Ca^+ Serum level = 4 - 5.5 mg/liter
         a. Hypocalcemia = muscle tremor, muscle cramps, tetany, tonoclonic seizures, paresthesia, bleeding, arrhythmias, hypotension.
         b. Hypercalcemia = lethargy, headache, muscle flaccidity, nausea, vomiting, anorexia, constipation, polydipsia, hypertension, polyuria.
      5. Cl^- Serum Level = 95 - 105 meq/liter
         a. Hypochloremia = increased muscle excitability, tetany, decreased respirations.
         b. Hyperchloremia = stupor, rapid deep breathing, muscle weakness.

6. P^- Serum Level = 2.5 - 5.0 meq/dl
   a. Hypophosphatemia = paresthesia (circumoral and peripheral) lethargy, speech defects (stuttering, stammering).
   b. Hyperphosphatemia = renal failure, vague neuroexcitability to tetany and convulsions, arrhythmias, and muscle twitching with sudden rise in phosphate levels.
7. Mg^+ Serum Level = 1.3 - 2.1 meq/liter
   a. Hypomagnesemia = dizziness, confusion, convulsions, tremor, leg and foot cramps, hyperirritability, arrhythmias, vasomotor changes, anorexia, nausea.
   b. Hypermagnesemia = drowsiness, lethargy, coma, arrhythmias, hypotension, vague neuromuscular changes (tremor), vague GI symptoms (nausea), slow weak pulse.

Electrolytes Contained in Body Fluid

	Extracellular Fluid	Intracellular Fluid
Na^{++}	142 mEq/L	0 mEq/L
K^{+}	5 mEq/L	41 mEq/L
Ca^{++}	5 mEq/L	1 mEq/L
Mg^{++}	3 mEq/L	58 mEq/L
Cl^{-}	103 mEq/L	4 mEq/L
HCO_3^{-}	28 mEq/L	10 mEq/L
Phosphates	4 mEq/L	75mEq/L
SO_4^{--}	1 mEq/L	2mEq/L
Glucose	90 mgm %	0 to 20 mgm %
Amino acids	30 mgm %	200 mgm % ?
Cholesterol, Phospholipids, Neutral fat	0.5 gm %	2 to 95 gm %
PO_2	35 mm Hg	20 mm Hg ?
PCO_2	46 mm Hg	50 mm Hg ?
pH	7.4	7.0

The electrolyte content of body fluids. (From Guy, A. C.: Function of the Human Body. 4th ed. Philadelphia, W. B. Saunders Co., 1974)

From Intravenous Fluid Therapy Course For The LPN Instructor Guide, Columbia, MO, 1988. Reprinted courtesy of I.M.L., Univ. of Missouri-Columbia.

01.01 **TASK: Describe the Principles, Purposes and Types of IV Therapy (cont.)**

3. Discuss conditions requiring IV therapy.

   A. Maintain and restore fluid & electrolyte balance

   B. Drug administration

   C. Blood transfusions

   D. Parenteral nutrition (rapid therapeutic effect cannot be absorb GI)

   E. Life line (e.g. telemetry patients)

4. Identify the 3 types of IV solutions (includes general information, specific solutions, their uses and dangers).

A. Isotonic
   1. Possesses same osmolarity as serum and other body fluids.
   2. Stays where you put it (inside the blood vessel).
   3. Expands the vessel without pulling other fluid from other compartments. Would be used to treat hypotension from hypovolemia.
      (ex: LR + NS)

B. Hypotonic
   1. Osmolarity lower than serum. Body fluid and electrolytes shift out of blood vessels and into the cells.
   2. Hydrates cells and depletes the circulatory system.
   3. Used when diuretics have dehydrated cells and hyperglycemic conditions. (ex: .45NS)

C. Hypertonic
   1. Higher osmolarity than serum. Fluids and electrolytes are pulled into the intravascular compartment.
   2. Used post-op because shift of fluid into blood vessels reduces edema, stabilizes BP, & ↑ urine. (ex: D_5 ½NS D_5 LR)

D. Solutions, uses and systemic dangers.
   1. Dextrose in water
      a. Isotonic - 5% is isotonic in container but becomes hypotonic in the body.
      b. pH - 3.5 - 6.5
      c. Calories - 1 liter D_5W = 170 calories
      d. Available in 2.5, 5, 10, 20, and 50% concentration, and in 1000, 500, 250, 100, 50 ml sizes.

e. Metabolic effect
   (1) Provides calories for essential energy.
   (2) Glucose is converted into glycogen by synthesis in the liver, resulting in improved hepatic function.
   (3) Spares body protein.
   (4) Prevents ketosis or excretion of organic acid which occurs when fat is burned by the body without an adequate supply of glucose.
   (5) When deposited intracellularly in the liver as glycogen, dextrose causes a shift of potassium from the extracellular to the intracellular fluid compartments.

f. Indications for use.
   (1) Dehydration
      (a) rapidly metabolized, leaving the water
      (b) water decreases the osmotic pressure of the blood plasma and invades the cell; provides immediately available water to dehydrated tissues.
   (2) Hypernatremia - to decrease the concentration of sodium if patient not fluid overloaded.
   (3) Vehicle for drug administration.
   (4) Nutrition - calories for energy.
   (5) Hyperkalemia - with insulin, causes anabolism (build up of body cells) which results in a shift of K^+ from ECF to ICF, thereby lowering serum K^+ concentration.

g. Systemic dangers
   (1) Hypokalemia.
   (2) Dehydration.
   (3) Hyperinsulinism - carbohydrates being infused, pancreas responds releasing insulin; termination of infusion leaves insulin in the body.
   (4) Water intoxication.
   (5) Increased intracranial pressure - due to increased cerebral edema.

h. Contraindications - do not give with blood or blood products, would result in hemolysis of blood cells.

2. Isotonic sodium chloride solution - NS
   a. Isotonic.
   b. pH 4.5 - 7.0
   c. Available in 1000, 500, 250, 150, 100, 50, and 25 ml sizes.
   d. Indications for use.
      (1) Extracellular fluid replacement when chloride loss has been relatively greater or equal to sodium loss.
      (2) Treatment of metabolic alkalosis in presence of fluid loss.
      (3) Sodium depletion.
      (4) Initiation and termination of blood transfusions.
   e. Systemic dangers.
      (1) Acidosis.
      (2) Hypernatremia.
      (3) Hypokalemia.
      (4) Circulatory overload.

3. Isotonic saline and 5% dextrose - D_5/NS
   a. Hypertonic in container; isotonic in body.
   b. pH 3.5 - 6.0
   c. Available in 1000, 500, 250, and 150 cc sizes
   d. Metabolic effects
      (1) Helps prevent formation of ketone bodies
      (2) Helps prevent catabolism and therefore loss of K^+ and intracellular water.
   e. Indications for use
      (1) Temporary treatment of circulatory insufficiency and shock due to hypovolemia in the immediate absence of a plasma expander.
      (2) Concurrent early treatment with plasma or albumin for replacement of loss due to burns.
      (3) Early treatment of adrenocortical insufficiency.
   f. Systemic dangers
      (1) acidosis
      (2) hypernatremia
      (3) hypokalemia
      (4) circulatory overload

4. 10% dextrose in normal saline - D_{10}/NS
   a. The combination of dextrose in isotonic NaCl results in a hypertonic solution.
   b. pH 3.5 - 6.0
   c. Available in 1000 and 500 cc sizes.
   d. Indications for use
      (1) Nutrient - increases calories
      (2) Electrolyte replenisher - Na^+ and Cl^-
      (3) Promotes diuresis
   e. Systemic dangers
      (1) Hypernatremia
      (2) Acidosis
      (3) Circulatory overload
   f. Administration - need large vein due to hypertonicity; can damage tissue.
5. Hypertonic NaCl (3% or 5%)
   a. Indications
      (1) Severe dilutional hyponatremia (water intoxification)
      (2) Severe sodium depletion
      (3) To dilute certain chemotherapeutic agents
   b. Systemic danger - circulatory overload of not administered slowly.
6. Hypotonic NaCl in water (0.45% NaCl in H_2O)
   a. Indications for use
      (1) Electrolyte replenisher
      (2) Hydration
      (3) To assess renal function
      (4) When fluid tolerance is in question
   b. Systemic danger - circulatory overload
7. Hydrating fluids
   a. Solutions consisting of dextrose with hypotonic saline provide more water than is required for excretion of salt.
      (1) 2.5% dextrose in 0.45% saline
      (2) 5% dextrose in 0.45% saline
      (3) 5% dextrose in 0.2% saline
   b. Indications for use
      (1) Hydrating fluids - assess kidney function before electrolyte replacement and maintenance are initiated.
      (2) Hydration of med/surg patient
      (3) Promotion of diuresis in dehydrated patient
   c. Systemic danger
      (1) Presence of edema
      (2) Cardiac disease
      (3) Renal disease
      (4) Liver disease

8. Isotonic multiple electrolyte fluids - Ringers lactate
   a. Indications for use
      (1) Great fluid and electrolyte loss (vomiting, diarrhea, diuresis, hemorrhage, burns)
      (2) Mild acidosis
   b. Systemic danger - circulatory overload

INTRAVENOUS FLUID REFERENCE CHART

Type of Fluid	Nonelectrolyte Constituents	Calories/ Liter	pH	Tonicity	Comment
Dextrose in Water Solutions					
5% Dextrose in Water	Dextrose	170	4.8	Isotonic (252 mOsm/L)	Does not replace or correct fluid deficits.
10% Dextrose in Water	Dextrose	340	4.7	Hypertonic (505 mOsm/L)	Hypertonic solutions irritate the veins and act as osmotic diuretics, thus increasing body fluid loss.
20% Dextrose in Water	Dextrose	680	4.8	Hypertonic (1,010 mOsm/L)	
50% Dextrose in Water	Dextrose	1,700	4.6	Hypertonic (2,525 mOsm/L)	Dextrose solutions mixed with blood infusions cause hemolysis of red cells.
Dextrose in Saline Solutions					
5% Dextrose and 0.2% Sodium Chloride	Dextrose	170	4.6	Isotonic (320 mOsm/L)	Provides Calories, Water, Na^+ and Cl^-
5% Dextrose and 0.45% Sodium Chloride	Dextrose	170	4.6	Hypertonic (406 mOsm/L)	Used to treat temporary hypovolemia and to promote diuresis in dehydrated patients.
5% Dextrose and 0.9% Sodium Chloride	Dextrose	170	4.4	Hypertonic (559 mOsm/L)	
10% Dextrose and 0.9% Sodium Chloride	Dextrose	340	4.8	Hypertonic (812 mOsm/L)	
Saline Solutions					
0.45% Sodium Chloride			5.9	Hypotonic (154 mOsm/L)	Supplies daily salt and water requirements. Widely used as a routine electrolyte replacement solution even though it supplies only Na^+ and Cl^-. These are supplied in excess of normal plasma levels. Used for correction of severe salt depletion only.
0.9% Sodium Chloride			6.0	Isotonic (308 mOsm/L)	
3% Sodium Chloride			6.0	Hypertonic (1,026 mOsm/L)	
5% Sodium Chloride			6.0	Hypertonic (1,710 mOsm/L)	
Multiple Electrolyte Solutions					
Ringer's Solution			6.0	Isotonic (309 mOsm/L)	Replaces K^+ and C^{++} besides Na^+ and Cl^-; Cl^- is in excess of normal plasma Cl^- level. Electrolyte concentration closely resembles ECF. Used to replace ECF deficits and losses from vomiting or gastric suction. Dextrose provides calories.
Lactated Ringer's Solution		9	6.5	Isotonic (273 mOsm/L)	
5% Dextrose in Lactated Ringer's	Dextrose	179	5.1	Hypertonic (524 mOsm/L)	
10% Dextrose in Lactated Ringer's	Dextrose	349	4.9	Hypertonic (776 mOsm/L)	

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INTRAVENOUS FLUID REFERENCE CHART

Type of Fluid	Nonelectrolyte Constituents	Calories/ Liter	pH	Tonicity	Comment
Plasma Substitutes					
10% Dextran 40 in 5% Dextrose	Dextrose	170	4.7	Isotonic (252 mOsm/L)	Raises osmotic pressure of blood drawing interstitial fluid into vessels.
10% Dextran 40 in 0.9% Sodium Chloride		0	5.1	Isotonic (308 mOsm/L)	Give Dextran carefully to patients with heart or renal disease.
Alcohol Solutions					
5% Alcohol in 5% Dextrose	Dextrose Alcohol	525	4.6	Hypertonic (1,114 mOsm/L)	Provides calories. Has depressant and diuretic effects.
Amino Acid Solutions					
8.5% Amino Acids	Essential and Nonessential Amino Acids	950	6.4	Hypertonic (950 mOsm/L)	Amino acid preparations are available in varying percentages and electrolyte content. Supplies proteins for tissue repair and helps to correct negative nitrogen balance states.
Fat Emulsions					
Intralipid, Liposyn, Travamulsion 10%	Fat Emulsion	550/500ml.	5.5-9	Isotonic (280-300 mOsm/L)	Excellent source of calories and essential fatty acids.
Intralipid, Liposyn, Travamulsion 20%	Fat Emulsion	1,000/500ml.	5.5-9	Isotonic (330-340 mOsm/L)	Contraindicated in patients with disorders of fat metabolism or liver damage.

NOTE: This chart is not meant to depict all the intravenous fluids that are commercially available today, but rather, is meant to illustrate the fluids that are most commonly used in the provision of intravenous therapy.

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5. Identify blood types & blood type compatibility

A. Blood has two components:

1. Cellular elements: erythrocytes, leukocytes, & platelets = 45% of blood volume.
2. Plasma: 55% of blood volume - water, protein, lipids, electrolytes, vitamins, & carbohydrates.
   Antigens & antibodies: Exist on surface of blood cells. Antigens - can imitate an immune response; can induce the formation of antibodies & cause allergic reactions.
   Compatibility tests: used to identify antigens & antibodies in recipient & donor. Most important are ABO blood typing, Rh typing, cross matching, & antibody screening test.
   ABO blood groups: classifies RBC's as either A, B, AB, or O. Group O blood lacks both A & B antigens. Can be transferred in an emergency to any patient (universal donor).
   Group AB blood has neither anti-A nor anti-B antibodies, so can receive A, B, or O blood (universal recipient).
3. ABO system
   a. Discovered by Karl Landsteiner in 1901
   b. Classification of human blood based on antigens on the red cells and antibodies in the serum.
   c. ABO grouping:

Blood Group	Antigens on Red Cells	Antibodies in Serum
O	No A or B antigens	Anti-A and Anti-B
A	A	Anti-B
B	B	Anti-A
AB	A and B	None

   d. Type O - considered universal donor

4. Rhesus (Rh) system
   a. Discovered by Landsteiner and Weiner in 1940
   b. Name comes from relationship to the substance in the red cells of the rhesus monkey.
   c. Antigens belonging to the Rh system are C, D, E, c, and e.
   d. Antibody D is built up with ease in the body, so typing is done to ensure D-negative recipients receive D-negative blood.
   e. Blood containing D antigen - Rh positive
   f. Blood lacking D antigen - Rh negative

6. Identify blood products commonly administered and their compatibility.
   A. Whole blood (500 cc)
      1. Indications
         a. Acute massive blood loss
         b. Exchange transfusion in newborn
         c. Cardiac surgery
      2. Must be ABO compatible
      3. Primary disadvantages
         a. During storage, potassium leaks from the cells into the plasma.
         b. Supply is limited.
         c. Massive transfusion may be accompanied by citrate toxicity.
   B. Packed red cells (250 cc)
      1. Prepared by the removal of 70-80% of the plasma
      2. Indications for use
         a. To restore or maintain oxygen-carrying capacity
         b. Chronic anemia (when unable to treat pharmacologically)
         c. Surgical loss
      3. Must be ABO compatible
      4. Advantages
         a. Reduced volume
         b. Reduced chemical content
         c. Reduced agglutinens
   C. Fresh frozen plasma (200-250 cc)
      1. Plasma seperated by centrifugation from whole blood
      2. Contains most clotting factors
      3. Indications for use
         a. Massive transfusion - with bleeding secondary to coagulation factor deficiencies.
         b. Massive hemorrhage - hypovolemia with coagulation factor deficiencies.
         c. Specific coagulation factor deficiencies -factors V, XIII and XI.
         d. Shock - acute hemorrhage, plasma loss, burns, (albumin preferred)
         e. Reverse excessive anticoagulant therapy.
         f. Liver disease with bleeding complications.
      4. Compatibility

Donor Group	Recipient
A, AB	A
B, AB	B
AB	AB
O	O, AB, A, B

      5. Use within two hours of thawing.

D. Platelets (35-50 ml/unit)

1. Platelet concentrates are prepared by separating platelet rich plasma from a unit of whole blood within 6 hours after collection. The platelet rich plasma is then centrifuged and the supernatant platelet poor plasma is expressed into a third satellite bag.
2. Two available preparations:
   a. Random-donor concentrates - made from separate individual donors
   b. Single-donor concentrates - taken from the same donor by plateletpheresis
   c. Indications for use
      (1) Thrombocytopenia due to:
         (a) Abnormally functioning platelets
         (b) Aplastic anemia
         (c) Chemotherapy
         (d) Rapid dilution of platelets by resuscitation fluids and stored whole blood
         (e) Drug reactions - being secondary to disseminated intravascular coagulation (DIC)
      (2) Idiopathic thrombocytopenia purpura (ITP)
         (a) ABO compatibility not essential
         (b) Rh preferred, but not necessary
         (c) Usually not given unless count more than 20,000
         (d) Special component drip set - specific platelet filter
         (e) Storage period - 72 hrs. at room temperature: 5 days after collection with special "breathable" bag

E. Cryoprecipitate (Factor VIII) (30 ml)
1. Single-donor concentrated factor VIII made from cold-thawed plasma
2. Indications for use
   a. Hemophilia A
   b. Von Willebrand's disease
   c. Hypofibrinogenemia
3. Provides factor VIII and fibrinogen
4. ABO-Rh compatible when possible
5. Storage life - one year frozen
6. Use within six hrs. of thawing

F. Plasma derivatives
   1. 5% normal serum albumin
      a. Prepared by fractionation of pooled plasma
      b. Commercially available
      c. Available in 250 ml and 500 ml of saline
      d. Is an isotonic solution
   2. Indications for use
      a. Restoring or maintaining blood volume
      b. Emergency treatment of shock owing to acute blood loss after trauma or surgery
      c. Useful for plasma replacement in treating hypovolemic shock caused by severe burns when there is loss of plasma fluids but not red cells
   3. Cross matching not necessary
   4. Administration set provided
   5. No hepatitis risk

G. 25% normal serum albumin
   1. Prepared the same way as 5% normal serum albumin
   2. Commercially available
   3. Supplied in units of 50 ml and 100 ml of saline
   4. Is a hypertonic solution
   5. Indications for use
      a. Plasma volume expander
      b. Treatment of hypovolemic shock
      c. In treatment of burn patient to maintain adequate plasma volume along with protein colloid levels
   6. Recommended rate of infusion
      a. No greater than 2-3 ml/minute
      b. Too-rapid infusion could result in:
         (1) Circulatory overload
         (2) Pulmonary edema
         (3) Increased interstitial dehydration
   7. Crossmatching not necessary
   8. Administration set provided
   9. No hepatitis risk

H. Principals of Blood Administration
   1. Role of responsibility
      a. Obtaining unit from blood bank - dependent upon individual agency's policy
   2. Crosschecking of identifying data pre-initiation of transfusion - dependent upon individual agency's policy

01.01 **TASK: Describe the Principles, Purposes and Types of IV Therapy (cont.)**

7. Relate the purposes of the IV infusion to the individual patient.

Instructor's Note: Put together case studies and have students choose the type of fluid needed.

01.02 TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products

1. Assess data base including physician order, intake & output record, & blood values.

   A. Physicians order: complete orders should include all of the following:
      1. Type & amount of solution
      2. Additives & their concentrations
      3. Rate & volume of infusion
      4. Duration of infusion

      Most institutions have policies that dictate an automatic stop order.

      Fluid Status:

      I & O, Daily Weights

Fluid Deficit	Fluid Excess
Wt. loss	Wt. gain
↑ pulse rate	↑ BP
↓ BP	Bounding pulse
↓ central venous pressure	Jugular venous distention
Dry mucous membranes	Dyspnea
Poor skin turgor	Crackles
↓ Perspiration/ salivation	Edema
Dry, cracked lips	Good skin turgor
↓ urine output	puffy eyelids
↑ hematocrit	↓ hematocrit
↑ electrolytes	↓ electrolytes
↑ BUN	↓ BUN
↑ Osmolarity	↓ Osmolarity

01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

2. Assess patient need and provide psychological support and/or teaching.
   - A. Assess patient's previous experience, expectations, and knowledge of IV therapy.
   - B. Use teaching aides, e.g. pamphlets, IV catheters, & videotapes.
   - C. Teach why patients need therapy, how it is performed, how IV therapy will limit activities, how the patient can help maintain the IV.
   - D. Allow the patient to express concerns/fears.
   - E. Evaluate your teaching -- ask questions, observe behavior.
   - F. Document all of your teaching. Note what was taught & whether the pt. understood.
   - G. Rationale of preparation
     1. Goal
        - a. IV fluid therapy that minimizes the potential for IV complications.
        - b. IV fluid therapy that minimizes discomfort.
     2. Results of preparation
        - a. Patient cooperation.
        - b. Participation in care.
        - c. Acceptance and alleviation of fears.
   - H. Process of patient preparation - activity
     1. Assessment
        - a. Stage of illness
        - b. Need for therapy
     2. Planning
        - a. Teaching
          - (1) Purpose of therapy
          - (2) Method of administration
          - (3) Possible duration of therapy
          - (4) Limitations - restrictions (mobility, maintain dryness of site)

b. Feedback (factors influencing a patients anxiety)
   (1) Conception that IV therapy is reserved for the critically ill.
   (2) Fear of the unknown (escalated when needle is involved)
   (3) Previous traumatic experience with IV therapy
   (4) Lack of or inappropriate patient preparation for procedure
   (5) Nature of underlying illness
   (6) Significance of the IV fluid therapy and relationship to illness
   (7) Patients personal psychological resources
      (a) Age
      (b) Individuals premorbid personality
      (c) Family relationships
      (d) Presence of other concerns
      (e) Previous experience with illness/pain
      (f) Relationship with members of health care team

c. Effects of stress on patient
   (1) Physical
      (a) Autonomic nervous system (vasovagal reaction)
         1) Vasodilation
         2) Drop in arterial blood pressure
         3) Syncope
         4) Diaphoresis
      (b) Cardiovascular system (pulmonary edema)
   (2) Emotional
      (a) Dependent, regressive behavior
      (b) Aggressive behavior

d. Approaches for emotional support for the IV therapy patient
   (1) Establish and maintain good interpersonal rapport with patient/patient's family.
   (2) Provide appropriate patient teaching
   (3) Obtain order for stress-reducing medication when needed.
   (4) Exhibit expertise in IV therapy procedures.
   (5) Reassurance of close monitoring.

e. The uncooperative patient
   (1) Exhibits uncooperativeness by:
      (a) Verbal abusiveness
      (b) Physical assault of care providers
      (c) Removing cannula
      (d) Altering flow rate
      (e) Disrupting delivery
   (2) Factors in noncooperation
      (a) Patients reaction to stress
      (b) Alteration in mental status
         1) Mentally handicapped
         2) Atherosclerotic cerebrovascular disease
         3) Chronic brain syndrome
         4) Drug induced
         5) Other underlying disease
      (c) Hearing impairment
      (d) Language barriers
   (3) Provide diversional activities for the uncooperative patient.
      (a) Close monitoring of patient
      (b) Use discrimination in selection of IV site
      (c) Assess possible alternative routes of medical administration
      (d) Behavior modifying medications
      (e) Use of restraints or safety mittens when indicated (use is dependent on institutional policy)

01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

3. Assess established IV site for patency & complications.
   - A. Be sure fluid flows freely.
   - B. Check IV site; be sure there is no redness or tenderness.
   - C. Check date on dressing, tubing and bottle.
   - D. Purpose of IV site dressing change - to observe the site for evidence of developing complications/infection.
   - E. Schedule
     1. Routine change - dependent upon type dressing used
        - a. Gauze - every 24-48 hrs.
        - b. Transparent - every 72 hrs. to one week
     2. PRN - change should be done whenever the condition of a dressing becomes wet, soiled, or nonocclusive.
   - F. Observations/Evaluation of site
     1. Absence of redness
     2. Absence of swelling
     3. Absence of induration
     4. Absence of drainage
   - G. Principles
     1. Aseptic technique must be observed
     2. The site should be cleansed with 70% isoprophyl alcohol or povidone-iodine solution and allowed to dry. (follow institutional policy)
     3. An antimicrobial agent should be applied to injection site if mandated by institutional policy.
     4. A label denoting date and time of change should be affixed to the new dressing.
   - H. Procedure
     1. Gauze dressing
        - a. Wash hands
        - b. Explain procedure to patient
        - c. Put on protective gloves
        - d. While stabilizing cannula, carefully remove tape and dressing from site
        - e. Visually inspect site for evidence of developing complications
        - f. Cleanse site with alcohol or povidone-iodine solution and allow to dry
        - g. Apply antimicrobial agent, if applicable
        - h. Apply sterile dressing and secure with tape
        - i. Remove gloves
        - j. Reapply original label inscribed with insertion information to dressing, recopy if soiled or nonocclusive
        - k. Apply tape label denoting dressing change information (date & time, initials of person performing procedure)

2. Transparent dressing
   a. Wash hands
   b. Explain procedure to patient
   c. Put on protective gloves
   d. While stabilizing cannula, carefully remove existing transparent dressing
   e. Visually inspect site for evidence of developing complications
   f. Apply scant amount of antimicrobial agent to site, if applicable
   g. Apply sterile transparent dressing
   h. Remove gloves
   i. Recopy insertion data on new label and apply to dressing
   j. Apply a small strip of tape denoting change

01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

4. Obtain correct solution, medication, & tubing.

5. Prepare IV system using plastic bag, glass bottle, prefilled syringe, and infusion devices using established facility protocols.

A. Plastic bag and plastic bottle
   1. Wash hands
   2. Verify fluid order, correct patient, & correct amount.
   3. Remove outer plastic covering if present/check expiration date.
   4. Check for particular material, cloudiness, leaks.
   5. Ascertain that med port is securely covered.
   6. Secure time strip to cover.
   7. Ascertain that cover over insertion port is secure.
   8. Carefully remove insertion port covering with one swift motion.
   9. Close tubing with roller clamp.
   10. Aseptically remove set from old container and insert into new container.
   11. Invert container.
   12. Open clamp and adjust to desired rate.
   13. Document.

B. Closed or open system (glass containers)
   1. Wash hands
   2. Verify fluid order, correct patient and correct amount.
   3. Check for patency of container; hold up to light and look for cracks.
   4. Check for particulate matter in fluid.
   5. Make sure rubber seal on top of bottle is depressed, ensuring sterile vacuum.
   6. Check to be sure air port is secure.
   7. Secure time strip to bottle.
   8. Remove rubber seal with one smooth upward pull motion.
   9. Close tubing with roller clamp. Check for presence of air in tubing/drip chamber.
   10. Aseptically remove set from old container and insert into new container.
   11. Invert container.
   12. Open clamp and adjust to desired rate.
   13. Document.

C. Procedure for changing administration set tubing

1. Wash hands
2. Prepare new container of primary IV solution and new IV administration set.
3. Suspend from patients IV standard
4. Prepare two pieces of tape, approx. three inches and five inches long.
5. Remove tape from old tubing.
6. Put on protective gloves.
7. Place sterile 2x2 or alcohol sponge under cannula/tubing connection.
8. Close control clamp on old tubing.
9. Holding new tubing between index and second fingers of dominant hand, remove protective cover from end.
10. Use thumb and first finger of dominant hand to remove old tubing from hub of cannula, stabilizing cannula with non-dominant hand.
11. Quickly insert new tubing into cannula.
12. Remove 2x2 or alcohol sponge.
13. Secure tubing with tape.
14. Open flow control clamp of new administration set and regulate to ordered flow rate.
15. Add appropriately inscribed tubing change label.
16. Document.

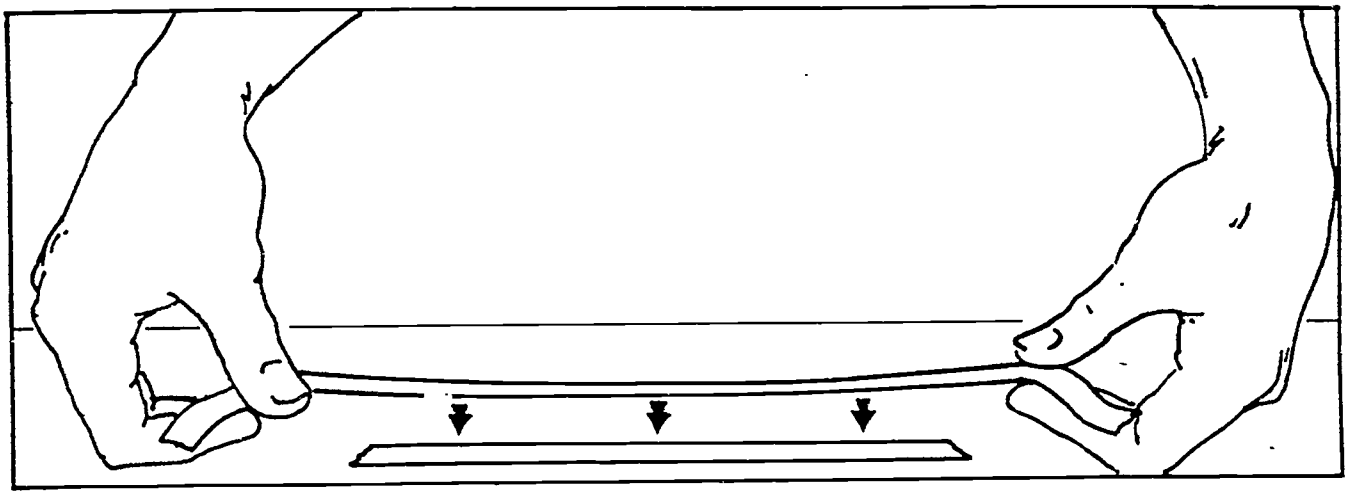
D. Procedures for application of armboards/restraints

1. Armboards
   a. Place extremity on armboard in functional position.
      (1) To prevent contractures.
      (2) To prevent unnecessary discomfort.
      (3) To prevent injury to the nerves and muscles of the upper arm.
   b. Face, or back-strap the tape used to secure armboard.
      (1) To ensure free blood circulation.
      (2) to ease eventual removal.
   c. Gauze may be used in lieu of tape to apply armboard, however, this creates a barrier for easy observation of site.
   d. To apply:
      (1) Place extremity on armboard.
      (2) Place tape around arm and armboard.
         (a) Keep face part of tape against patients arm and adhesive part against armboard.
         (b) Tape securely enough to immobilize the arm, but loose enough to prevent impeding circulation.
         (c) Do not completely encircle extremity with tape - may impede circulation.
      (3) Ascertain that circulation is not compromised.

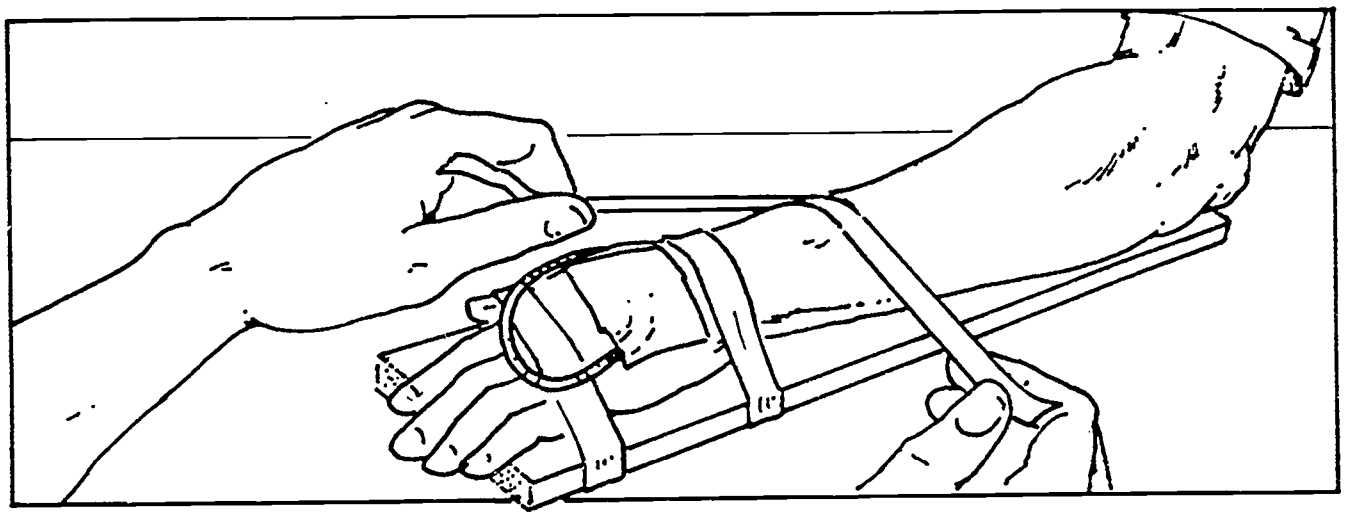
2. Restraints
   a. Avoid placing restraint directly over IV site.
   b. Do not apply so tight as to impede circulatory flow.
   c. Do not tie restraint to siderail.
   d. Some armboards facilitate restraint application via strategically placed loops/slots.
   e. To apply: apply according to manufacturers recommendations.

3. Administration sets.
   a. Selection depends on rate & type of infusion & type of solution container.
   b. Macrodrip: Delivers solution in large quantity at a rapid rate.
   c. Microdrip: delivers a smaller amount of solution with each drop. Used for pediatric pts. & for adults requiring small or closely regulated amounts of IV solution.
   d. Basic set: piercing spike, drop orifice, drip chamber, Y-site injection ports, roller clamp, leur-lok or needle adapter. Length is 70"-110" (vented or non-vented), drip factors are 10, 15, or 20 gtts/ml. Microdrips deliver 60 gtts/ml.
   e. Secondary sets: Used to infuse medications into a primary line.
   f. Burrettes/Volutrols: Used primarily for pediatric pts., delivers a small, precise amount of fluid & medication.
   g. In-line-filters: Located already in-line. Filters pathogens, particles, & air. Determine if additives should be added above or below the filter.

Applying an Armboard to Patient



Backing Two Adhesive Strips Together



Place the non-adhesive sides in contact with the patient's arm. Allow the adhesive ends to go down and under to adhere to the underneath portion of the armband.

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01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

6. Calculate the rate of infusion using standard formulas.

Drops/minute = roller clamp
Ml/hour = volumetric pump

Volume of infusion (in ml)
Time of infusion (mins) x gtt factor (in drops/ml) = gtt/min.

A. Calculation of flow rates

1. Flow rate should be calculated and recorded each time a new container of fluid or dose of medicine is administered.
2. Flow rate is expressed as volume of fluid delivered per unit of time.
   a. The flow rate expressed in ml/hr is more accurate in monitoring volume delivered over a period to time. Calculate by dividing the volume of fluid to be infused in ml. by the infusion time in hours.
   b. To deliver desired hourly volume it is necessary to convert the flow rate into drops per minute. To achieve this one must know:
      (1) Volume of fluid to be infused
      (2) Total infusion time
      (3) Drop factor of the administration set - number of gtts/ml
         (a) Standard set (dependent upon manufacturer) - delivers 10, 15, or 20 gtts per ml - allows higher flow.
         (b) Micro set - delivers 60 gtts per ml - use for slower delivery over extended time.
      (4) Methods to calculate gtts/min
         (a) flow rate (drops/min)=
         $\frac{\text{gtt factor}}{60 \text{ (min/hr)}} \times \frac{\text{volume/1 hour}}{1} =$

         With sets that deliver 10 gtts/ml. infuse 120 ml/hr:
         $\frac{10}{60} \times \frac{120}{1} = 20$ gtts/min

Assignment Sheet

DIRECTIONS: Calculate the following:

1) Calculate the correct flow rate in ml/hr for a patient who is to receive 1,800 ml of solution in 24 hrs.

2) Determine gtts/min for a patient who is to receive 1,000 ml of solution in 10 hrs.
   a) With a set that delivers 15 gtts/ml

   b) With a set that delivers 10 gtts/ml

   c) With a set that delivers 60 gtts/ml

3) Determine gtts/min using a 15 gtts/ml set for a patient who is to receive 1,000 ml in 6 hrs.

Answers to assignment sheet:

Calculations of IV fluid flow rates:

1. 1,800 cc÷24 = 75 ml/hr

2. Method 1: $\frac{\text{vol. of fluid in ml}}{\text{time to be infused in min.}} \times \text{calibration gtts/ml}$

   a) $\frac{1{,}000 \text{ ml}}{600 \text{ min}} \times 15 \text{ gtts/ml} = \text{flow rate of } 25 \text{ gtts/min}$

   b) $\frac{1{,}000 \text{ ml}}{600 \text{ min}} \times 10 \text{ gtts/ml} = 16\text{-}17 \text{ gtts/min}$

   c) $\frac{1{,}000 \text{ ml}}{600 \text{ min}} \times 60 \text{ gtts/ml} = 100 \text{ gtts/min}$

   Method 2: $\frac{\text{ml/hr}}{4 \text{ (15 gtts/ml set)} \text{ or } 6 \text{ (10 gtts/ml set)} \text{ or } 1 \text{ (60 gtts/ml set)}}$

   a) For a set that delivers 15 gtts/ml
   100 ml/hr÷4 = 25 gtts/min

   b) For a set that delivers 10 gtts/ml
   100 ml/hr÷6 = 16-17 gtts/min

   c) For a set that delivers 60 gtts/ml
   100 ml/hr÷1 = 100 gtts/min
   (with sets that deliver 60 gtts/ml, ml/hr = gtts min

3. $\frac{1{,}000 \text{ ml}}{6 \text{ hr}} = 166 \text{ ml/hr}$

   $\frac{166}{4} = 41\text{-}42 \text{ gtts/min}$

Calculating Flow Rates

1. How much solution did the physician order?

2. Over how much time is this amount to infuse?

3. Divide amount of solution to be given by the delivery time.

   Example: $\frac{1000 \text{ ml}}{8 \text{ hr}} = 125 \text{ ml/hr}$

4. Decide which type of drip system you are using.

   (NOTE: The drop rate per milliliter of fluid varies with each manufacturer of macrodrip tubing. Abbott tubing delivers 15 gtt/ml; Travenol tubing delivers 10 gtt/ml; all microdrip tubings deliver 60 gtt/ml.)

5. Calculate drops per minute to deliver set amount of fluid per hour.

   $$\frac{\text{gtt/ml}}{\text{60 sec/min}} \times \frac{\text{Amt Fluid/hr}}{1} = \text{gtt/min}$$

   Example:

   $$\frac{10}{60} \times \frac{125}{1} = \frac{1250}{60} = 21 \text{ gtt/min}$$

or:

With sets that deliver 10 gtts/ml, divide hourly volume by 6.

Example:

$$\frac{125 \text{ ml/hr}}{6} = 21 \text{ gtts/min}$$

With sets that deliver 15 gtts/ml, divide hourly volume by 4.

Example:

$$\frac{125 \text{ ml/hr}}{4} = 31 \text{ gtts/min}$$

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01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

7. Administer commercial and/or pharmacy pre-mixed solutions & piggyback meds at the prescribed rate using established facility protocol.

NOTE THE FOLLOWING:

- Be sure medication & primary solution are compatible.
- Incompatibilities may be from binding of two drugs resulting in ↓ activity, physical alterations, or chemical changes.
- Check expiration date.

Intermittent Infusion
Can be given through a regular line or heparin/saline lock.

IV Piggyback
Need medication, secondary tubing, 18-22 G needle, & tape.

Volutrol/Burrette
Place medication in with primary solution in the volutrol & infuse.

A. Objectives of Drug Administration
   1. Diagnostic purposes - to assess functions of certain organs or organ systems.
      a. Conray for intravenous pyelogram
      b. Nuclear agents for bone imaging
      c. Thallium for thallium stress test
   2. Prophylactic purposes
      a. Pre - operative antibiotics
      b. Lidocaine - to prevent ectopic beats postmyocardial infarction
      c. Therapeutic purposes
         (1) Curative - example: antibiotic therapy
         (2) Palliative - relief of symptoms as with analgesic administration
         (3) Supportive - sustaining patient while other types of therapy are being employed; example: anesthesia during surgery
         (4) Temporary alteration of normal processes; example: anticoagulant administration
         (5) Replacement therapy - substituting substances which are normally in the body which may be depleted or absent in certain disease states; example: vitamins, insulin, electrolytes, etc.

B. Advantages of IV Route

1. Insures almost immediate and total absorption and rapid delivery to the site of action; circulation time is usually less than 1 min.
   a. Pulmonary circulation time - approx. 12-15 sec.
   b. Systemic circulation time - approx. 17-23 sec.
2. Precise dosage calculation and flow rates can be achieved.
3. Should an adverse drug reaction occur during administration, the remainder of the drug can be discontinued immediately.
4. Pain and irritation to the tissues, which can accompany intramuscular (IM) or subcutaneous (S/C) administration, can be avoided.
5. Provides an alternate route of delivery for drugs which are highly irritating to the gastrointestinal (GI) tract or which are inactivated by gastric secretions.
6. Provides a means of delivery for those patients whose clinical condition warrants being placed on NPO (nothing by mouth)
7. The dose can be titrated to sustain continous control of the therapeutic response.

C. Disadvantages of IV Route

1. There is no recall system; since untoward reactions can occur with the same rapidity as the desired response, unexpected effects can be serious and may be fatal.
   a. Proper identification of patient is essential
   b. The key is: <u>prevention, not intervention</u>
2. There is added risk of IV therapy related complications; aseptic technique is essential
3. IV therapy procedures require a considerable degree of knowledge and skill which limits the group of available personnel qualified to perform such procedures
4. Even when administered skillfully, IV drug administration is not without some discomfort which can become a source of emotional trauma
5. Existant drug incompatibilities

D. Factors Affecting Response to Drugs

1. Size of individual
   a. Final concentration of a drug in the body is dependent on body mass; a drug dose which is within the therapeutic range for the "average" 70 kg (150 lb) adult may be ineffective for an obese person
   b. Weight alone is not reflective of body mass
   c. Body surface area is a major consideration in drug dosing. Nomograms are used for this purpose

2. Age
   a. Children are more sensitive to drugs than are adults and require altered doses
   b. Effects stage of development of organ systems
   c. Geriatric patients may require a smaller dose than young adults due to declining psyiological functions associated with the aging process
3. Sex
   a. Due to differences in body size and porportion, women are often more susceptible to the action of some drugs than are men
   b. Great care must be undertaken in regard to drug dosing during pregnancy to avoid harming the fetus
4. Genetic factors
   a. Inappropriate metabolism of a drug may be attributed to genetically-determined enzyme activity
   b. Physician considers genetic factors associated with various ethnic and racial groups when determining drug dosages
5. Presence of disease process
   a. Alteration of drug dosage may be indicated when certain disease states are present. Hepatic and renal impairment interfere with normal metabolism and excretion of many drugs
   b. Presence of other pathological conditions may alter an individuals sensitivity to the effects of a particular drug
6. Route of administration
   a. Magnitude of response evoked by a drug will be limited by how much is absorbed into the circulatory system and distributed to appropriate sites of action
   b. Drugs given intravenous go directly into circulation
      (1) Higher serum level reached faster
      (2) Require less dosage
7. Interaction with other drugs given concurrently
   a. Dosage of drug given alone may produce a response within the therapeutic range
   b. The addition of other drugs to the treatment regime can alter effects
      (1) Action can be intensified
      (2) Action can be reduced

E. Incompatibilities

1. Types
   a. Visual or physical incompatibility
      (1) Precipitation
      (2) Color change
      (3) Evolution of gas
      (4) Turbidity/cloudiness

      NOTE: May be too sparse, transparent, fine, or palely colored to be readily detected visually.
   b. Chemical incompatibility
      (1) Usually involves the irreversible degradation of drugs to produce therapeutically inactive or otherwise toxic products
      (2) May or may not be visible
      (3) Laboratory analysis may be only means of detection
   c. Therapeutic incompatibility
      (1) An undesireable pharmacologic reaction occuring within a patient as a result of two or more drugs given concurrently
      (2) Effect may be potentiation or antagonism
2. Prevention of incompatibilities
   a. Utilize current drug reference material prior to the administration of any drug intravenously
   b. Adhere to drug manufacturers instructions regarding:
      (1) Reconstitution/preparation
      (2) Administration
3. Be aware that a warning to avoid mixing certain drugs "in any manner" means that the drugs cannot be combined under circumstances in:
      (1) Syringe
      (2) Intravenous administration set tubing
      (3) Fluid container
4. Utilize special flushing techniques when incompatible drugs must be given through the same IV line
5. Direct questions regarding incompatibilities to the professional pharmacy staff

Intravenous Drug Administration

Advantages of IV Route

1. Administration directly into a vein insures almost immediate and total absorption and rapid delivery to the site of action with theraputic effects beginning almost immediately.

2. Because of total dose absorption, precise dosage calculation and flow rates can be achieved.

3. Should an adverse reaction to the drug occur during administration, the remainder of the drug can be immediately discontinued.

4. Prevention of pain and irritation to the tissues, which can accompany intramuscular and subcutaneous administration of many drugs

5. Provides an alternative route of delivery for drugs which are highly irritating to the gastrointestinal tract or are inactivated by gastric secretions

6. Provides a means of delivery for those patients whose clinical condition warrants being placed on NPO

7. The dose can be titrated to sustain continuous control of the therapeutic response.

Disadvantages of IV Route

1. There is no recall system for drugs administered intravenously.

2. There is the added risk of IV therapy-related complications, thrombosis, speedshock, etc.; and, unless aseptic technique is closely adhered to, infection.

3. IV therapy procedures require a considerable degree of skill, which limits the group of nurses and other health professionals qualified to perform such procedures. State legislation and institutional policy often impose further restrictions resulting in limited available personnel to administer drugs via the IV route.

4. Even when performed skillfully, intravenous cannula insertion and drug administration are not without some discomfort which can be a source of emotional trauma.

5. Existent drug incompatibilities

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Intravenous Drug Incompatibilities

VISUAL/PHYSICAL INCOMPATIBILITY

Typified by precipitation, color change, evolution of gas, turbidity or cloudiness. NOTE: Some precipitates are transparent - too sparse, fine, or palely colored to be readily detected visually.[1]

CHEMICAL INCOMPATIBILITY

Usually involves the irreversible degradation of drugs to produce therapeutically inactive or otherwise toxic products; it may or may not be visible, the only means of detection may be laboratory analysis.[1]

THERAPEUTIC INCOMPATIBILITY

An undesirable pharmacological reaction occurring within a patient as a result of two or more drugs being given concurrently. The effect may be one of potentiation (increasing therapeutic response) or antagonism (negating the desired response). A therapeutic incompatibility may initially go undetected until it is noted that the patient has failed to show the expected clinical response to the drugs. In the event that an incompatibility is not suspected, the patient may be given increasingly higher doses of the drug to try to obtain the desired therapeutic effect. Should the incompatibility then be alleviated by the discontinuation of the other drug which caused it, an overdosage could result.[2]

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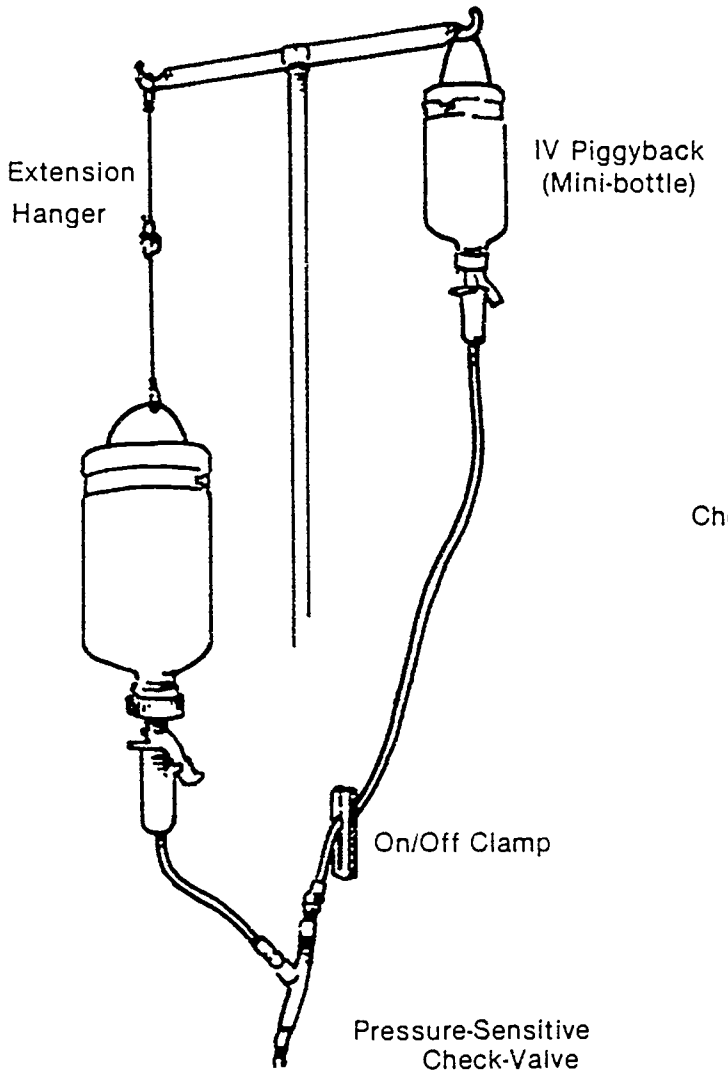
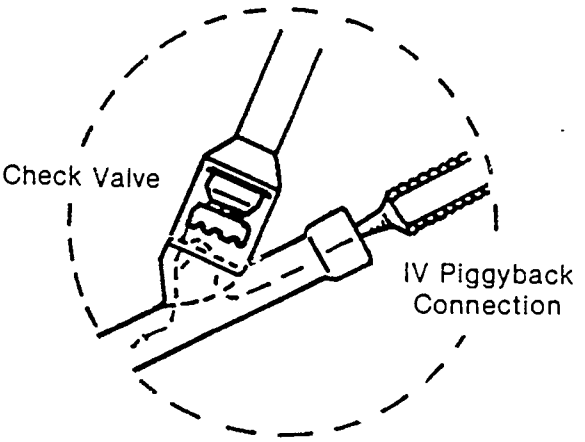
Automatic IV Piggyback Set





Close-Up View of Pressure-Sensitive Check-Valve

Automatic piggyback sets are available from most manufacturers of IV administration equipment. Such sets contain a built-in pressure sensitive check-valve.

When a piggyback is connected to one of these sets and the flow clamp is opened, the check-valve automatically closes off the primary infusion.

When the infusion of the piggyback has been completed, the check-valve automatically opens, thereby restarting the primary infusion.

The check-valve works because of pressure differences. To achieve this difference it is imperative that the primary infusion container is hung lower than the secondary piggyback container by means of an extension hanger. Such hangers which may be plastic or metal are supplied by the manufacturer and are usually contained in the secondary administration set packaging.

CAUTION: The flow clamps of the secondary medication administration sets are considered **STRICTLY** on/off clamps and are not intended to be utilized as a flow regulating clamp.

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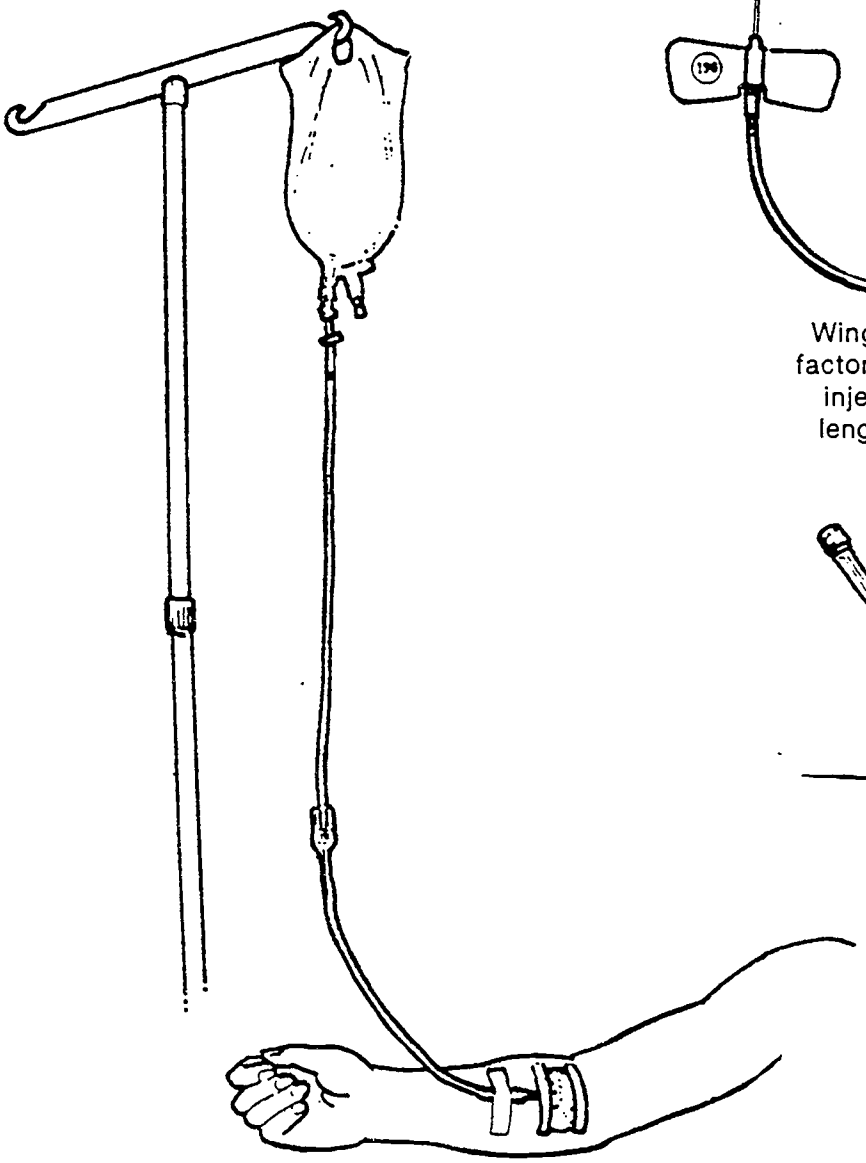
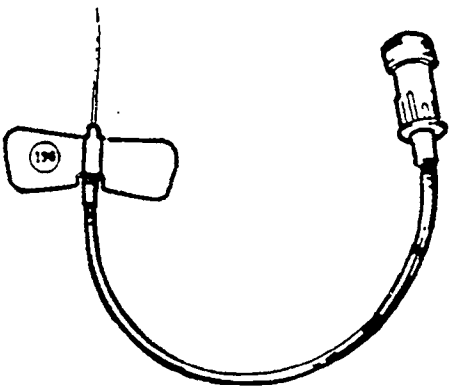
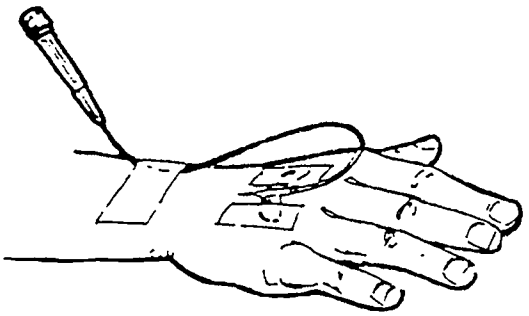
Straight Line into Heparin Lock



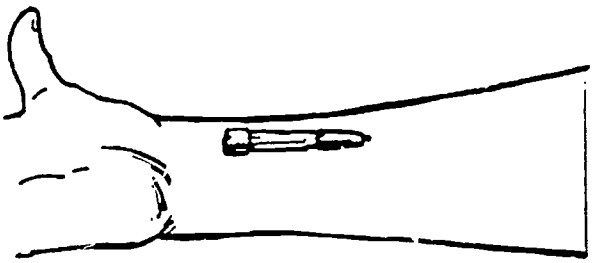


Winged infusion set with factory-attached permanent injection site and short length of flexible tubing



Male Luer adapter with injection site connected to a winged infusion set

Male Luer adapter with injection site connected to an IV catheter



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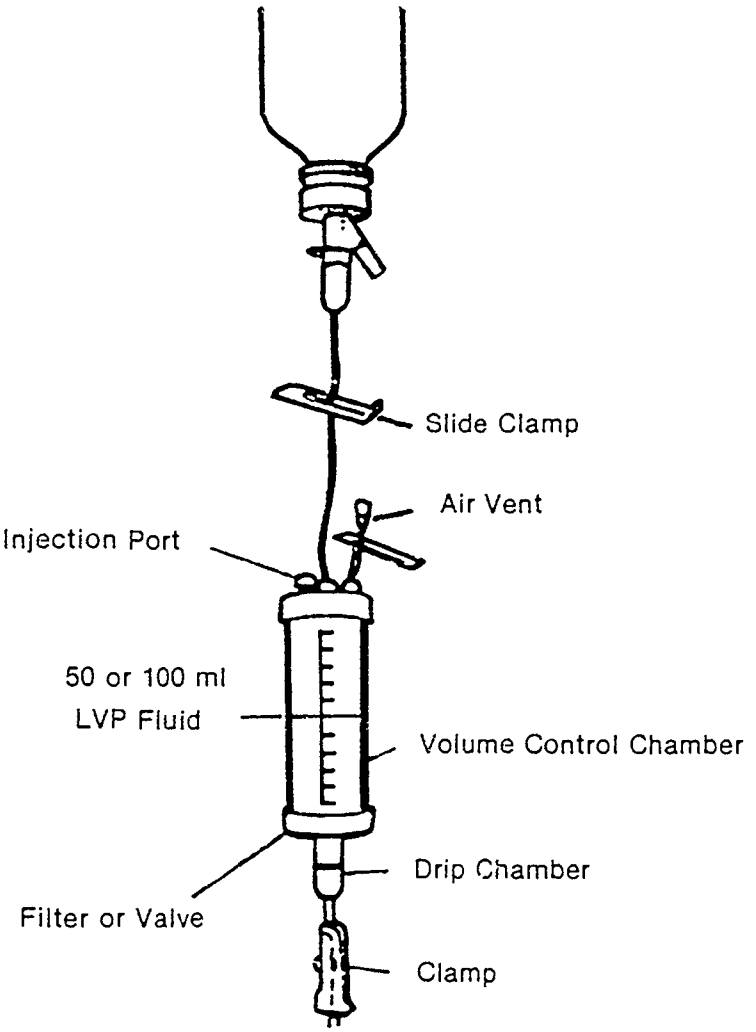
Medication Administration via Volume-Control Set



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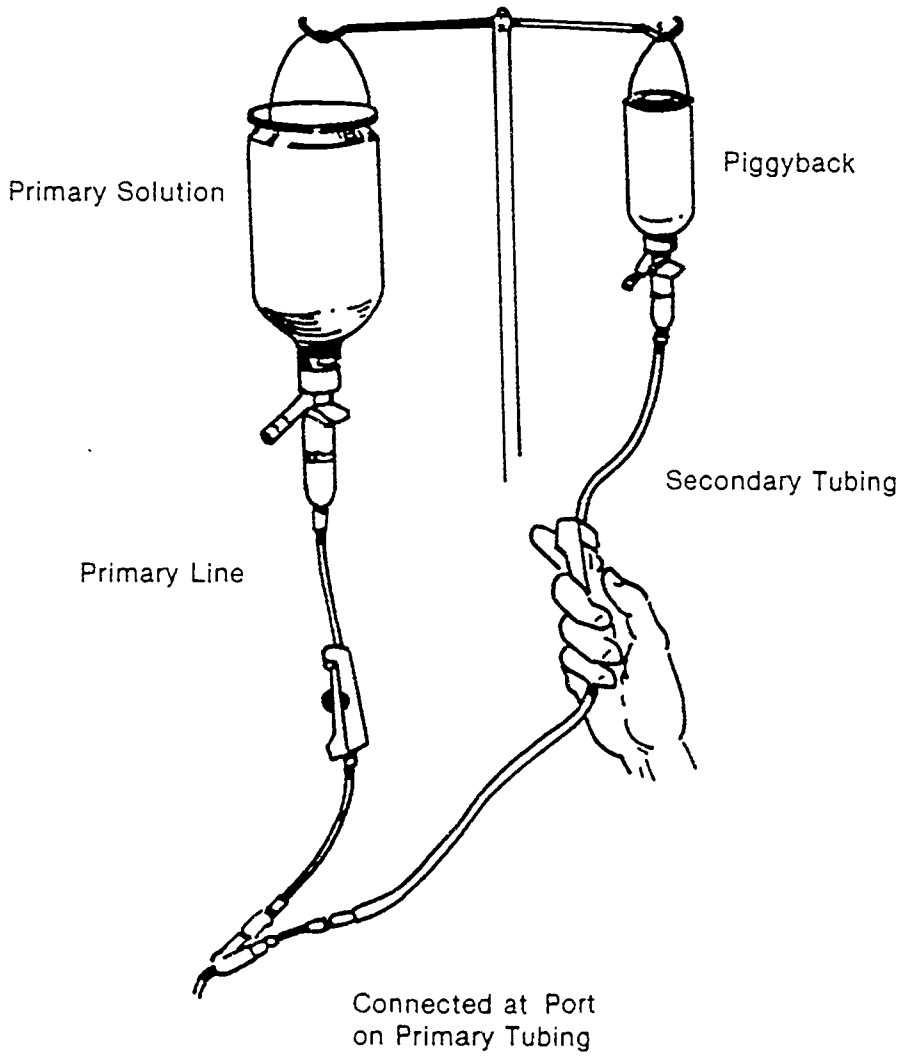
Intravenous Piggyback via Secondary Line



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01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

8. Administer blood and/or blood products using established facility protocols.

   A. Double check patient's name, medical record number, ABO and Rh status and blood bank number against the label blood bag with another nurse.
   B. Check expiration date.

   Whole blood or components

   1. Must be given right after it is checked out from the blood bank.
   2. Use "Y" type IV set.
   3. Hang with 250 cc bag of normal saline.
   4. Blood warmer if ordered.
   5. If you use an infusion pump, be sure to check with manufacturer to be sure blood can be given through it.
   6. Spike: flush tubing and filter with NS, plug into patient, close NS, begin blood.

01.02 TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)

9. Record administration of IV solutions, meds, blood, blood products on the appropriate chart.

SEE 1.02 #8

01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

10. Maintain IV infusion at prescribed rate by either gravity flow or IV infusion device/pump.

Instructor Note: Set up a lab with various pumps to acquaint students with pumps.

01.02 **TASK: Administer Intravenous Solutions, Medications, and Blood or Blood Products (cont.)**

11. Measure and record intake and output:

    A. Record intake of all IV infusions including fluids, meds, flush solutions, blood, blood products & TPN.

    B. Record output as often as is determined by your patient's condition.

01.03 **TASK: Provide Care of Patient Receiving IV Therapy**

1. Describe signs & symptoms of complications of IV therapy including: infiltration, phlebitis, over hydration, air embolism.

SEE -- RISKS OF PERIPHERAL IV THERAPY - NEXT PAGE

Risks of peripheral I.V. therapy

As with any invasive vascular procedure, peripheral I.V. therapy carries associated risks. Complications may be local, such as phlebitis, or systemic, such as circulatory overload or infection. This chart lists some common complications along with their signs and symptoms, possible causes, and nursing interventions, including preventive measures.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Phlebitis		
•Tenderness at tip of venipuncture devise and above •Redness at tip of catheter and along vein •Puffy area over vein •Vein hard on palpation •Elevated temperature	•Poor blood flow around venipuncture device •Friction from catheter movement in vein •Venipuncture device left in vein too long •Clotting at catheter tip (thrombophlebitis) •Solution with high or low pH or high osmolarity	•Remove venipuncture device •Apply warm pack •Notify doctor if patient has fever •Document patient's condition and your interventions. ***Prevention:*** •Restart infusion using larger vein for irritating infusate, or restart with smaller-gauge device to ensure adequate blood flow. •Use filter to reduce risk of phlebitis. •Tape venipuncture device securely to prevent motion.
Extravasation		
•Swelling at and above I.V. site (may extend along entire limb) •Discomfort, burning, or pain at site •Feeling of tightness at site •Decreased skin temperature around site •Blanching at site •Continuing fluid infusion even when vein is occluded, although rate may decrease •Absent backflow of blood •Slower flow rate	•Venipuncture device dislodged from vein or perforated vein	•Remove venipuncture device. •Apply ice (early) or warm soaks (later) to aid absorption. •Elevate limb. •Check for pulse and capillary refill periodically to assess circulation. •Restart infusion above infiltration site or in another limb. •Document patient's condition and your interventions. ***Prevention:*** •Check I.V. site frequently (especially when using I.V. pump). •Don't obscure area above site with tape •Teach patient to observe I.V. site and report pain or swelling
Catheter dislodgment		
•Loose tape •Catheter partly backed out of vein •Infusate infiltrating	•Loosened tape or tubing snagged in bedclothes, resulting in partial retraction of catheter	•If no infiltration occurs, retape without pushing catheter back into vein. ***Prevention:*** •Tape venipuncture device securely on insertion.

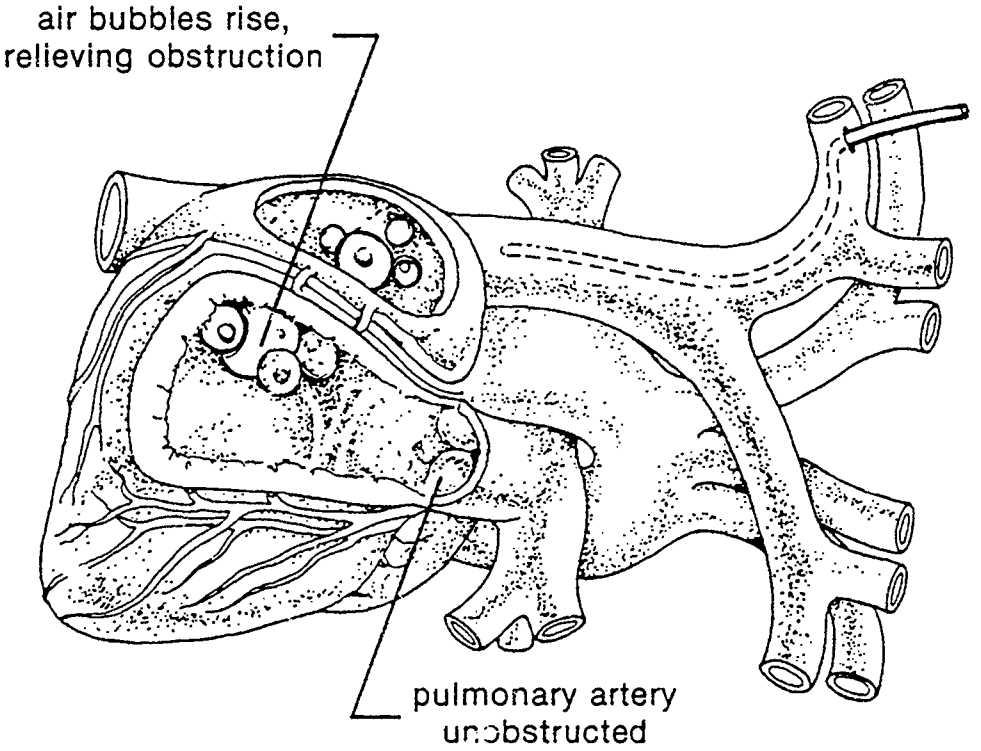
SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Occlusion		
•No increase in flow rate when I.V. container is raised •Blood backup in line •Discomfort at insertion site	•I.V. flow interrupted •Heparin lock not flushed •Blood backup in line when patient walks •Hypercoagulable patient •Line clamped too long	•Use mild flush injection. Don't force injection. If unsuccessful, reinsert I.V. line. ***Prevention:*** •Maintain I.V. flow rate •Flush promptly after intermittent piggyback administration. •Have patient walk with his arm folded to chest to reduce risk of blood backup.
Vein irritation or pain at I.V. site		
•Pain during infusion •Possible blanching if vasospasm occurs •Red skin over vein during infusion •Rapidly developing signs of phlebitis	•Solution with high or low pH or high osmolarity, such as 40 mEq/liter of potassium chloride; phenytoin; and some antibiotics (vancomycin and nafcillin)	•Slow the flow rate. •Try using an electronic flow device to achieve a steady flow. ***Prevention:*** •Dilute solutions before administration. For example, give antibiotics in 250-ml solution rather than 100 ml. If drug has low pH, ask pharmacist if drug can be buffered with sodium bicarbonate. (Refer to hospital policies) •If long-term therapy of irritating drug is planned, ask doctor to use central I.V. line.
Severed catheter		
•Leakage from catheter shaft	•Catheter inadvertently cut by scissors •Reinsertion of needle into catheter	•If broken part is visible, attempt to retrieve it. If unsuccessful, notify doctor. •If portion of catheter enters bloodstream, place tourniquet above I.V. site to prevent progression of broken portion. •Notify doctor and radiology department. •Document patient's condition and your interventions ***Prevention:*** •Don't use scissors around I.V. site. •Never reinsert needle into catheter. •Remove unsuccessfully inserted catheter and needle together.

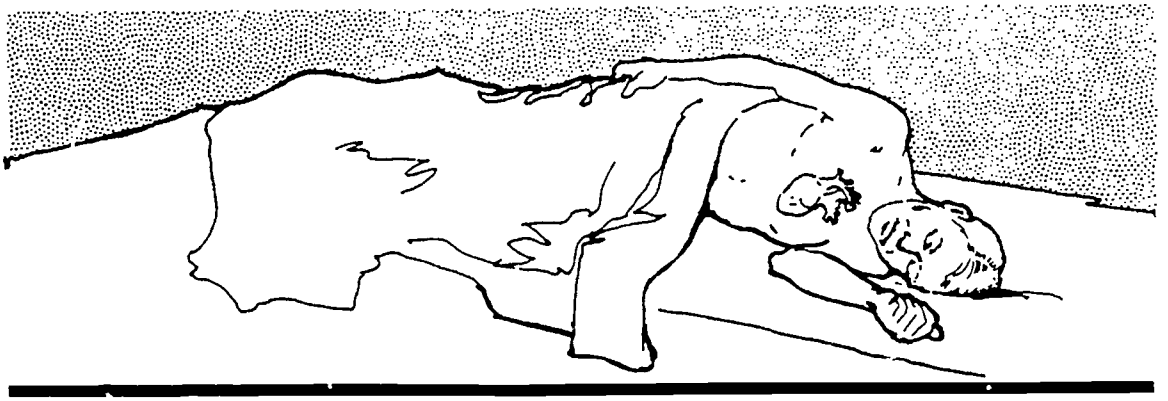
SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTION
Local complications		
Hematoma		
•Tenderness at venipuncture site •Area around site bruised •Inability to advance or flush I.V. line	•Vein punctured through other wall at time of venipuncture •Leakage of blood from needle displacement	•Remove venipuncture device. •Apply pressure and warm soaks to affected area. •Recheck for bleeding. •Document patient's condition and your interventions ***Prevention:*** •Choose a vein that can accommodate size of venipuncture device. •Release tourniquet as soon as successful insertion is achieved.
Venous spasm		
•Pain along vein •Flow rate sluggish when clamp completely open •Blanched skin over vein	•Severe vein irritation from irritating drugs or fluids •Administration of cold fluids or blood •Very rapid flow rate (with fluids at room temperature)	•Apply warm soaks over vein and surrounding area. •Slow flow rate ***Prevention:*** •Use blood warmer for blood or packed red blood cells.
Vasovagal reaction		
•Sudden collapse of vein during venipuncture •Sudden pallor accompanied by sweating, faintness, dizziness, and nausea •Decreased blood pressure	•Vasospasm from anxiety or pain	•Lower head of bed. •Have patient take deep breaths. •Check vital signs. ***Prevention:*** •Prepare patient adequately for therapy to relieve his anxiety. •Use local anesthetic to prevent pain of venipuncture.
Thrombosis		
•Painful, reddened, and swollen vein •Sluggish or stopped I.V. flow	•Injury to endothelial cells of vein wall, allowing platelets to adhere and thrombus to form	•Remove venipuncture device: restart infusion in opposite limb if possible. •Apply warm soaks •Watch for I.V. therapy related infection; thrombi provide an excellent environment for bacterial growth. ***Prevention:*** •Use proper venipuncture techniques to reduce injury to vein.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Thrombophlebitis		
•Severe discomfort •Reddened, swollen, and hardened vein	•Thrombosis and inflammation	•Same as for thrombosis ***Prevention:*** •Check site frequently. Remove venipuncture device at first sign of redness and tenderness.
Nerve, tendon, or ligament damage		
•Extreme pain (similar to electrical shock when nerve is punctured) •Numbness and muscle contraction •Delayed effects including paralysis, numbness, and deformity	•Improper venipuncture technique, resulting in injury to surrounding nerves, tendons, or ligaments •Tight taping or improper splinting with armboard	•Stop procedure ***Prevention:*** •Don't repeatedly penetrate tissues with venipuncture device •Don't apply excessive pressure when taping or encircle limb with tape. •Pad armboards and pad tape securing armboard if possible
Systemic complications		
Circulatory overload		
•Discomfort •Neck vein engorgement •Respiratory distress •Increased blood pressure •Crackles •Increased difference between fluid intake and output	•Roller clamp loosened to allow run-on infusion •Flow rate too rapid •Miscalculation of fluid requirements	•Raise the head of the bed. •Administer oxygen as needed. •Notify doctor. •Administer medications (probably furosemide) as ordered. ***Prevention:*** •Use pump, controller, or rate minder for elderly or compromised patients. •Recheck calculations of fluids requirements. •Monitor infusion frequently.
Systemic infection (septicemia or bacteremia)		
•Fever, chills, and malaise for no apparent reason •Contaminated I.V. site, usually with no visible signs of infection at site	•Failure to maintain aseptic technique during insertion or site care •Severe phlebitis, which can set up ideal conditions for organism growth •Poor taping that permits venipuncture device to move, which can introduce organisms into bloodstream •Prolonged indwelling time of venipuncture device •Immunocompromised patient	•Notify doctor •Administer medications as prescribed •Culture site and device. •Monitor vital signs. ***Prevention:*** •Use scrupulous aseptic technique when handling solutions and tubings, inserting venipuncture device, and discontinuing infusion. •Secure all connections. •Change I.V. solutions, tubing, and venipuncture device at recommended times. •Use I.V. filters

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Systemic complications		
Air embolism		
•Respiratory distress •Unequal breath sounds •Weak pulse •Increase central venous pressure •Decreased blood pressure •Loss of consciousness	•Solution container empty •Solution container empties, and added container pushes air down line	•Discontinue infusion. •Place patient in Trendelenburg's position to allow air to enter right atrium and disperse via pulmonary artery. •Administer oxygen •Notify doctor. •Document patient's condition and your interventions. ***Prevention:*** •Purge tubing of air completely before infusion •Use air-detection device on pump or air-eliminating filter proximal to I.V. site. •Secure connections.
Allergic reaction		
•Itching •Tearing eyes and runny nose •Bronchospasm •Wheezing •Urticarial rash •Edema at I.V. site •Anaphylactic reaction (may occur within minutes or up to 1 hour after exposure), including flushing, chills, anxiety, agitation, generalized itching, palpitations, paresthesia, throbbing in ears, wheezing, coughing, convulsions, and cardiac arrest	•Allergens such as medications	•If reaction occurs, stop infusion immediately. •Maintain patent airway. •Notify doctor. •Administer antihistaminic steroid, anti-inflammatory, and antipyretic drugs, as ordered. •Give 0.2 to 0.5 ml of 1:1,000 aqueous epinephrine subcutaneously. Repeat at 3-minute intervals and as needed. •Administer cortisone if ordered. ***Prevention:*** •Obtain patient's allergy history. Be aware of cross-allergies. •Assist with test dosing. •Monitor patient carefully during first 15 minutes of administration of a new drug.

Positioning the Patient with Air Embolism





Placing the patient in the left lateral and Trendelenburg's position relieves the obstruction of blood flow through the pulmonary artery.

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01.03 TASK: Provide Care of Patient Receiving IV Therapy (cont.)

2. Describe signs & symptoms of adverse drug reaction.

A. Adverse Drug Reactions

1. Consist of wide variety of toxic drug reactions, dose or non-dose related, that occur in therapeutic situations
2. Usually excludes non-therapeutic overdosage; example - attempted suicide
3. Can occur even when great care has been undertaken in prescribing
4. Should be distinguished from side effects which, though therapeutically undesirable, are a consequence of the drug's normal action
5. Can occur regardless of route of administration but are potentially more hazardous where drug is given intravenously due to immediacy of response
6. May be of a quantitative nature
   a. Tolerance - need for increasing amounts of a drug to produce the same therapeutic response; may develop after a drug has been given over a period of time
   b. Tachyphylaxis - rapidly developing tolerance to a drug occurring after only a very few doses have been given
   c. Cumulation - result of a drug having been given at a rate faster than it can be metabolized and excreted
   d. Intolerance - response greater than normal due to lowering of the threshold to normal pharmacological action
      (1) Referred to as hypersusceptibility
      (2) Requires that a lower than normal dose be given
7. May be of a qualitative nature
   a. Idiosyncrasy
      (1) Generally refers to an unpredictable reaction or symptoms which are different in quality from the expected response and which are not due to an allergic reaction
      (2) Evidence suggests that such reactions result from an enzyme deficiency interfering with the normal metabolism of the drug.
      (3) Sometimes an individual response
      (4) Believed to be a genetic deficiency of a familial or racial nature

b. Toxicity
   (1) Refers to the adverse effects which result directly from a pharmacological action of a drug
   (2) Generally dose-related, occurring when the dose given exceeds the therapeutic level
   (3) Can occur in some persons even though the drug was administered in the therapeutic dosage range
   (4) Types
      (a) Overdosage toxicity - predictable toxic effect that occurs with dosages in excess of the therapeutic range for a particular patient
      (b) Absolute overdosage toxicity - results from an error in the amount or frequency of administration of individual doses

B. Drug allergy (Hypersensitivity)
   1. Not most frequent adverse drug reaction
   2. Often responsible for most serious and fatal outcomes
   3. Is a response resulting from an antigen-antibody reaction or cell-mediated immunity
      a. Exposure to drug stimulates individual's immune system to form antibodies
      b. Once antibodies are present, individual is said to be sensitized
      c. On subsequent exposure to the drug an allergic response is evoked
   4. Types
      a. Type I
         (1) Reaction between antigen and antibodies that are bound to cells - releases histamine which acts on target organs and tissue
         (2) Sudden, generalized systemic reaction occurring within seconds to minutes after exposure to a causative agent
         (3) Signs and symptoms
            (a) Sense of uneasiness/anxiety
            (b) Diffuse erythema and feeling of warmth (with or without itching)
            (c) Hives on face and upper chest
            (d) Respiratory difficulty -choking sensation, swallowing difficulty, tightness or pain in chest, wheezing, shortness of breath, hoarseness

(c) Angioedema
CAUTION: With massive facial angioedema, expect that upper respiratory edema may occur.
(f) Severe abdominal cramps, nausea and vomiting
(g) Urinary and bowel incontinence
(h) Vascular collapse - cyanosis, pallor, imperceptible pulse
(i) Coma and death

(4) Treatment
(a) Must be instituted immediately since death can ensue in a matter of minutes
(b) Essential elements generally include:
1) Epinephrine to provide rapid relief of hypersensitivity reaction
2) Establishment patient airway
3) Establishment of a second, secure, patient IV line
4) Administration of antihistamine drugs
5) Administration of corticosteriods
6) Administration volume expanders
7) Administration aminophylline
8) Close nursing observation, including vital sign monitoring, for a least 24 hours after the reaction or until stable

(5) Documentation
(a) Drug causing the reaction
1) Name of drug
2) Dose of drug administered
3) Date and time of administration
4) Route of administration
5) Site of administration
(b) Reaction
1) Date and time
2) Clinical signs and symptoms
3) Duration of manifestation
(c) Treatment
1) Date and time
2) Airway establishment
3) Intravenous lines - sites and parenteral fluids
4) Drugs
5) Names of persons providing treatment

(d) Patient's response to treatment
(e) Follow-up monitoring
1) Vital signs
2) Observations
(f) Health teaching
1) Advisement of allergy
2) Significance of allergy
3) Availability of medical alert identification tags

b. Type II (cytotoxic or cytolytic)
(1) Antigen-antibody reaction occurs on cell surface resulting in cell destruction
(2) One responsible for hemolytic anemia of an allergic basis and other blood cell destruction
(3) May cause damage to individual organs
(4) Also called autoimmunity

c. Type III (arthus type)
(1) Antigen-antibody complexes form microprecipitates and circulate in the serum
(2) Symptoms (either accelerated or late)
(a) Fever
(b) Urticaria
(c) Arthralgia
(d) Edema
(e) Neuritis

d. Type IV (delayed)
(1) A cell-mediated immunity due to lymphocytes which have been sensitized
(2) Contact dermatitis due to this type of mechanism

C. Ascertaining Allergy History
1. At time of admittance patient should be questioned regarding allergy history.
2. Patient admitting to a drug allergy should be questioned as to the type of allergic symptoms experienced.
3. Questionable allergies should be communicated to the physician.
4. Prior to IV drug administration patient should again be questioned concerning allergy history.

D. Communication of Allergy History to Allied Health Team Members
   1. Must have a definitive policy regarding known allergy history of each patient
   2. Communication of allergy history must be provided to all allied health team members
      a. Inscription on nursing care plan
      b. Eye-catching special warning tapes applied to front of patient's chart
      c. Use of special allergy-denoting patient wrist bracelets
      d. Admitting notes
      e. Input of data in computer system

E. Drug-Produced Cross Reactions - may occur with related drugs: a person allergic to one drug has the potential for developing an allergic response to another related drug; example - penicillin and ampicillin

F. Nursing Implications - the nurse administering intravenous drugs is responsible for:
   1. Identifying patients who are most susceptible to drug allergy
   2. Instituting appropriate preventive measures
   3. Observing for allergic reaction
   4. Initiating/assisting in emergency treatment of an occurring allergic reaction

G. Monitoring Patient For Signs/Symptoms of Allergic Reactions
   1. Patient with no allergy history
      a. Remain in close proximity during first 5-15 minutes after drug has started infusing.
      b. Observe for:
         (1) Hives
         (2) Nasal congestion
         (3) Anxiety
         (4) Shortness of breath
         (5) Wheezing
         (6) Local reactions at the IV site
         (7) Angioneurotic edema
      c. In a manner that would not stimulate undue alarm, advise patient to report any of the above symptoms.
      d. Monitor confused/comatose patients every 5-10 minutes until initial dose of drug has infused.
      e. Check frequently during initial period of infusion of subsequent doses.

2. Patients with an allergic history
   a. Remain in close proximity during first 10-20 minutes after drug has started infusing.
   b. Have immediate access to emergency medications.
   c. Continue to monitor patient every one-half hour for several hours post-initial infusion.
   d. Advise patient to immediately report occurrence of
      (1) Difficulty of breathing
      (2) Wheezing
      (3) Any swelling
      (4) Any type of skin reaction

Untoward Drug Responses

Even when great care is taken to prescribe the dose of a drug or a particular drug, untoward effects, that is, effects which are unexpected and undesired can occur. These should be distinguished from *side effects,* which, though therapeutically undesirable, are a consequence of the drug's normal action.

Untoward drug responses are either QUANTITATIVE or QUALITATIVE.

Quantitative Drug Responses

Tolerance

Tachyphylaxis

Cumulation

Intolerance

Qualitative Drug Responses

Idiosyncrasy

Toxicity

Drug Allergy

Types of Allergic Response

Type I (Anaphylactic Type)

Type II (Cytotoxic or Cytolytic)

Type III (Arthus Type)

Type IV (Delayed Type)

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Signs and Symptoms of Anaphylactic Reaction

1. Sense of uneasiness/anxiety
2. Diffuse erythema and feeling of warmth (with or without itching)
3. Hives appearing on the face within the first few seconds after an injection
4. Respiratory Difficulty: Choking sensation, difficulty in swallowing, tightness or pain in the chest, wheezing and shortness of breath, hoarseness
5. Angioedema: CAUTION: With massive facial angioedema, expect that upper respiratory edema may occur
6. Severe abdominal cramps, nausea and vomiting, urinary and bowel incontinence
7. Vascular Collapse: Cyanosis, pallor, imperceptible pulse - circulatory failure leading to coma and death

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Documentation of Anaphylactic Reaction

1. DRUG CAUSING THE REACTION:
   - Name of the Drug
   - Date and Time of Administration
   - Route of Administration
   - Site of Administration
   - Amount of Drug Administered when Reaction Occurred

2. ANAPHYLACTIC REACTION:
   - Date and Time
   - All Clinical Signs and Symptoms Exhibited:
     a. Description
     b. Time of Occurrence
     c. Duration of Manifestation

3. EMERGENCY TREATMENT:
   - Date and Time of all Elements of Treatment:
     a. Airway Establishment
     b. Intravenous Sites Initiated
     c. Parenteral Solutions Administered
     d. Drugs Administered
     e. Names of Persons Providing Emergency Treatment

4. PATIENT'S RESPONSE TO TREATMENT

5. FOLLOW-UP MONITORING:
   - Vital Signs
   - Observations

6. HEALTH TEACHING:
   - Advisement of Allergy
   - Significance of Allergy
   - Availability of Medical Alert Identification Tags

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01.03 **TASK: Provide Care of Patient Receiving IV Therapy (cont.)**

3. Describe signs and symptoms of blood transfusion reaction.

   A. Hemolytic Rxn = shaking, chills, fever, nausea/vomiting, chest pain, dyspnea, hypotension, oliguria, hemoglobinuria, flank (back) pain. abnormal bleeding.

   B. Febrile Rxn = Fever, chills, headache, flank (back) pain.

   C. Allergic Rxn = Pruritus, uticaria, fever, chills, nausea/vomiting, facial swelling, wheezing, laryngeal edema.

   D. Bacterial contamination = Chills, fever, vomiting, abdominal cramping, diarrhea, shock, signs of renal failure.

01.03 TASK: **Provide Care of Patient Receiving IV Therapy (cont.)**

4. Assess body symptoms affected by IV therapy for signs & symptoms or complications or adverse reactions.

   A. Neuro: Change in level of consciousness from air embolism, fluid overload, or medication reaction.

   B. Cardiac: ↑ BP from fluid overload, ↓ BP from shock.

   C. Resp.: Crackles from fluid overload.

   D. GI/GU: Nausea/vomiting, from medication reaction.

   E. Integument: Edema from fluid overload, tissue sloughing from extravasation with irritating substance.

SEE ALSO 1.03 #1

01.03 TASK: Provide Care of Patient Receiving IV Therapy (cont.)

5. Assess peripheral IV site for signs & symptoms of complications including infiltration, infection, inflammation.

SEE 1.03 #1

01.03 **TASK: Provide Care of Patient Receiving IV Therapy (cont.)**

6. Provide site care & dressing change.

   See 1.02 #3

01.03 **TASK: Provide Care of Patient Receiving IV Therapy (cont.)**

7. Convert & flush heparin/saline lock.

Instructor Note: Provide lab for students to practice this skill maintaining aseptic technique.

Heparinization/Intermittent Infusion Sets

TIME SCHEDULE

REASON FOR HEPARIN LOCK UTILIZATION	TIME SCHEDULE FOR HEPARINIZATION
1. To provide immediate intravascular access in the event that the patient's status should change	Immediately after insertion of the heparin lock and then every 8-24 hours dependent upon type of cannula
2. For a daily IV push injection or daily IVPB infusion of full strength heparin	Immediately following the administration of the ordered full strength heparin and then every 8-24 hours dependent upon type of cannula
3. For multiple IV push injections or IVPB infusions of full strength during a 24 hour period	Immediately following each IV push injection or IVPB infusion of full strength heparin
4. For a daily IV push injection or IVPB infusion of any medications OTHER THAN heparin	Immediately following the administration of the medication and subsequent flushing of the heparin lock with bacteriostatic sodium chloride and then every 8-12 hours
5. For multiple IV push injections or IVPB infusions of any medications OTHER THAN heparin during a 24 hour period	Immediately following each administration of medication and subsequent flushing of the heparin lock with bacteriostatic sodium chloride

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8. Discontinue peripheral IV.

   A. Check for order to discontinue IV.
   B. Gather equipment (gauze 2 X 2), betadine wipe, band-aid
   C. Don gloves
   D. Carefully d/c tape and dressing and discard
   E. Hold gauze over insertion site and remove catheter while applying pressure
   F. Hold pressure until hemostasis is achieved
   G. Apply band-aid
   H. Required documentation
      1. Time & Date
      2. Catheter intact
      3. Reason for discontinuing therapy
      4. Patient reactions, complications, and nursing interventions
      5. Follow-up actions (dressing, pressure held, IV restarted)

01.03 **TASK: Provide Care of Patient Receiving IV Therapy (cont.)**

9. Report fluid imbalance, signs & symptoms of complications, adverse drug reaction, or blood transfusion reaction to RN/MD.

SEE 1.03 #3

01.03 TASK: Provide Care of Patient Receiving IV Therapy (cont.)

10. Record data related to intravenous therapy including site care, signs and symptoms of complications, adverse drug reaction or blood transfusion reaction on the appropriate chart form.

SEE 1.03 #3

01.04 **TASK: Provide Care of IV Therapy Equipment**

1. Assess equipment for operation
2. Change IV tubing.
3. Record equipment operation.
4. Adjust infusion pump to maintain infusion at prescribed rate.

Instructor Note: All 4 enabling objectives have been combined.

Prepare a lab for students to be able to practice skills.

01.05 TASK: Describe General Precautions in Administering IV Therapy

1. Relate general precautions that need to be applied to IV therapy: Universal precautions, patient comfort/safety, & fluid management.

   A. Protect patient

      1. Wash hands
      2. Clean venipuncture site
      3. Check the equipment
      4. Never reuse the catheter/needle
      5. Cover site with sterile dressing
      6. Change tubing according to policy

   B. Protect yourself

      1. Always wear gloves
      2. Never re-cap needles/catheters
      3. Wash hands
      4. Wear additional barriers as needed

APPENDIX A

CHECKLISTS FOR PART I

Learner's Name:_____ Date:_____

PART I - TASK 1.02

Checklist for Piggyback Administration of Intravenous Drugs via Secondary Line with Established Primary Line

Equipment:

Secondary Administration Set
Medication as ordered
Sterile gloves as needed

		Yes	No
1.	Wash hands.		
2.	Close clamp on secondary administration set.		
3.	Remove cover from spike on secondary administration set.		
4.	Squeeze drip chamber while inserting spike into piggyback container.		
5.	Suspend container.		
6.	Squeeze and release drip chamber until half-filled.		
7.	Remove protector from needle, partially open roller clamp and prime tubing slowly.		
8.	Close clamp and recover needle.		
9.	Label secondary administration set.		
10.	Prepare primary line's lower "Y" -port (secondary port) with antiseptic for one (1) minute.		
11.	Insert needle of secondary administration set.		
12.	Secure needle to port with tape courtesy tab.		
13.	Open secondary administration set control clamp and adjust flow rate for piggyback medication.		
	<u>After drug has been administered:</u>		
14.	Close control clamp on secondary administration set.		
15.	Disattach piggyback connection.		

Piggyback Administration of Intravenous Drugs via Secondary Line with Established Primary Line (cont.)		Yes	No
16.	Remove used needle and place in puncture-proof needle container.		
17.	Place new needle with protective cover on secondary administration set.		
18.	Place secondary administration set out of patient's reach.		
19.	Document.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.02

Checklist for Piggyback Administration of IV Drugs via Heparin Lock

Equipment:

Secondary Administration Set and separate sterile needle with cover intact
Antiseptic
Tape
Heparin Lock
Saline
Drug to be administered

		Yes	No
1.	Wash hands.		
2.	Close clamp on secondary administration set.		
3.	Remove cover from spike on secondary administration set.		
4.	Squeeze drip chamber while inserting spike into piggyback container.		
5.	Suspend container.		
6.	Squeeze and release drip chamber until half-filled.		
7.	Remove protector from needle.		
8.	Partially open roller clamp and prime tubing slowly.		
9.	Close clamp and recover needle.		
10.	Label secondary administration set.		
11.	Prepare heparin lock medication port with antiseptic.		
12.	Insert needle of syringe with N/S into heparin lock medication port. Aspirate for blood return and flush over (1) minute checking patency of heparin lock.		
13.	Insert needle of administration set and secure with courtesy tape.		
14.	Open secondary administration set control clamp and adjust flow rate.		
15.	Examine site for any signs of complications.		

Piggyback Administration of IV Drugs via Heparin Lock (cont.)	Yes	No
<u>After drug has been administered:</u> 16. Close control clamp on secondary administration set.		
17. Remove needle from heparin lock while stabilizing the lock.		
18. Replace used needle with sterile needle with cover intact to secondary administration set.		
19. Aseptically flush heparin lock with N/S over one (1) minute.		
20. Aseptically flush heparin lock with heparinized solution over one (1) minute.		
21. Document medication and heparin flush.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.02

Checklist for Application of Armboard/Restraints

Equipment:

Armboard
Restraint
Tape

	Yes	No
Armboard 1. Place extremity on armboard.		
2. Tape armboard to extremity using faced or back strapped tape.		
Restraints 1. Apply according to manufacturer's recommendations.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ _____
Student's Signature

_____
Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.03

Checklist for Discontinuance of IV Infusion

Equipment:

Sterile sponge
Sterile dressing
Sterile gloves
Disposable bag

		Yes	No
1.	Prepare for discontinuance.		
	a. Check order.		
	b. Wash hands.		
	c. Explain procedure to patient.		
	d. Close control clamp.		
	e. Put on protective gloves.		
2.	Remove cannula.		
	a. Stabilize cannula and remove tape and dressing.		
	b. Visually inspect site for evidence of local complications.		
	c. Place sterile sponge over site.		
	d. Quickly and smoothly remove cannula.		
	e. Elevate extremity and apply pressure to site.		
	f. Apply dressing to site.		
	g. Verify cannula was removed in entirety.		
	h. Remove glov. s/wash hands.		

Discontinuance of IV Infusion (cont.)		Yes	No
3.	Instruct patient.		
a.	Leave dressing 24 hours.		
b.	Avoid rubbing, scratching or bumping site.		
c.	Notify nurse if renewed bleeding or develops pain/discomfort.		
4.	Complete post-discontinuance procedures.		
a.	Dispose of equipment properly.		
b.	Charge for supplies used.		
c.	Document procedure properly.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.03

Checklist for Heparin Flush

Equipment:

Alcohol sponges	Sterile syringes
Normal saline	Heparinized saline
Disposal needle container	Disposal bag

		Yes	No
1.	Wash hands.		
2.	Explain the procedure to patient.		
3.	Verify injection cap securely attached to cannula.		
4.	Cleanse injection cap with alcohol for one (1) minute.		
5.	Using syringe containing NS, insert needle into cap and aspirate for blood return.		
6.	Inject NS over one (1) minute.		
7.	Insert needle of heparinized saline into injection cap and inject over one (1) minute.		
8.	Place syringes and needles in puncture-proof container.		
9.	Remove used and contaminated equipment from area and dispose of.		
10.	Charge for supplies used.		
11.	Document procedure.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.03

Checklist for Care of Infusion Site

Equipment:

Sterile gloves	Antimicrobial agent (alcohol or povidone-iodine solution)
Sterile dressing	Tape
Tape label	Disposal bag

		Yes	No
Gauze dressing:			
1.	Wash hands.		
2.	Explain the procedure to patient.		
3.	Put on protective gloves.		
4.	Stabilize cannula and remove tape and dressing from site.		
5.	Visually inspect site for evidence of developing complications.		
6.	Cleanse site and allow to dry (alcohol or povidone-iodine solution).		
7.	Apply antimicrobial agent, if applicable.		
8.	Apply sterile dressing and secure with tape.		
9.	Remove gloves		
10.	Reapply original label inscribed with insertion information to dressing, recopy if soiled or nonocclusive.		
11.	Apply tape label denoting dressing change information with date, time and initials.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.03

Checklist for Changing Transparent Dressing

Equipment:
Disposable sterile gloves
Antimicrobial agent
Sterile transparent dressing
Tape
Disposal bag for old dressings

	Yes	No
Transparent dressing:		
1. Wash hands.		
2. Explain the procedure to patient.		
3. Put on protective gloves.		
4. Stabilize cannula and remove existing transparent dressing.		
5. Visually inspect site for evidence of developing complications.		
6. Apply scant amount of antimicrobial agent, if applicable.		
7. Apply sterile transparent dressing.		
8. Remove gloves.		
9. Recopy insertion date on new label and apply to dressing.		
10. Apply small strip of tape denoting dressing change information with date, time and initials.		
Post Dressing Change:		
1. Remove contaminated dressing and rubbish from room and dispose of according to approved institutional policy.		
2. Charge for supplies used.		
3. Document procedure.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.04

Checklist for Changing Intravenous Container

Equipment:

IV Administration set:
Plastic bag/bottle
Time strip

		Yes	No
Plastic Bag/Plastic Bottle:			
1.	Wash hands.		
2.	Verify fluid order, correct patient, correct amount.		
3.	Remove outer plastic covering if present/check expiration date.		
4.	Check for particulate matter, cloudiness, leaks.		
5.	Ascertain that med port is securely covered.		
6.	Secure time strip to container.		
7.	Ascertain that cover over insertion port is secure.		
8.	Carefully remove insertion port covering with one swift motion.		
9.	Close tubing with roller clamp; check for presence of air in tubing/drip chamber.		
10.	Aseptically remove set from old container and insert into new container.		
11.	Invert container.		
12.	Open clamp and adjust to desired rate.		
13.	Document.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART I - TASK 1.04

Checklist for Changing Administration Set Tubing

Equipment:

Primary solution	New IV Administration Set
Tape	Sterile gloves
Disposal bag	Sterile dressing (2x2 or alcohol sponge)

		Yes	No
1.	Wash hands.		
2.	Prepare new container of primary solution and new IV administration set tubing.		
3.	Suspend from patient's IV standard.		
4.	Prepare tape.		
5.	Remove old tape from old tubing without disturbing cannula/cannula tape.		
6.	Put on protective gloves.		
7.	Place sterile 2x2 or alcohol sponge under cannula/tubing connection.		
8.	Close control clamp on old tubing.		
9.	Remove protective covering from new tubing.		
10.	Remove old tubing from cannula hub while stabilizing cannula.		
11.	Quickly insert new tubing into cannual.		
12.	Remove 2x2 or alcohol sponge.		
13.	Remove gloves.		
14.	Dispose of old tubing.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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TEST

POST-TEST FOR PART I
and
PRE-TEST FOR PART II

IV THERAPY FOR LPN's
PRE-TEST FOR PART II / POST-TEST FOR PART I

Beside each electrolyte, indicate whether it is intracellular (I) or extracellular(E).

1. _____ Potassium
2. _____ Phosphorus
3. _____ Sodium
4. _____ Chloride

Pick a statement from column B that describes column A.

A	B
5. _____ Isotonic	A.causes fluid to shift out of the intravascular compartment.
6. _____ Hypotonic	B.osmolality equal to that of serum.
7. _____ Hypertonic	C.draws fluid and electrolytes into the intravascular compartment.

Pick a solution from column B that describes column A.

A	B
8. _____ Isotonic	A.1/2 Normal Saline
9. _____ Hypotonic	B.D 5 1/2 Normal saline
10._____ Hypertonic	C.Lactated Ringers

Multiple Choice: For each of the following, circle the correct answer.

11. The oxygen carrying part of the blood is contained in the:

a. red blood cells
b. monocytes
c. plasma
d. platelets

12. The slanted portion of the tip of a needle is the:

a. flange
b. lumen
c. bevel
d. hub

13. If a patient's IV is running at 25 gtts/min through a tubing in which 15 gtts = 1 ml, how much fluid will he/she get in 1 hour?

a. 36 ml
b. 50 ml
c. 100 ml
d. 125 ml

14. The physician has ordered 3 liters of IV fluid to run over 24 hours. How many ml/hr will this be?

a. 50
b. 100
c. 125
d. 150

15. Convert 75 ml/hr to gtts/min (using 10 gtts/cc tubing).

16. Which of the following IV catheters is largest?

a. 18 gauge
b. 20 gauge
c. 23 gauge
d. 16 gauge

17. List 2 complications of IV therapy that can cause alterations of the cardiopulmonary system.

a.

b.

18. List 2 nursing responsibilities when monitoring fluid balance.

a.

b.

19. Match the following symptoms from column B to the complications in column A.

A	B
19. _____ Hematoma	A. Swelling adjacent to IV site, slowing/cessation of IV flow, skin cool to touch, pain
20. _____ Cellulitis	B. Obvious fragmentation of the catheter
21. _____ Infiltration	C. Redness, swelling, warm to the touch, pain, induration
22. _____ Infection at site	D. Chills, fever, malaise, nausea/vomiting, vascular collapse, shock
23. _____ Pyrogenic reaction	E. Tenderness, redness, warm to touch, swelling
24. _____ Circulatory Overload	F. Discoloration and/or swelling adjacent to venipuncture site.
25. _____ Phlebitis	G. Venous distention, engorged neck veins, dyspnea, tachypnea
26. _____ Catheter Emboli	H. possible increased temp., swelling, induration, warm, red, vein becomes tortuous, aching of entire extremity

Match the following complications from column A with the correct nursing interventions from column B.

A	B
27. _____ Catheter Emboli	A. Remain with the patient, slow rate to TKO, sit patient up, monitor vitals, call RN/MD
28. _____ Phlebitis	B. Discontinue site, notify RN/MD, culture cannula
29. _____ Circulatory Overload	C. Remain with patient, Apply tourniquet to involved extremity, notify RN/MD immediately.
30. _____ Infection at the site	D. Discontinue site, elevate extremity, warm compresses, notify RN/MD if irritating (vesicant) substance involved.
31. _____ Infiltration	E. Discontinue site, elevate extremity, warm compresses

32. CDC guidelines regarding blood contamination recommend:

a. wear protective gloves when performing procedures associated with blood contact.
b. do not recap needles or IV catheter stylets.
c. wear gown, mask, and protective eyeshades if blood spattering could occur.
d. A & C
e. all of the above.

Match the following types of IV tubing in column A to the proper description in column B.

A	B
33. _____ Minidrip (microdrip)	A. Used for administration of fluids and medicants with a primary line
34. _____ Macrodrip	B. Delivers very small amounts over a long period of time.
35. _____ Secondary set	C. Used to administer blood and blood components.
36. _____ "Y" set	D. Can be used for rapid infusion

Write "T" if statement is True and "F" if statement is false.

37. _____ Flow rates may vary depending on the patients position.

38. _____ Warm refrigerated fluids by submerging in hot water before administering.

39. _____ IVPB administration sets do not have to be changed as frequently as the primary sets.

40. _____ Blood and blood component sets should be changed every 24 hours.

41. _____ Monitoring of IVs should include the rate of flow, amount of solution remaining, and the site.

42. _____ If you are certain the heparin lock is patent, it is not necessary to flush with normal saline before and/or after drug delivery.

43. _____ If more than one (1) unit of blood is to be given, both may be issued. One may be kept in the unit refrigerator until needed.

44. _____ Blood must <u>never</u> be given to a patient lacking an identification bracelet.

45. _____ Vital signs should always be taken prior to initiation of a transfusion.

46. _____ Medications should be added via the lowest part of the blood administration set to insure as short as possible contact with the blood.

47. _____ Patients are not to be scheduled for diagnostic tests or therapy necessitating transporting to another Department during a transfusion.

48. List 4 nursing interventions that should be done for all suspected blood transfusions.

a.

b.

c.

d.

49. When administering blood or blood components you must do all of the following except:

a. check cross typing
b. check expiration date
c. use a blood warmer
d. observe for cell clumping

50. List 4 signs/symptoms of hemolytic or febrile blood reactions.

a.

b.

c.

d.

ANSWER KEY FOR TEST

ANSWER KEY

IV THERAPY FOR LPN's
PRE-TEST FOR PART II / POST-TEST FOR PART I

Beside each electrolyte, indicate whether it is intracellular (I) or extracellular(E).

1. I Potassium
2. I Phosphorus
3. E Sodium
4. E Chloride

Pick a statement from column B that describes column A.

A	B
5. B Isotonic	A.causes fluid to shift out of the intravascular compartment.
6. A Hypotonic	B.osmolality equal to that of serum.
7. C Hypertonic	C.draws fluid and electrolytes into the intravascular compartment.

Pick a solution from column B that describes column A.

A	B
8. C Isotonic	A.1/2 Normal Saline
9. A Hypotonic	B.D 5 1/2 Normal saline
10. B Hypertonic	C.Lactated Ringers

Multiple Choice: For each of the following, circle the correct answer.

11. The oxygen carrying part of the blood is contained in the:

(a). red blood cells
b. monocytes
c. plasma
d. platelets

12. The slanted portion of the tip of a needle is the:

a. flange
b. lumen
©. bevel
d. hub

13. If a patient's IV is running at 25 gtts/min through a tubing in which 15 gtts = 1 ml, how much fluid will he/she get in 1 hour?

a. 36 ml
b. 50 ml
©. 100 ml
d. 125 ml

14. The physician has ordered 3 liters of IV fluid to run over 24 hours. How many ml/hr will this be?

a. 50
b. 100
©. 125
d. 150

15. Convert 75 ml/hr to gtts/min (using 10 gtts/cc tubing).

$$\frac{75\ ml/hr \times 10\ gtts/ml}{60} = 12.5\ gtts/min$$

16. Which of the following IV catheters is largest?

a. 18 gauge
b. 20 gauge
c. 23 gauge
@. 16 gauge

17. List 2 complications of IV therapy that can cause alterations of the cardiopulmonary system.

medication reaction (incl. blood)

a. *fluid/electrolyte imbalance*
fluid overload

b. *septicemia*
emboli
vasovagal reaction

18. List 2 nursing responsibilities when monitoring fluid balance.

a. *accurate I & O*

b. *daily weights*

19. Match the following symptoms from column B to the complications in column A.

A	B
19. __F__ Hematoma	A. Swelling adjacent to IV site, slowing/cessation of IV flow, skin cool to touch, pain
20. __C__ Cellulitis	B. Obvious fragmentation of the catheter
21. __A__ Infiltration	C. Redness, swelling, warm to the touch, pain, induration
22. __H__ Infection at site	D. Chills, fever, malaise, nausea/vomiting, vascular collapse, shock
23. __D__ Pyrogenic reaction	E. Tenderness, redness, warm to touch, swelling
24. __G__ Circulatory Overload	F. Discoloration and/or swelling adjacent to venipuncture site.
25. __E__ Phlebitis	G. Venous distention, engorged neck veins, dyspnea, tachypnea
26. __B__ Catheter Emboli	H. possible increased temp., swelling, induration, warm, red, vein becomes tortuous, aching of entire extremity

Match the following complications from column A with the correct nursing interventions from column B.

A	B
27. __C__ Catheter Emboli	A. Remain with the patient, slow rate to TKO, sit patient up, monitor vitals, call RN/MD
28. __E__ Phlebitis	B. Discontinue site, notify RN/MD, culture cannula
29. __A__ Circulatory Overload	C. Remain with patient, Apply tourniquet to involved extremity, notify RN/MD immediately.
30. __B__ Infection at the site	D. Discontinue site, elevate extremity, warm compresses, notify RN/MD if irritating (vesicant) substance involved.
31. __D__ Infiltration	E. Discontinue site, elevate extremity, warm compresses

32. CDC guidelines regarding blood contamination recommend:

a. wear protective gloves when performing procedures associated with blood contact.
b. do not recap needles or IV catheter stylets.
c. wear gown, mask, and protective eyeshades if blood spattering could occur.
d. A & C
(e). all of the above.

Match the following types of IV tubing in column A to the proper description in column B.

A	B
33. __B__ Minidrip (microdrip)	A. Used for administration of fluids and medicants with a primary line
34. __D__ Macrodrip	B. Delivers very small amounts over a long period of time.
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36. __C__ "Y" set	D. Can be used for rapid infusion

Write "T" if statement is True and "F" if statement is false.

37. T Flow rates may vary depending on the patients position.

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46. F Medications should be added via the lowest part of the blood administration set to insure as short as possible contact with the blood.

47. T Patients are not to be scheduled for diagnostic tests or therapy necessitating transporting to another Department during a transfusion.

48. List 4 nursing interventions that should be done for all suspected blood transfusions.

a. *stop transfusion*

b. *TKO c̄ NS*

c. *notify MD/RN*

d. *notify blood bank*

49. When administering blood or blood components you must do all of the following except:

a. check cross typing
b. check expiration date
©. use a blood warmer
d. observe for cell clumping

50. List 4 signs/symptoms of hemolytic or febrile blood reactions.

a. *shaking*
   chills
b. *fever*
   nausea/vomiting
c. *chest pain*
   dyspnea
d. *↓blood pressure*
   oliguria
   hemoglobinuria
   flank (back) pain
   headache

PART II

INTRAVENOUS THERAPY INSTRUCTION

FOR

LICENSED PRACTICAL NURSES

PART II - INTRAVENOUS THERAPY FOR LICENSED PRACTICAL NURSES

02.0 INITIATE, MAINTAIN AND MONITOR INTRAVENOUS INFUSIONS

02.01 TASK: Describe Role of the LPN Relative to IV Initiation

1. Identify and explain the legal & ethical aspects of his/her role in IV therapy.

2. Identify his/her responsibility to the patient, the institution, and the nursing profession.

3. Define "legal scope of practice".

4. Research related policies/procedures of employing institution and correlate with the Idaho Nurse Practice Act.

   A. Standards, Rules, & Regulations Governing the Practice of Nursing by the Idaho State Board of Nursing - the following is a list of what LPNs may do under the direction or supervision of a professional nurse, licensed physician, or licensed dentist. Some facilities may not allow LPNs to do all of these and **you must do only what is allowed by the employing agency.**

      1. Observe & monitor IV infusions.
      2. Hang containers of medicated or unmedicated IV solutions which are commercially prepared or pre-mixed by the pharmacy.
      3. Hang blood or blood derivatives.
      4. Adjust the drip rate on IV infusions, including IV pumps.
      5. Fill solusets & volume controls.
      6. Change IV tubing.
      7. Flush heparin/saline locks.
      8. Discontinue IV infusions.
      9. Perform venipunctures to draw blood for laboratory testing.
      10. Convert an IV infusion to a heparin/saline lock.
      11. Attach a medication vial with a screw-on top to a container of diluent solution then hang the solution if pharmacy dispenses the vial and diluent solution as a unit or if pharmacy attaches a label to the medication vial specifying the name and amount of diluent solution.
      12. Perform venipunctures to start IV infusions.

13. Perform the following for a stabilized patient with a long term central venous catheter:
    a. Hang containers of unmedicated or medicated solutions, premixed by a pharmacy.
    b. Change dressings.
    c. Change IV tubing.
    d. Adjust drip rates.
14. Identify his/her responsibility to the patient, the institution and the nursing profession.
15. Select the appropriate equipment.
16. Prepare the equipment correctly.
17. Select the appropriate insertion site.
18. Correct site preparation.
19. Correctly secure the venipuncture device and dress the site.

B. The LPN may not:
    1. Hang titrated or continously monitored medicated IV solutions.
    2. Administer any medication by IV push.
    3. Discontinue central lines.

C. LPN's must research related policies /procedures of employing institution and correlate with the Idaho Nurse Practice Board.

Instructor Note: Have LPNs go to their institutions and research what their policies say they may do. Be sure they understand that they may only perform skills/tasks that are covered by their institution policy and the rules/regulations of the Idaho State Board.

02.02 TASK: Prepare the Patient for the IV Infusion

1. Identify reasons for an IV infusion.

   A. Restore or maintain fluids and electrolyte balance (when unable to take PO).
   B. Administer water soluable medications.
   C. Transfuse blood.
   D. Deliver parenteral nutrition solutions TPN.
   E. Life-line in case medications are needed.

2. Determine concerns the patient and/or the nurse may have regarding the procedure.

   A. Assess the patient's knowledge base and concerns regarding IV therapy.
      1. Knowledge of venipuncture and IV therapy.
         a. Previous experience.
         b. Conception that IV therapy is reserved for seriously ill.
      2. Expectations.
         a. Pain - "Will it hurt?"
         b. Decreased activity - "Can I move my arm? Can I go to bathroom?"
         c. Length of therapy - "How long will this IV be in?"
   B. Assess nurse's own fears and concerns regarding IV therapy.
      1. Concern about pain - "I may hurt the patient."
      2. Concern of not being able to find a vein.
      3. Concern of not being able to insert the IV needle the first time.

3. Describe nursing responsibilities/interventions related to patient comfort, privacy and safety.

A. Discuss with patient the following areas.
   1. Reasons IV therapy is needed.
   2. IV insertion and therapy procedure.
      a. Adult: IV means "inside the vein". A plastic catheter is placed inside the vein and fluids from a bottle will flow through a tubing and then through a plastic catheter into a vein.
      b. Child: a "plastic straw" is used to give medication/fluid through; a needle is used at first, but then it is thrown away.
   3. Approximate length of time for IV therapy.
   4. Activity restrictions.
   5. Care of IV site.
      a. Report any discomfort at IV site.
      b. Keep dressing dry, report wet or loose dressing to nurse.
   6. Care of IV line.
      a. IV bottle/bag must remain above heart.
      b. Care taken in not lying on or pulling at tubing.
      c. Report IV rate increase or decrease.
   7. Procedure for discontinuing IV.

B. Evaluate patient teaching.

C. Document patient teaching in nurse's notes.

4. Discuss body fluid precautions as identified by the Centers for Disease Control.

A. The Centers for Disease Control (CDC) now recommends that health care providers take blood and body fluid precautions with all patients.

B. Universal precautions are especially important in emergency care settings, where the risk of exposure to blood is greater and the patient's infection status is usually unknown.

C. The CDC specifically recommends that **all** health care providers:

1. Wear gloves when touching blood and body fluids, mucous membranes, or broken skin of all patients. Gloves should also be worn when handling items or surfaces soiled with blood or body fluids and while performing **venipunctures** or other procedures that would involve vascular access. Change gloves after contact with each patient.
2. Prevent exposure to mucous membranes of the mouth, nose, and eyes when performing procedures that may cause spattering of blood or other body fluids. Wear masks, protective eye wear or face shields, and gowns or aprons as necessary.
3. Wash hands and other skin surfaces immediately and thoroughly if they become contaminated with blood or other body fluids. Hands should also be washed immediately after removing gloves.
4. Care should be taken to prevent injuries from needles, scapels, and other sharp instruments. Special care should be employed when performing procedures, cleaning used instruments, disposing of used needles, and handling sharp instruments after procedures. To prevent needlestick injuries, **DO NOT RECAP**, bend or break needles; **DO NOT** remove them from disposable syringes or otherwise manipulate them by hand.
5. Place used disposable syringes and needles, scapel blades, and other sharp items in puncture-resistant containers for disposal. (These containers should be placed as close as practical to the area where they would be needed. Place large-bore reusable needles in a puncture-resistant container for transport to the appropriate reprocessing area.

D. Special circumstances: The CDC also recommends that health care providers who have exudative leisons or weeping dermatitis **not perform** any direct patient care or handle patient care equipment until the condition clears.

E. According to the CDC, health care providers should take the following precautions with invasive procedures:

1. Routinely use appropriate barrier precautions to prevent skin and mucous membrane contact with blood or body fluids of all patients. Wear gloves and surgical masks for **all invasive procedures.** Use protective eye wear or face shields and gowns or aprons for procedures that commonly cause droplets, splashes of blood or body fluids, or bone chips.
2. If a glove is torn or punctured, it should be removed and a new glove put on.

Excepted and adapted from "Recommendations for Prevention of Human Immunodeficiency Virus (HIV) Transmission in Health-Care Settings" Centers for Disease Control, Morbidity and Mortality Weekly Report, August 21, 1987.

The U.S. Department of Labor Mandates AIDS Protection:

Compliance with the CDC Guidelines by health care institutions are **mandatory** and are being enforced by the department's Occupational Safety and Health Administration (OSHA). Institutions failing to comply with the mandatory guidelines could be fined up to $10,000. Effective October, 1987.

02.03 **TASK: Implement Nursing Interventions for the Patient Within Any Level of Growth and Development (LPNs are limited to IV therapy of children seven years and older, until completion of IV Therapy training).**

1. Discuss special needs of the pediatric patient (seven years of age and older) needing IV therapy relative to:

   A. Structure & function of the cardiovascular and integumentary systems.
   B. Emotional & cognitive development.
      1. Definition by age of the pediatric patient.
         a. Newborn - 0-4 weeks
         b. Infant - 1 year
         c. Toddler - 1-3 years
         d. Preschool - 3-5 years
         e. School age - 6-12 years
         f. Adolescent - 13-18 years
      2. Psychological considerations of intravenous therapy in pediatric patients.
         a. Explain the procedure and provide support. The child will be less fearful if he/she understands the procedure.
            (1) For the child.
               (a) Use language the child can understand.
               (b) Base on child's age, developmental stage and level, and previous knowledge and expectations.
                  1) Young infants (1-3 months)
                     a) Possess a built-in stimulus barrier that causes reactive delays and possibly reduces sensitivity.
                     b) Intellectual level and lack of experience tend to minimize fear and anxiety.
                     c) Restricted movement; prolonged discomfort, and deep painful stimuli cause distress.
                     d) Gentle handling, stroking, and a soothing voice can provide some comfort during and after procedure.

2) Older infants (up to 12 months).
   a) Generally anticipate pain-cry, struggle, and wiggle.
   b) Parents may be helpful in comforting children of this age.
   c) Support given by stroking and verbal reassurance in soothing voice.
3) Toddlers (1-3 years) and preschool children (3-5 years).
   a) Reactions are influenced by previous experiences and fantasies. Give children enough information so they don't fantasize.
   b) Language limitations may result in physical expressions of fear, crying, striking at nurse, pulling away.
   c) Play therapy with objects of care as applied to self or doll.
   d) Tell child pain will occur with procedure.
   e) Tell child it is all right to cry with procedure, but set limitations of motion.
   f) Reassure child of not being alone during procedure.
4) School age children (6-12 years).
   a) Child has intellectual capacity to understand the purpose of procedure and technique used.
   b) Will be able to cooperate when he/she knows what behavior is expected.
   c) Allow time for verbalization of fears and concerns. May have fear of mutilation.
   d) Play therapy may assist in dramatizing fears and/or concerns, as may simple anatomical drawings or readings about the procedure.
   e) Allow time to familiarize child with procedure and equipment.

f) Give truthful and appropriate explanation.

g) Time preparation of child so it is adequate but not too far in advance to allow for unnecessary worry.

5) Adolescents (13-18 years).

a) Information given is similar to that of adult.

b) Particularly concerned about body image/appearance, threatened by illness and helplessness.

c) Detail truthful explanations as much as necessary.

(c) Encourage to express his/her version of what is going to occur, listen to what they have to say.

(d) Provide child with a sense of control by allowing choices when possible.

1) What side to use.

2) How they can/want to help.

(e) Acknowledge and accept fears - assurance that it is all right to be afraid and to to cry.

(f) Positive feedback during procedure (ex. "great", "you're doing really well").

(2) For the parent.

(a) Include parents when procedure is explained to child; may act as liaison.

(b) Assess parent-child interaction to determine effectiveness of parents in supporting the child.

(c) If parents desire, allow them to assist in caring for child.

1) Question parent(s) regarding ability to cope during physical presence while procedure is being performed on child.

2) Stress importance of emotional and physical comfort to child during and after procedure.

3) Do not ask parent(s) to restrain child or participate in any way with venipuncture. Parent is a "safe" person.

b. Insertion of IV cannula should be done in treatment room.
   (1) Allows child to associate bed and room with comfort and security.
   (2) Physically removed from other pediatric patients.
c. Post-procedure.
   (1) Praise behavior.
   (2) Allow child to talk about or play out feelings.
   (3) Use of colorful bandaides.

3. Principles of pediatric fluid and electrolyte balance relevant to IV therapy.
   a. The younger the child, the greater the risk of fluid and electrolyte imbalance as well as fluid overload and congestive heart failure. Many frequently ordered medications contain considerable amounts of electrolytes.
   b. Pediatric patients have immature homeostatic regulating mechanisms.
   c. A young child has a larger body surface in relation to weight resulting in greater fluid losses than the adult.
   d. Metabolic rate is about three times faster than the adult which increases water requirements.
   e. Pediatric patients have a tendency to develop metabolic acidosis.

4. Equipment selection for the pediatric patient.
   a. Cannula
      (1) Winged-tip needle unit (butterfly, scalp-vein needle).
         (a) Neonate - 25-27 G
         (b) Older child - 23-25 G
         (c) Size depends on: age, size, fluids to be administered, site.
      (2) Inlying catheter (cutdown) - 22 G.
      (3) ONC and/or INC
      (4) Umbilical - radiopaque catheters Fr 3.5, 5.0, or 8.0.
   b. Containers
      (1) Plastic is recommended - if glass container is used, it should be cushioned.
      (2) Smaller volume
         (a) Infants - 250 ml maximum.
         (b) Less than 12 years old - 500 ml maximum.
         (c) Over 12 years old - same as adult.
   c. Administration set - pediatric infusion set (volume-control set)
      (1) Used for all children under 12 years.
      (2) If volume-control sets unavailable, microdrip (minidrip) sets through age 12.
      (3) For newborns and infants, fill volume-control chamber with no more than one third of the day's requirement each time.

d. Electronic flow control devices may be used for delivery of ordered therapy.
   (1) Flow rate should be tenths of ml, if possible.
   (2) Should be tamper-proof.
   (3) Should know accuracy of device (10% deviation could result in a major problem with infant/small child).
   CAUTION: Does not take place of nurse, continue to carefully monitor fluid volume.

5. Pediatric Infusion Sites.
   a. Peripheral veins.
      (1) Dorsal hand veins.
         (a) Often preferred - allows for mobility.
         (b) Avoid using dominant hand or thumb-sucking hand.
      (2) Dorsal foot veins and flexion surfaces of the wrist.
         (a) May need only grasp of an assistant around extremity instead of a tourniquet.
         (b) Immobilize extremity with padded board but always maintain normal joint configuration.
      (3) Antecubital fossa.
         (a) Generally unsatisfactory as hard to immobilize.
         (b) More favorable in older children.
         (c) Use armboard or sandbag to immobilize joint.
         (d) Allow child to select arm to be used.
      (4) Scalp veins.
         (a) Often used in neonates and young infants up to approximately one year.
         (b) Sites: superficial temporal, supraorbital, posterior auricular, facial veins.
         (c) To dilate, place head lower than rest of body which will usually cause crying. Crying, along with lowered head, will help raise scalp veins. May also place rubber band around head (above ears) to act as a tourniquet.
         (d) Can create psychological distress for parents.
         (e) Must be well-protected to prevent dislodgement. A small paper cup or medicine cup may be placed over IV site for protection.
   b. Central veins.
      (1) External jugular for infants and toddlers.
      (2) Subclavian for the older child.

6. Nursing Care
   a. Maintenance of flow rate.
      (1) Appropriate equipment.
         (a) Pediatric infusion set.
         (b) Minidrip solution administration set.
      (2) Regulate flow rate while patient is at rest; crying constricts vessels.
      (3) Constant rate must be maintained - fluctuating rate may result in erratic blood glucose or overhydration resulting in congestive heart failure and/or pulmonary edema.
      (4) Infusion pump must be used with umbilical arterial catheter to maintain an infusion pressure greater than aortic pressure.
   b. Assess patient.
      (1) General condition.
         (a) Assess IV site every half hour.
         (b) Activity/behavior.
         (c) Nature of cry.
         (d) Vital signs.
         (e) Fontanelles.
         (f) Skin turgor.
         (g) Physical appearance.
      (2) Observe for complications.
         (a) Irritability.
         (b) Lethargy.
         (c) Pallor.
         (d) Changes in bowel movements.
         (e) Changes in vital signs.
         (f) Redness and swelling at site.
         (g) Dependent edema (infiltration more difficult to assess because of increased body fat.
         (h) Decreased urinary output.
         (i) Acute weight loss or gain (5%).
         (j) Absence of tears and salivation.
         (k) Specific to scalp vein site.
            1) Facial and head asymmetry.
            2) Sloughing and necrosis with infiltration of hypertonic solutions.

c. Keep accurate intake and output record.
   (1) Intake.
      (a) Hourly record of type and amount of fluid received.
      (b) Running totals.
         1) Rate of flow.
         2) Amount of fluid added to chamber.
         3) Amount of fluid remaining in bottle/chamber.
   (2) Output.
      (a) Record urinary output.
         1) Urine collecting container.
         2) Weighing diaper.
      (b) Accurate record of blood withdrawn for lab.
      (c) Record amounts, color, and characteristics of drainage, stools, emesis.

d. Provide accurate daily weight record.
   (1) Same scale.
   (2) Same time of day.
   (3) Same amount of clothing.

e. Know normal lab values.

7. Special pediatric procedures.
   a. Umbilical catheterization.
      (1) Performed by surgeon.
      (2) Used for emergency IV therapy when peripheral access unachievable.
      (3) Insertion successful up to three days of life.
      (4) Can be left in place 3-7 days.

8. Heparin flush strengths.
   a. Pediatrics.
      (1) 10 units/ml.
      (2) Frequency of administration is dependant upon ordered therapy.
   b. Neonates.
      (1) Should be preservation-free flush solution - benzyl alcohol preservative is toxic to neonates.
      (2) Frequency of administration dependant upon ordered therapy.

02.03 **TASK: Implement Nursing Interventions for the Patient Within Any Level of Growth and Development (LPNs are limited to IV therapy of children seven years and older, until completion of IV Therapy training). (cont.)**

2. Describe physiological and psychosocial changes and needs of the elderly patient which might impact the IV procedure.

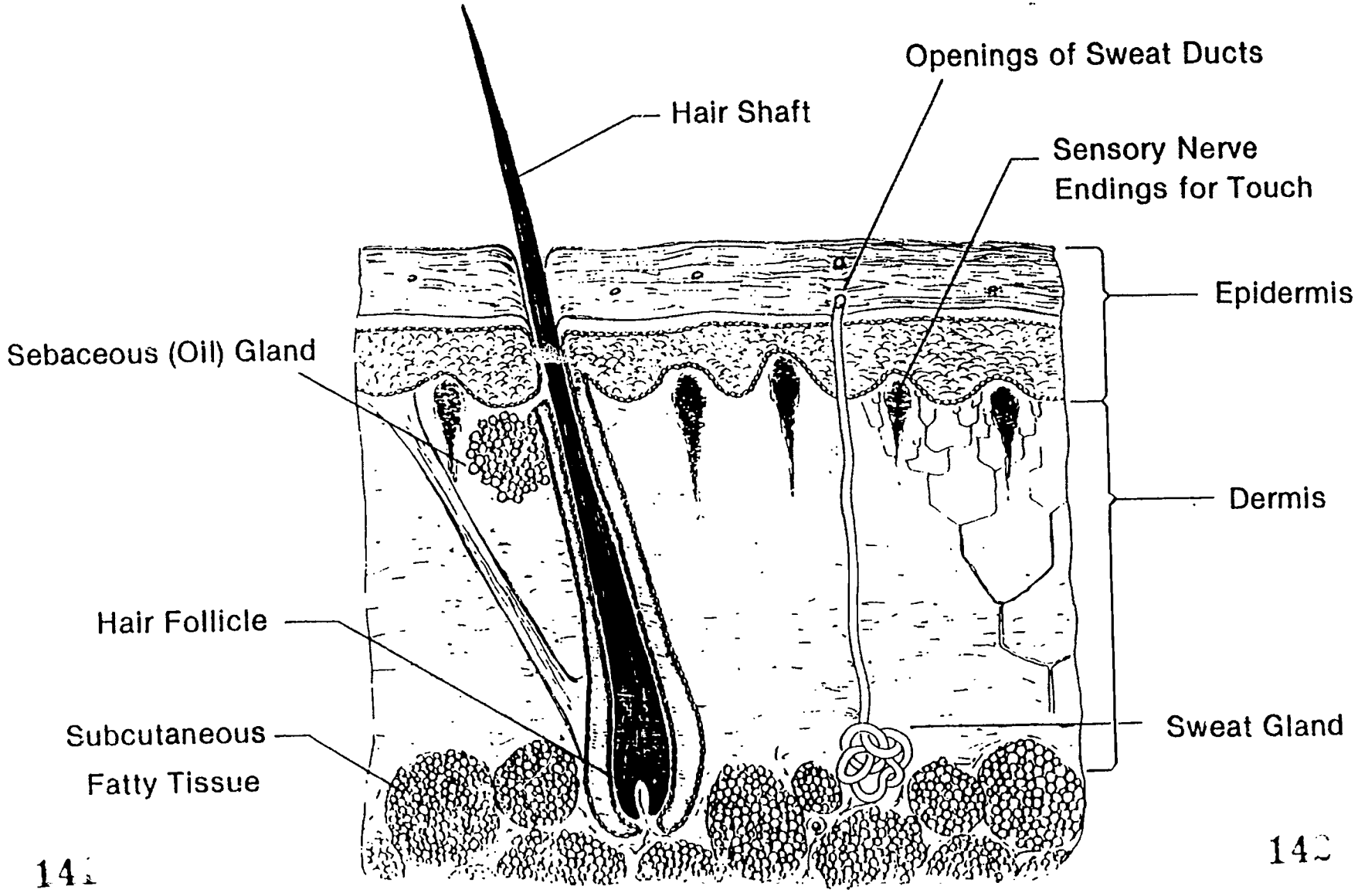
A. Physiologic changes related to IV therapy.
   1. Loss of tissue elasticity.
      a. Loss of skin integrity.
      b. Loss of resiliency and moisture.
   2. Elastic fibers fragment, split, straighten.
   3. Calcium leaves the bones and is deposited in the vessels.
   4. Lumen of vessels is decreased and causes blood flow to various organs to become uneven.
   5. Cardiac muscle cells decrease in size, but heart appears larger due to narrowed and changed dimension of thoracic structure; reduces efficiency of hear muscle, decreased cardiac output.
   6. Subcutaneous fat is lost.
   7. Decreased ability to metabolize glucose.

B. Possible psychological changes.
   1. Senility - forgetfulness.
   2. Impairment - confusion.
   3. Depression.

C. IV principles.
   1. Use extreme caution in site selection.
      a. Least accessible site.
      b. Avoid dominant hand when possible.
      c. Least fragil vein.
      d. As much bone support under vein as possible.
      e. Metacarpal veins are not desirable as there is not enough subcutaneous tissue to support.
   2. Insertion of cannula.
      a. More gentle prep of skin.
      b. Be aware of increased hematoma formation with contusion to area.
      c. Observe closely for distention of veins due to increased venous pressure, eliminating need for standard tourniquet.
      d. Observe for sclerosed veins.
      e. Secure with paper tape or kerlix due to skin fragility.
   3. Maintenance.
      a. Observe at least every 1/2 hour.
      b. Reorient patient to procedure frequently, if applicable.
      c. Employ safety measures if indicated (armboard, restraints, protective gauze wrap).

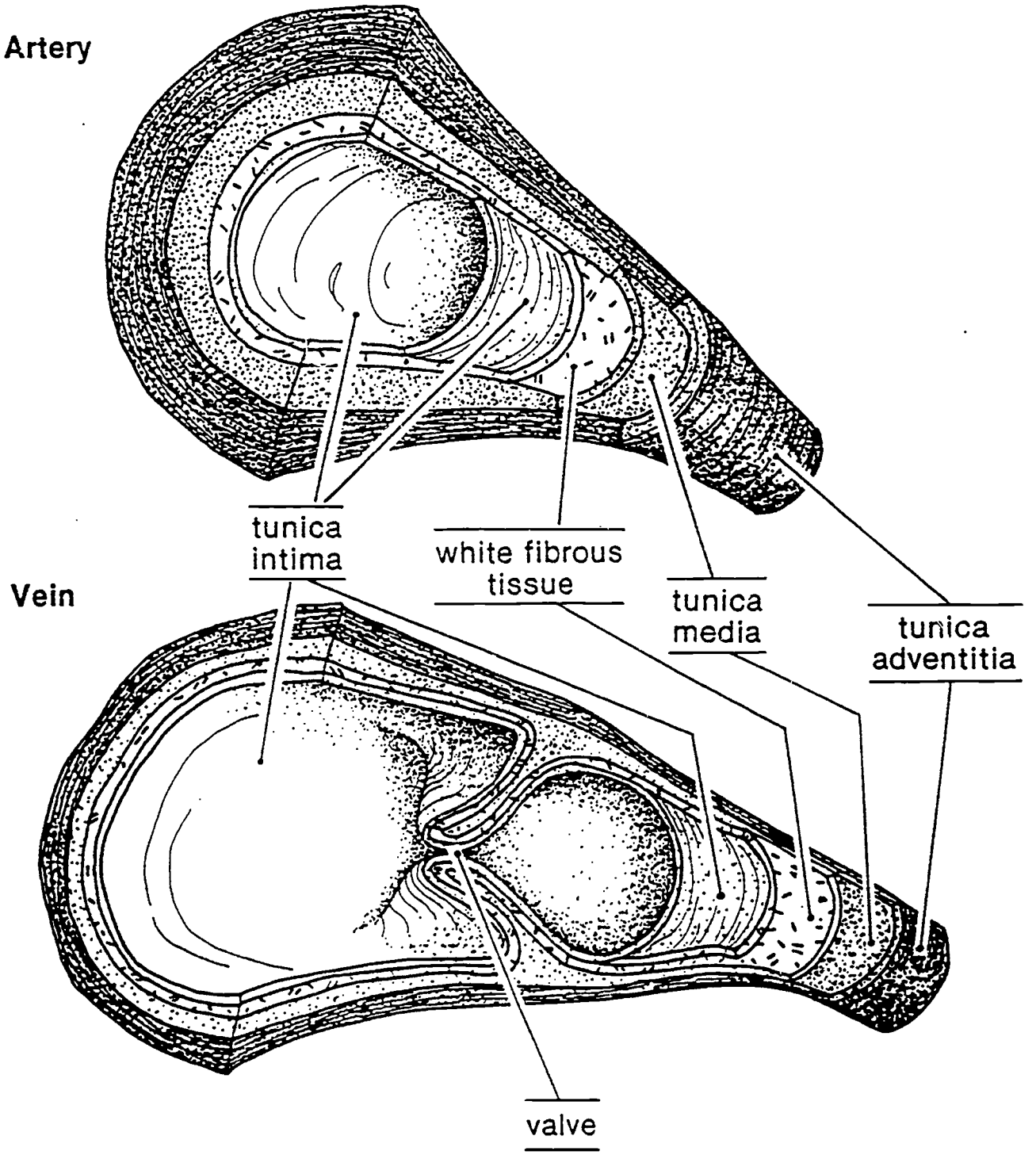
4. Observation - increased risk for:
   a. CHF.
   b. Pulmonary edema.
   c. Glycosuria.
   d. Injury due to self removal of cannula.
   e. Infiltration.
   f. Hematoma.

The Skin



From Intravenous Fluid Therapy Course For The LPN Instructor Guide, Columbia, MO, 1988.
Reprinted courtesy of I.M.I., Univ. of Missouri-Columbia.

Blood Vessel Structure



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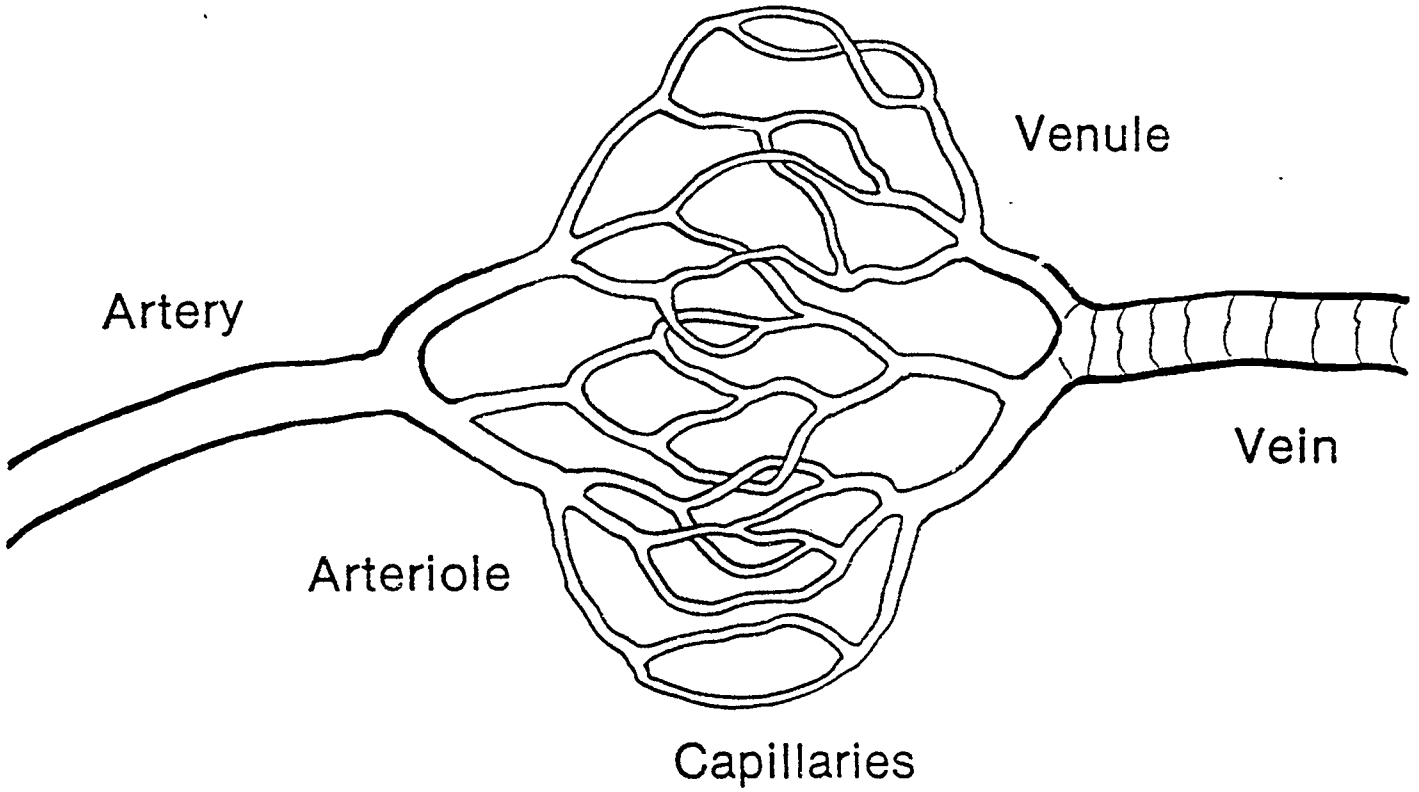
Capillary System



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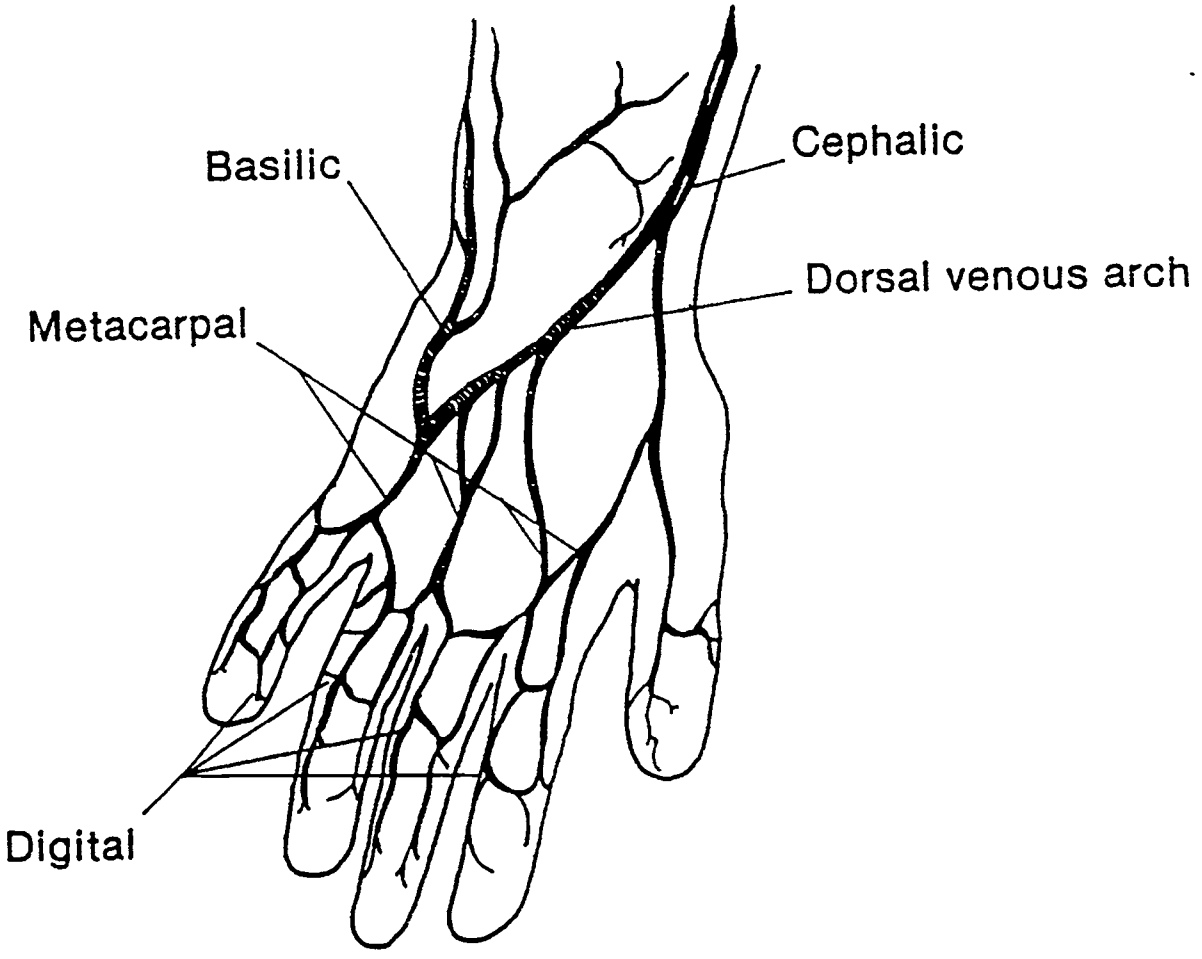
Metacarpal Veins



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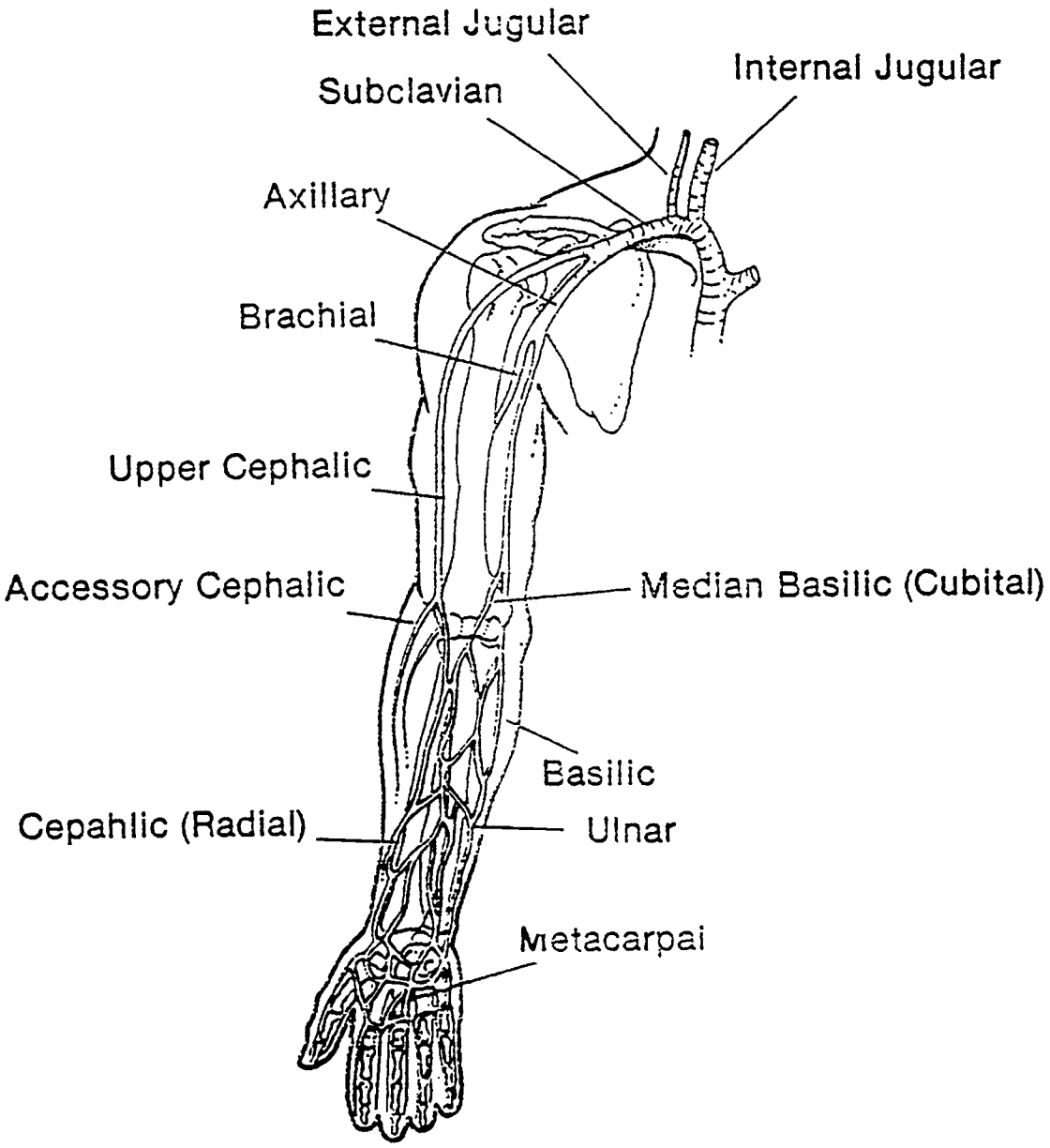
Major Veins of the Right Arm and Upper Torso



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02.04 **TASK: Select the Intravenous Infusion Site.**

1. As applicable to an intravenous infusion, review the structure & function of the skin, circulatory system, and cardiovascular system.

   A. Skin functions: covers body, protection, temperature regulation.

   B. Epidermis: Top layer, protective covering for epidermis, thickness varies (thickest on palms of hands & soles of feet), thickness varies with age, may be thin in the elderly.

   C. Dermis: Highly sensitive & vascular with capillaries, many nerves that react to temperature, touch, pressure, & pain. Nerve sites vary, so IV sites vary in tenderness (inner aspect of wrist is painful).

   D. Sub-cutaneous tissue: Lies below the dermis, site of superficial veins, covers muscles & tendons, varies in thickness, potential site of cellulitis.

   E. Circulatory System and Cardiovascular System: CV System pumps fluid around the body, regulates the volume of fluid in the body, pumps blood to kidney to get rid of fluid. (Circulatory system carries the blood, dilatation or constriction depends on the volume of blood the body has.)

   F. Venous Structure
      1. Tunica Externa (outer layer) - connective tissue that surrounds & supports the vessel. Serves to hold the vessel together.
      2. Tunica Media (middle layer) - muscle and vascular tissue, nerves that control constriction and dialation are here (these can result in venospasm because of anxiety or cold IV fluids).
      3. Tunica Intima (inner layer) - elastic endothelial lining, layers of smooth flat cells which allow blood to flow smoothly (the IV catheter may scratch or roughen this surface causing thrombosis). semilunar valves (these prevent backflow & keep blood flowing to the heart).

   G. Arteries
      1. Elastic muscular tubes.
      2. Recoil forces blood onward in pulsating waves - reflect ventricular beat.
      3. Layers.
         a. Tunica intima - inner layer.
         b. Tunica media - middle layer, thicker than in veins.
         c. Tunica adventitia - outer layer.
         d. Blood supply - vasa vasorum.

   H. Arterioles: Small extensions of arteries connecting to capillaries.

   I. Capillaries: Microscopic vessels between arterioles and venules (walls single cell thickness).

J. Venules: Small extensions of vein connecting to capillaries.

K. Veins.
   1. More numerous than arteries.
   2. Thinner walled than arteries.

L. Functions.
   1. Arteries.
      a. Supply oxygenated blood to most tissues and cells.
      b. Carry blood containing carbon dioxide to lungs.
   2. Arterioles - carry O_2 blood from arteries to capillaries.
   3. Capillaries - exchange between blood and interstital fluids takes place through capillary wall.
   4. Venules - carry CO_2 blood.
   5. Veins - carry CO_2 blood from most tissues and cells, carry O_2 blood from lungs.

M. Circulatory system of the upper arm and torso.
   1. Identification of major veins of the arm.
      a. Axillary.
      b. Cephalic.
      c. Brachial.
      d. Median basilic.
      e. Basilic.
      f. Ulnar.
      g. Radial.
      h. Metacarpal.
   2. Identification of major central veins of upper torso.
      a. Subclavian.
      b. Jugular (internal, external).

N. Vasovagal reaction.
   1. Undesirable autonomic nervous system response.
   2. Manifested by vasoconstriction.
   3. Frequently seen in IV therapy patients.
   4. Predisposing factors.
      a. Preconceived fear of needles or IV therapy itself.
      b. Previous IV associated traumatic experience (multiple unsuccessful venipuncture attempts).
      c. Unfamiliarity with venipuncture procedure (lack of or inadequate patient preparation).
   5. May constitute real threat to patient with severe cardiac disease.

02.04 TASK: Select the Intravenous Infusion Site (cont.)

2. Identify the anatomical structures and functions of veins utilized as venipuncture sites.

CHARACTERISTIC	ARTERY	VEIN
Body location	Located deep in body tissue beneath muscle layers (exception is "aberrant artery" which is located superficially and in an unusual place)	Superficial: located immediately beneath skin in superficial fascia. Deep: locat -ed deep in tissue near principle arteries
Flow direction	Carries blood away from heart	Carries blood to- ward heart
Role in circulation	A specific area is supplied by a sin- gle artery; injury or malfunction of the artery threat- ens circulation in the area it supplies, possible tissue death could result	Veins are numerous and generally arr- anged in networks to supply a specific area; injury or malfunction of a vein is compen- sated for by others, and circu- lation is maintained.
Valves	No valves-continual pressure of blood moving away from heart assures circu- lation	Function in opposi -tion to muscular pressure to prevent backflow as blood moves toward heart
Pulsation	Pulsates when left ventricle contracts and blood is forced into aorta	No pulsation
Color of blood	Bright in color re- sulting from oxy- genated blood delivered from lungs or pulmonary circu- lation	Dark red in color indicating pre- sence of materials drained from tissue by capillaries

Factors to Consider in Selecting a Vein

1. PURPOSE OF THE INFUSION
    a. To Correct Fluid and Electrolyte Imbalance
    b. Drug Therapy
    c. As a Preventive Measure
    d. To Administer Blood or Blood Products

2. DURATION OF THERAPY

3. CONDITION OF VEINS

4. SUITABLE LOCATION FOR THE PARTICULAR STYLE OF NEEDLE SELECTED

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3. Differentiate among the various venipuncture sites.

Comparing peripheral venipuncture sites

SITE	ADVANTAGES	DISADVANTAGES
Digital veins		
Run along lateral and dorsal portions of fingers	•May be used for short-term therapy. •May be used when others means aren't available.	•Fingers must be splinted with a tongue blade, decreasing ability to use hand. •Uncomfortable for patient. •Infiltration occurs easily. •Can't be used if veins in dorsum of hand already used.
Metacarpal veins		
On dorsum of hand; formed by union of digital veins between knuckles	•Easily accessible. •Lie flat on back of hand. •In adult or large child, bones of hand act as splint.	•Wrist movement decreased unless a short catheter is used. •Insertion more painful because more nerve endings in hands. •Site becomes phlebitic more easily.
Accessory cephalic vein		
Runs along radial bone as a continuation of metacarpal veins of thumb.	•Large vein excellent for venipuncture. •Readily accepts large-gauge needles. •Doesn't impair mobility. •Doesn't require an armboard in an older child or adult.	•Sometimes difficult to position catheter flush with skin. •Usually uncomfortable. Venipuncture device at bend of wrist, so movement caused discomfort.
Cephalic vein		
Runs along radial side of forearm and upper arm	•Large vein excellent for venipuncture. •Readily accepts large-gauge needles. •Doesn't impair mobility.	•Proximity to elbow may decrease joint movement. •Vein tends to roll during insertion.

SITE	ADVANTAGES	DISADVANTAGES
Median antebrachial vein		
Arises from palm and runs along ulnar side of foreman.	•Vein holds winged needles well. •A last resort when no other means are available.	•Many nerve endings in area may cause painful venipuncture or suffer infiltration damage. •Infiltration occurs easily in this area.
Basilic vein		
Runs along ulnar side of forearm and upper arm	•Will take a large-gauge needle easily. •Straight strong vein suitable for large-gauge venipuncture devices.	•Uncomfortable position for patient during insertion. •Penetration of dermal layer of skin where nerve endings are located causes pain. •Vein tends to roll during insertion.
Antecubital veins		
Located in antecubital fossa (median cephalic, located on radial side; median basilic, on ulnar side; median cubital rises in front of elbow joint)	•Large veins facilitate drawing blood. •Often visible or palpable in children when veins won't dilate. •May be used in an emergency or as a last resort.	•Difficult to splint elbow area with armboard. •Median cephalic vein crosses in front of brachial artery. •Veins may be small and scarred if blood has been drawn frequently from this site.
Great saphenous vein		
Located at internal malleolus	•Large vein excellent for venipuncture.	•Circulation od lower leg may be impaired. •Walking difficult with device in place. •Increased risk of deep vein thrombosis.
Dorsal venous network		
Located on dorsal portion of foot	•Suitable for infants and toddlers.	•Vein may be difficult to see or find if edema is present. •Walking difficult with device in place. •Increased risk of deep vein thrombosis.

02.04 TASK: Select the Intravenous Infusion Site (cont.)

4. Describe criteria to be considered when selecting a venipuncture site.

   A. Evaluate for potential sites by assessing patient.
      1. CVA.
      2. Radical mastectomy or other pertinent surgery.
      3. History of drug abuse.
      4. Prior cutdown.
      5. Arthritis.

   B. Factors to consider in selecting a vein.
      1. Purpose of the infusion.
         a. To correct fluid and electrolyte imbalance.
         b. Drug therapy.
         c. As a preventative measure.
         d. To administer blood or blood products.
      2. Duration of therapy.
      3. Condition of veins.
      4. Suitable location for the particular style of needle selected.
      5. Non-dominant arm/hand.
         a. No edematous or impaired arm/hand.
         b. No sclerotic veins, if possible.
         c. Go as distal as possible.
         d. No leg veins without MD orders on adults.

02.04 TASK: Select the Intravenous Infusion Site (cont.)

5. Identify growth & development factors pertinent to venipuncture site selection.

A. Elderly.

1. Possible physiological changes.
   a. Sclerotic veins or hardened veins (artereosclerosis).
   b. Looser tissue, less subcutanious fat (less able to stabilize veins).
   c. Fragile veins that cause veins to "blow".
   d. Tortous veins.
2. Possible psychological changes.
   a. Senility - forgetfulness.
   b. Confusion.
   c. Depression.
3. Nursing interventions related to physiological and psychological changes in elderly.
   a. Use extreme caution in site selection.
      (1) Select least tortouous and fragile vein.
      (2) Select vein with as much bone support as possible.
      (3) Metacarpal veins are not desirable as there is not enough subcutaneous tissue to support.
   b. Choose nondominent hand if possible and site that allows for the most movement of extremity.

B. Pediatric.

(Refer to Task 02.03 number 1.)

02.05 TASK: Perform Venipuncture and Initiate the Intravenous Infusion

1. Assess data base information including physician orders, patient vital signs, and special needs.
   - A. Components of physician's order.
     1. Type of solution (including additives).
     2. Amount of solution.
     3. Rate of solution.
     4. Date & time to be given.
     5. Doctor's signature.
   - B. Vital signs.
     1. Obtain baseline VS's for evaluation of patient's status and for later comparison.
     2. Assess hydration level.
   - C. Assessment of special needs.
     1. Allergies (ie. betadine).
     2. Arthitis.
     3. Atherosclerosis.
     4. CVA.
     5. Radical mastectomy or other pertinent surgery.
     6. History of drug abuse.

02.05 **TASK: Perform Venipuncture and Initiate the Intravenous Infusion (cont.)**

2. Identify the steps of venipuncture and of initiating infusion.

   See Task 2.02, numbers 2 and 3; and this Task 2.05, numbers 3-9.

02.05 TASK: Perform Venipuncture and Initiate the Intravenous Infusion (cont.)

3. Identify and assemble all equipment needed; explain the use of each item.
   - A. Collect equipment.
     1. Container of solution.
        - a. Verify type and volume of solution ordered.
        - b. Verify accuracy of added medicants and amount ordered.
        - c. Check expiration date of solution.
        - d. If using glass bottles, check for chips and/or cracks.
        - e. If using flexible bags, gently squeeze to detect any leaks.
        - f. Observe for clarity of solution and presence of particulate matter.
     2. Administration set tubing and label - tubing length (primary, secondary, extension, bld. filter tubing, TPN tubing).
        NOTE: Verify drop factor.
     3. Venipuncture equipment.
        - a. Cannula.
        - b. Skin bactericidal.
        - c. Antimicrobial agent.
        - d. 2x2 gauze or transparent dressing.
        - e. Tape.
        - f. Tourniquet.
        - g. IV needle - angiocatheter, insyte catheter, butterfly (appropriate size depends on vein size, solution infused, bld. 20-18g.).
        - h. Protective gloves.
        - i. Puncture-proof container.
     4. Electronic infusion device, if applicable.
     5. IV standard.
   - B. Assemble Equipment.
     1. Wash hands.
     2. Remove container cover and discard, if applicable.
     3. Remove administration set tubing from box.
     4. Close roller control clamp.
     5. Insert administration set spike into container.
     6. Squeeze chamber to fill at least 1/3.
     7. Open clamp slightly and allow tubing to fill slowly while inverting medports and tapping to clear air.
     8. Close roller clamp.
     9. Tape time strip to solution container to indicate rate of flow.
     10. Label administration set with time and date for change and initials.
     11. Suspend from IV standard or connect to infusion control device, if applicable.

4. Differentiate among the various venipuncture devices; include gauge and size of each and use.

A. Measurements of needles and catheters.
   1. Gauge - diameter size of needle.
   2. Length - length of needle, hub to tip.
   3. Lumen - size of opening.

B. Types of cannuals.
   1. Winged-tip needle.
      a. Short, small gauge needle with one or two plastic side arms or wings
      b. Size - 19-27 gauge; usually 3/4" long.
      c. Use - short-term therapy for any patient, especially children, infants or anyone with fragile veins.
      d. Advantages.
         (1) Wings enable easy insertion and securing.
         (2) Less phlebitis.
      e. Disadvantages.
         (1) Decreased mobility due to rigidness of device.
         (2) Increased infiltration risk.
   2. Over-the-needle catheter (ONC).
      a. Catheter mounted on a needle.
      b. Size - 10-27 gauge; length 3/4"-3".
      c. Use - active or moderately agitated patients who require a secure venous line.
      d. Advantages.
         (1) Less prone to infiltrate.
         (2) Allows more mobility than winged-tip needles.
      e. Disadvantages.
         (1) More likely to cause phlebitis.
         (2) Can kink if inserted in area of flexion without armboard applicatin.
         (3) May emboli if improper techniques employed during insertion.
   3. Through-the-needle catheter (INC)
      a. Catheter inside lumen of needle; needle removed leaving catheter.
      b. Size - gauge, length varies.
      c. Use.
         (1) Moderate to long-term therapy.
         (2) Administration of hypertonic fluids/irritating drugs which must be given via a central vein to insure adequate dilution.
         (3) CVP monitoring.
         (4) Critical care situations such as codes.

d. Advantages.
   (1) Very secure - often sutured to skin.
   (2) Available in lengths to go to a central vein via peripheral vein.

e. Disadvantages.
   (1) Greater risk of infection.
   (2) May emboli if:
      (a) Improper technique is employed during insertion.
      (b) Needle guard is omitted when use is indicated.
   (3) Central venous insertion requires physician.

5. Describe IV site skin preparation.

A. Select site.
B. Place protective paper towel or cloth under proposed site.
C. Clip excessive hair.
D. Dilate vein.
   1. Place extremity in dependent position (below heart).
   2. Apply tourniquet 6-8" above chosen site (tight enough to obstruct venous flow, not so tight to obstruct arterial flow - check for radial pulse).
   3. Stroke vein distal to site, toward heart (helps fill the vein).
   4. Have patient clench and unclench fist, contracting muscles (compresses distal veins, forcing blood along veins and distending them).
   5. Lightly tap vein with fingertips.
   6. May use heating pad on extremity to assist in dilating veins (according to agency policy).
F. Cleanse site with bactericidal agent.
   1. Center to periphery.
   2. Over at least one minute, with friction.
   e. Allow to dry.
G. Put on protective gloves.

02.05 TASK: Perform Venipuncture and Initiate the Intravenous Infusion (cont.)

6. Perform venipuncture.

A. Inform patient of stick.
B. Aseptically insert cannula, bevel up.
C. Ascertain blood return.
D. Advance stylet (needle) slightly.
E. Advance catheter.
F. Release tourniquet.
G. Remove stylet (needle) while occluding vein with digital pressure to minimize blood spillage.
H. Place stylet in puncture proof container.
I. Aseptically connect administration set to cannula hub.
J. Initiate flow of infusion slowly.
K. Observe for sign of infiltration.
L. Anchor cannula with tape according to manufacturer's guidelines.
M. Apply antimicrobial agent to site (per agency policy).
N. Apply dressing and secure to tape.
O. Remove gloves.
P. Apply label to dressing.
    1. Type, gauge and length of cannula.
    2. Date and time.
    3. Initials/name of person performing venipuncture.
Q. Regulate flow rate to coincide with ordered rate.
R. Advise patient of restrictions, precautions.
S. Dispose of used equipment and rubbish according to institutional policy.
T. Charge for supplies used.
U. Document procedures and patient reactions.
    1. Date and time of venipuncture.
    2. Number of solution container.
    3. Type and amount of solution.
    4. Name and dosage of additives in solution.
    5. Type of venipuncture device used.
    6. Venipuncture site.
    7. Number of insertion attempts if more than one.
    8. Flow rate.
    9. Any adverse reactions.
    10. Patient teaching and evidence of patient understanding.
    11. Name of person initiating the infusion.

02.05 **TASK: Perform Venipuncture and Initiate the Intravenous Infusion** (cont.)

7. Perform the infusion procedure maintaining aseptic technique.

SEE this Task 02.05 number 6.

02.05 **TASK: Perform Venipuncture and Initiate the Intravenous Infusion** (cont.)

8. Accurately calculate the flow rate.

A. Ensure appropriate infusion flow. (Need to know drops/min. of solution of each brand name/type tubing - printed on package, macrodrips 10, 15, 20; microdrips 60.)

B. Formula: $\frac{\text{volume of infusion (in ml)}}{\text{time of infusion (in min.)}}$ x drop factor = drops/min.

C. Mark IV solution container with amount of infusion/hr. (timing label).

D. Check IV flow rate every hour and with position change.

02.05 **TASK: Perform Venipuncture and Initiate the Intravenous Infusion** (cont.)

9. Document procedures and patient reactions.

SEE this Task 02.05 number 6 (U).

Calculating Flow Rates

1. How much solution did the physician order?
2. Over how much time is this amount to infuse?
3. Divide amount of solution to be given by the delivery time.

   Example: $\frac{1000 \text{ ml}}{8 \text{ hr}} = 125 \text{ ml/hr}$
4. Decide which type of drip system you are using.

   (NOTE: The drop rate per milliliter of fluid varies with each manufacturer of macrodrip tubing. Abbott tubing delivers 15 gtt/ml; Travenol tubing delivers 10 gtt/ml; all microdrip tubings deliver 60 gtt/ml.)
5. Calculate drops per minute to deliver set amount of fluid per hour.

   $$\frac{\text{gtt/ml}}{\text{60 sec/min}} \times \frac{\text{Amt Fluid/hr}}{1} = \text{gtt/min}$$

   Example:

   $$\frac{10}{60} \times \frac{125}{1} = \frac{1250}{60} = 21 \text{ gtt/min}$$

or:

With sets that deliver 10 gtts/ml, divide hourly volume by 6.

Example:

$$\frac{125 \text{ ml/hr}}{6} = 21 \text{ gtts/min}$$

With sets that deliver 15 gtts/ml, divide hourly volume by 4.

Example:

$$\frac{125 \text{ ml/hr}}{4} = 31 \text{ gtts/min}$$

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02.06 TASK: Provide for On-Going Assessment of Patient

1. Recognize sign and symptoms of local and/or systemic complications of IV fluid or drug therapy.
   (See chart next page.)

2. Take appropriate nursing actions in the event of IV complications.
   (See chart next page.)

3. Document assessment and nursing actions.
   (See chart next page.)

Risks of peripheral I.V. therapy

As with any invasive vascular procedure, peripheral I.V. therapy carries associated risks. Complications may be local, such as phlebitis, or systemic, such as circulatory overload or infection. This chart lists some common complications along with their signs and symptoms, possible causes, and nursing interventions, including preventive measures.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Phlebitis		
•Tenderness at tip of venipuncture devise and above •Redness at tip of catheter and along vein •Puffy area over vein •Vein hard on palpation •Elevated temperature	•Poor blood flow around venipuncture device •Friction from catheter movement in vein •Venipuncture device left in vein too long •Clotting at catheter tip (thrombophlebitis) •Solution with high or low pH or high osmolarity	•Remove venipuncture device •Apply warm pack •Notify doctor if patient has fever •Document patient's condition and your interventions. ***Prevention:*** •Restart infusion using larger vein for irritating infusate, or restart with smaller-gauge device to ensure adequate blood flow. •Use filter to reduce risk of phlebitis. •Tape venipuncture device securely to prevent motion.
Extravasation		
•Swelling at and above I.V. site (may extend along entire limb) •Discomfort, burning, or pain at site •Feeling of tightness at site •Decreased skin temperature around site •Blanching at site •Continuing fluid infusion even when vein is occluded, although rate may decrease •Absent backflow of blood •Slower flow rate	•Venipuncture device dislodged from vein or perforated vein	•Remove venipuncture device. •Apply ice (early) or warm soaks (later) to aid absorption. •Elevate limb. •Check for pulse and capillary refill periodically to assess circulation. •Restart infusion above infiltration site or in another limb. •Document patient's condition and your interventions. ***Prevention:*** •Check I.V. site frequently (especially when using I.V. pump). •Don't obscure area above site with tape •Teach patient to observe I.V. site and report pain or swelling
Catheter dislodgment		
•Loose tape •Catheter partly backed out of vein •Infusate infiltrating	•Loosened tape or tubing snagged in bedclothes, resulting in partial retraction of catheter	•If no infiltration occurs, retape without pushing catheter back into vein. ***Prevention:*** •Tape venipuncture device securely on insertion.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Occlusion		
•No increase in flow rate when I.V. container is raised •Blood backup in line •Discomfort at insertion site	•I.V. flow interrupted •Heparin lock not flushed •Blood backup in line when patient walks •Hypercoagulable patient •Line clamped too long	•Use mild flush injection. Don't force injection. If unsuccessful, reinsert I.V. line. *Prevention:* •Maintain I.V. flow rate •Flush promptly after intermittent piggyback administration. •Have patient walk with his arm folded to chest to reduce risk of blood backup.
Vein irritation or pain at I.V. site		
•Pain during infusion •Possible blanching if vasospasm occurs •Red skin over vein during infusion •Rapidly developing signs of phlebitis	•Solution with high or low pH or high osmolarity, such as 40 mEq/liter of potassium chloride; phenytoin; and some antibiotics (vancomycin and nafcillin)	•Slow the flow rate. •Try using an electronic flow device to achieve a steady flow. *Prevention:* •Dilute solutions before administration. For example, give antibiotics in 250-ml solution rather than 100 ml. If drug has low pH, ask pharmacist if drug can be buffered with sodium bicarbonate. (Refer to hospital policies) •I long-term therapy of irritating drug is planned, ask doctor to use central I.V. line.
Severed catheter		
•Leakage from catheter shaft	•Catheter inadvertently cut by scissors •Reinsertion of needle into catheter	•If broken part is visible, attempt to retrieve it. If unsuccessful, notify doctor. •If portion of catheter enters bloodstream, place tourniquet above I.V. site to prevent progression of broken portion. •Notify doctor and radiology department. •Document patient's condition and your interventions *Prevention:* •Don't use scissors around I.V. site. •Never reinsert needle into catheter. •Remove unsuccessfully inserted catheter and needle together.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Hematoma		
•Tenderness at venipuncture site •Area around site bruised •Inability to advance or flush I.V. line	•Vein punctured through other wall at time of venipuncture •Leakage of blood from needle displacement	•Remove venipuncture device. •Apply pressure and warm soaks to affected area. •Recheck for bleeding. •Document patient's condition and your interventions ***Prevention:*** •Choose a vein that can accommodate size of venipuncture device. •Release tourniquet as soon as successful insertion is achieved.
Venous spasm		
•Pain along vein •Flow rate sluggish when clamp completely open •Blanched skin over vein	•Severe vein irritation from irritating drugs or fluids •Administration of cold fluids or blood •Very rapid flow rate (with fluids at room temperature)	•Apply warm soaks over vein and surrounding area. •Slow flow rate ***Prevention:*** •Use blood warmer for blood or packed red blood cells.
Vasovagal reaction		
•Sudden collapse of vein during venipuncture •Sudden pallor accompanied by sweating, faintness, dizziness, and nausea •Decreased blood pressure	•Vasospasm from anxiety or pain	•Lower head of bed. •Have patient take deep breaths. •Check vital signs. ***Prevention:*** •Prepare patient adequately for therapy to relieve his anxiety. •Use local anesthetic to prevent pain of venipuncture.
Thrombosis		
•Painful, reddened, and swollen vein •Sluggish or stopped I.V. flow	•Injury to endothelial cells of vein wall, allowing platelets to adhere and thrombus to form	•Remove venipuncture device: restart infusion in opposite limb if possible. •Apply warm soaks •Watch for I.V. therapy related infection; thrombi provide an excellent environment for bacterial growth. ***Prevention:*** •Use proper venipuncture techniques to reduce injury to vein.

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Local complications		
Thrombophlebitis		
•Severe discomfort •Reddened, swollen, and hardened vein	•Thrombosis and inflammation	•Same as for thrombosis ***Prevention:*** •Check site frequently. Remove venipuncture device at first sign of redness and tenderness.
Nerve, tendon, or ligament damage		
•Extreme pain (similar to electrical shock when nerve is punctured) •Numbness and muscle contraction •Delayed effects including paralysis, numbness, and deformity	•Improper venipuncture technique, resulting in injury to surrounding nerves, tendons, or ligaments •Tight taping or improper splinting with armboard	•Stop procedure ***Prevention:*** •Don't repeatedly penetrate tissues with venipuncture device •Don't apply excessive pressure when taping or encircle limb with tape. •Pad armboards and pad tape securing armboard if possible
Systemic complications		
Circulatory overload		
•Discomfort •Neck vein engorgement •Respiratory distress •Increased blood pressure •Crackles •Increased difference between fluid intake and output	•Roller clamp loosened to allow run-on infusion •Flow rate too rapid •Miscalculation of fluid requirements	•Raise the head of the bed. •Administer oxygen as needed. •Notify doctor. •Administer medications (probably furosemide) as ordered. ***Prevention:*** •Use pump, controller, or rate minder for elderly or compromised patients. •Recheck calculations of fluids requirements. •Monitor infusion frequently.
Systemic infection (septicemia or bacteremia)		
•Fever, chills, and malaise for no apparent reason •Contaminated I.V. site, usually with no visible signs of infection at site	•Failure to maintain aseptic technique during insertion or site care •Severe phlebitis, which can set up ideal conditions for organism growth •Poor taping that permits venipuncture device to move, which can introduce organisms into bloodstream •Prolonged indwelling time of venipuncture device •Immunocompromised patient	•Notify doctor •Administer medications as prescribed •Culture site and device. •Monitor vital signs. ***Prevention:*** •Use scrupulous aseptic technique when handling solutions and tubings, inserting venipuncture device, and discontinuing infusion. •Secure all connections. •Change I.V. solutions, tubing, and venipuncture device at recommended times. •Use I.V. filters

SIGNS AND SYMPTOMS	POSSIBLE CAUSES	NURSING INTERVENTIONS
Systemic complications		
Air embolism		
•Respiratory distress •Unequal breath sounds •Weak pulse •Increase central venous pressure •Decreased blood pressure •Loss of consciousness	•Solution container empty •Solution container empties, and added container pushes air down line	•Discontinue infusion. •Place patient in Trendelenburg's position to allow air to enter right atrium and disperse via pulmonary artery. •Administer oxygen •Notify doctor. •Document patient's condition and your interventions. ***Prevention:*** •Purge tubing of air completely before infusion •Use air-detection device on pump or air-eliminating filter proximal to I.V. site. •Secure connections.
Allergic reaction		
•Itching •Tearing eyes and runny nose •Bronchospasm •Wheezing •Urticarial rash •Edema at I.V. site •Anaphylactic reaction (may occur within minutes or up to 1 hour after exposure), including flushing, chills, anxiety, agitation, generalized itching, palpitations, paresthesia, throbbing in ears, wheezing, coughing, convulsions, and cardiac arrest	•Allergens such as medications	•If reaction occurs, stop infusion immediately. •Maintain patent airway. •Notify doctor. •Administer antihistaminic steroid, anti-inflammatory, and antipyretic drugs, as ordered. •Give 0.2 to 0.5 ml of 1:1,000 aqueous epinephrine subcutaneously. Repeat at 3-minute intervals and as needed. •Administer cortisone if ordered. ***Prevention:*** •Obtain patient's allergy history. Be aware of cross-allergies. •Assist with test dosing. •Monitor patient carefully during first 15 minutes of administration of a new drug.

03.0 MAINTAIN AND MONITOR CENTRAL VENOUS LINES

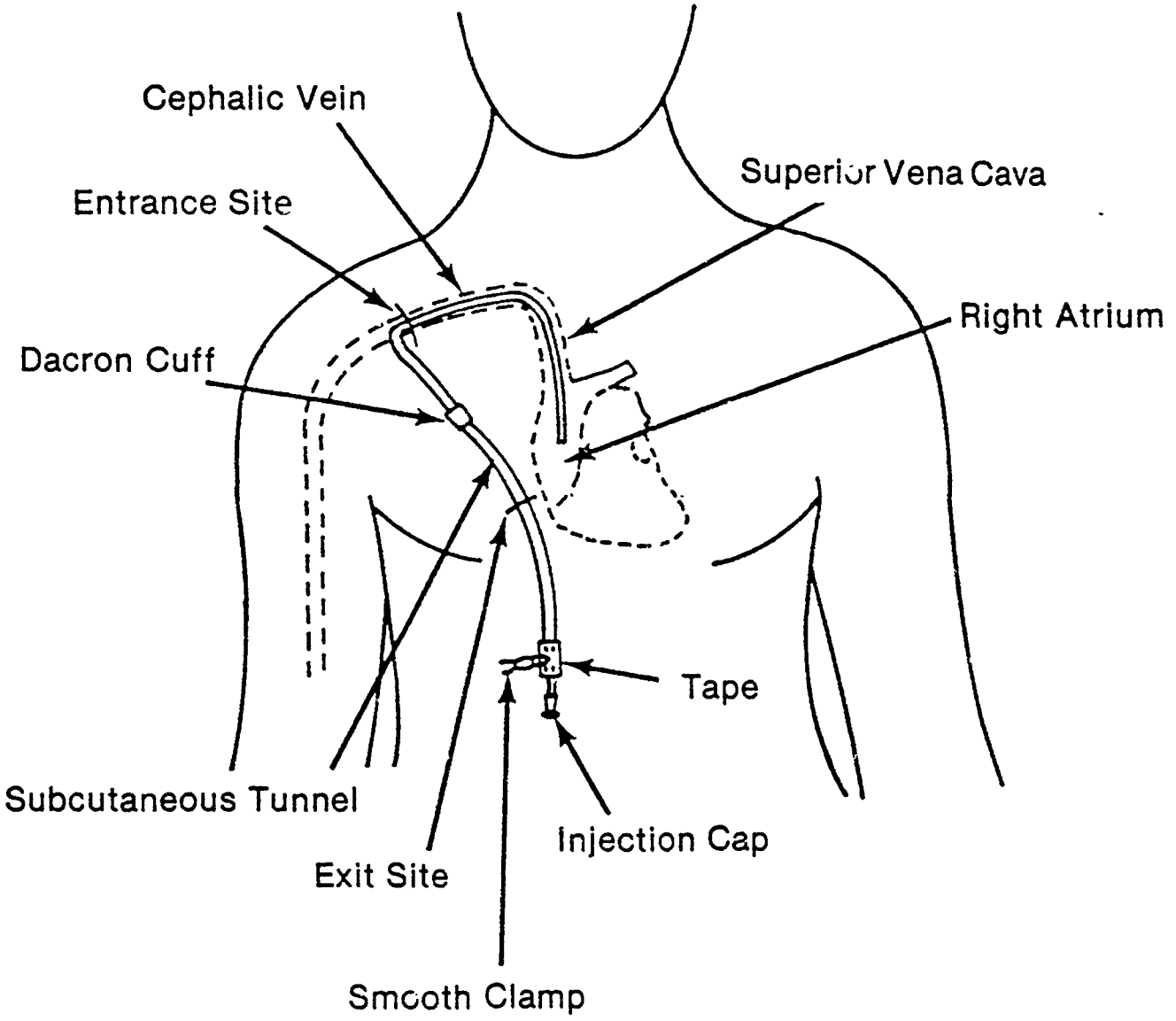
03.01 TASK: Perform Selected IV Therapy Functions for the Stable Patient with CV Lines

1. Identify the LPN's legal scope in caring for patients with CV lines.

   A. According to the Idaho State Board of Nursing LPNs may perform the following functions for a stabilized patient with a central venous catheter.
      1. Hang containers with
         a. Unmedicated or medicated solutions premixed by a pharmacy.
         b. TPN and lipids.
         c. Blood.
      2. Change tubing.
      3. Change dressings.
      4. Adjust drip rates.

   B. According to the Idaho State Board of Nursing LPNs may not perform the following functions.
      1. D/C central lines.
      2. Hang and monitor titrated medications.
      3. Draw blood from central lines.

Placement of Long-Term Catheter



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2. Identify and describe different types of CV lines.

A. Materials.
   1. Polyurethane.
   2. Polyvinylchloride (pvc).
   3. Silicone rubber.

B. Short term CV lines.
   1. Single lumen (1 opening, 1 solution at a time).
   2. Multi lumen (more than 1 solution with regard to compatibility).
   3. Gages may vary - 16g. distal (cvp), 18g. proximal and medial (IV solutions).
   4. Lumens exit approx. every 3/4".
   5. Length approx. 8".
   6. Advantages: may administer multi-solutions at one time, even incompatible solutions, easily inserted at the bedside, easily removed, stiffness of catheter aids insertion and aids central venous pressure monitoring.
   7. Disadvantages: PVC is thrombogenic, irritates inner lumen of blood vessel, needs to be changed every 3-7 days.
   8. Designed for IV therapy lasting 4 weeks or less.
   9. Intravenous Nursing Society recommends changing every 3-7 days.
   10. May be single, double, triple or quadruple lumens; exiting at 3/4" intervals.
   11. Nursing considerations:
      a. Minimize patient's motion.
      b. Assess frequently for signs of infection and clot formation.
      c. Change dressing every 48 to 72 hours.
      d. Irrigate each lumen not attached to a continuous infusion with normal saline or Heparin every 8 hours and before and after use.

C. Long term CV lines - indicated when long term CV access (greater than 4 weeks) is needed.
   1. Characteristics.
      a. Made of silicone rubber and therefore:
         (1) More flexible.
         (2) More physiologically compatible.
         (3) Less thrombogenic.
         (4) Insertion more difficult.
      b. Inserted in OR.
      c. Catheter tip lies in central vein (superior vena cava or right atrium) and other end is threaded through subqutaneous tissue to exit site outside of skin.
      d. Just before catheter exits the skin, a dacron cuff is placed around the catheter.

e. Granulation tissue forms around the cuff in approximately 2 weeks.
   (1) The dacron cuff secures and anchors the catheter in place.
   (2) The dacron duff acts as a barrier to microorganisms.
f. Two surgical sites require dressings after insertion.
g. Tears and kinks more easily than short term catheter.
h. Approximately 35" long.

2. Types of long term CV catheters.
   a. Hickman.
      (1) Silicone rubber.
      (2) 35" long.
      (3) Open end(s) with clamp (eliminates need for Valsalva's maneuver when using catheter).
      (4) Dacron cuff.
      (5) Single or multi lumen.
      (6) Lumen 1.6 mm.
      (7) Nursing considerations: flush with 3 to 5 cc of Heparin or N/S BID and after each use (or according to hospital policy).
      (8) Advantages: less thrombogenic, dacron cuff (anchors catheter, prevents bacterial migration).
      (9) Disadvantages: requires surgical insertion, tears & kinks easily.
   b. Broviac: same as Hickman except smaller lumen (1.0mm).
   c. Pediactric Broviac: same as Broviac except smaller lumen (0.6mm).
   d. Groshung.
      (1) Closed end with pressure - sensitive two-way valve.
         (a) Valve normally remains closed (↓ risk of air embolism).
         (b) Valve opens with positive pressure to infuse fluids.
         (c) Valve opens with negative pressure to withdraw blood.
         (d) Eliminates need for clamping catheter.
      (2) Available with single or double lumen.
      (3) Nursing considerations:
         (a) Irrigate each lumen not in use with 5cc of normal saline every 7 days and before and after use.
         (b) Irrigate with 20cc of N/S after blood draw or administration.
   e. Long line catheter.
      (1) Periferally inserted central catheter (PICC).

(2) Inserted above anticubital fossa in cephalic or basilic vein and then threaded to vena cava or right atrium.
(3) 20" long: available in 16G, 18G, and 20G.
(4) Indications for use:
(a) Patient with poor central access.
(b) Patient who needs CV access but has had head or neck surgery.
(5) Easily inserted at bedside.
(6) Disadvantages:
(a) Catheter may occlude smaller peripheral vessels.
(b) Greater chance of phlebitis and thrombus formation.
(c) CVP reading may not be as accurate.
(d) Flush with Heparin or N/S every 8 hours or before and after each use (according to hospital policy).

D. Implantable infusion ports:
1. Useful for patients requiring intermitten IV therapy for longer than 6 months.
2. Catheter tubing is attached to an infusion port with a self sealing septrum.
3. Infusion port is implanted under the skin in subcutaneous tissue.
4. Advantages.
a. Easier to maintain than external catheters: no dressing changes and less frequent H/L flushes.
b. May be easier to accept, as no external catheter.
c. Fewer activity restrictions: i.e. can shower and swim.
d. Less risk of infection; no exit site for microorganisms to enter.
5. Disadvantages.
a. Access requires inserting a needle through subcutaneous tissue.
b. Implantation and removal requires surgery and hospitalization and therefore is more costly.
6. Types:
a. Infuse-a-port.
b. Port-a-cath.
c. Medi port.
7. Nursing considerations:
a. Flush port once per month with 3-5 cc of heparin, 100 u/ml when not in use.
b. Requires special Huber needle to enter port.
(1) Regular needle will "core" hole in septum.
(2) Huber needle "slices" septum and then it reseals itself.

3. Add medicated/unmedicated solutions.

   A. May run isotonic solution at 20 ml/hr until catheter placement confirmed by x-ray.

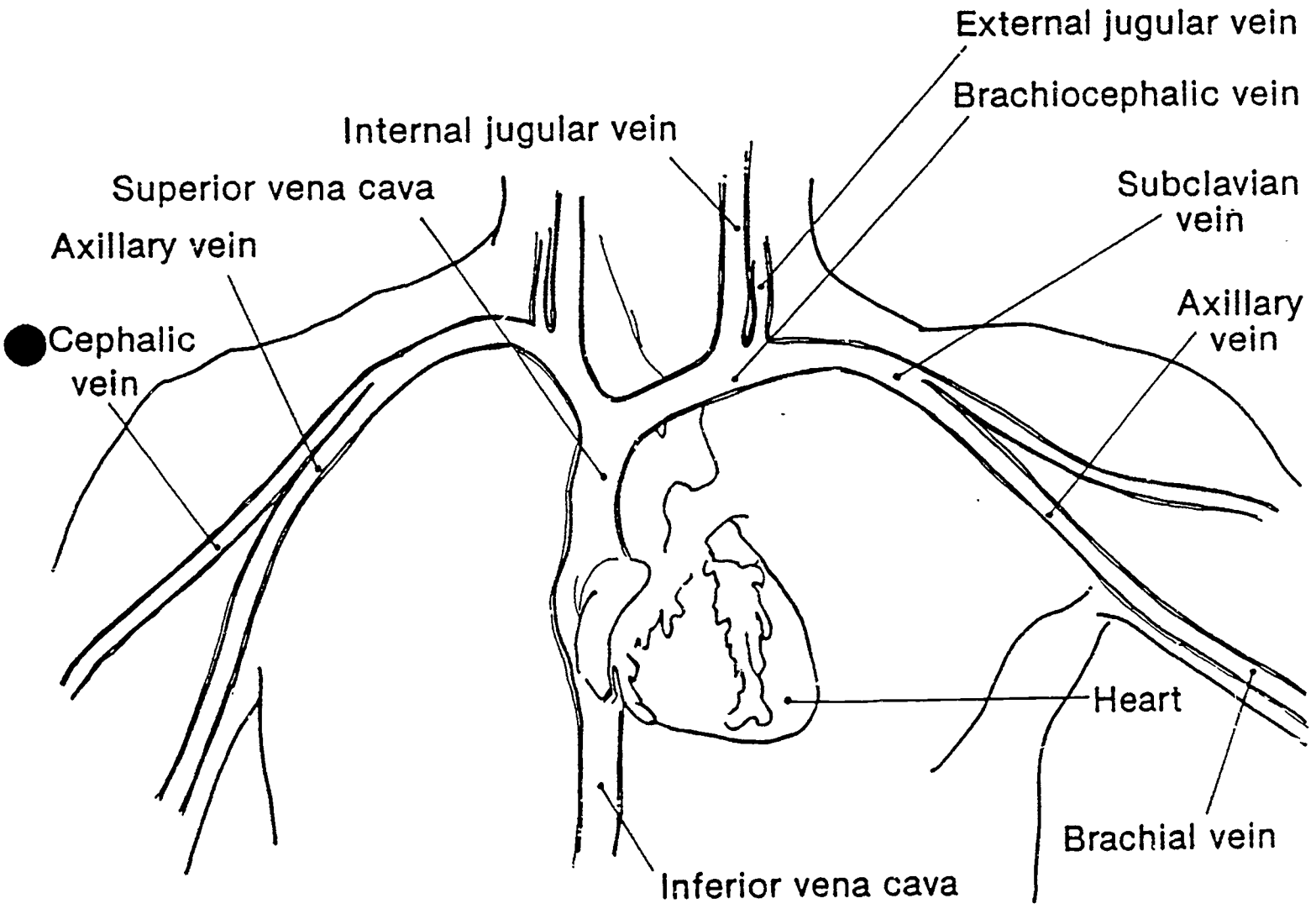
   B. IV & IV medications - same procedure as peripheral IV line except H/L flush.

      1. H/L flush: Groshong: amount depends on size of cath.; Hickman = 2 ml,
         Broviac = 1 ml: generally 3-5 ml n/s or heparin is used.
      2. Procedure: Clean cap with alcohol swab and let dry, inject solution, after flushing, maintain positive pressure by keeping thumb on plunger of syringe while withdrawing needle. This prevents blood back flow and potential clotting of line.

   C. Intermittent Infusions:

      1. If solution is to run 30 min. or less, piggyback into cap of CV line and tape connection.
      2. If solution is to run 30 min. or more, clamp catheter tubing, remove cap, attach infusion tubing directly to the luerlock connection of catheter. (This may prevent needle puncture of catheter.)

Central Veins of the Upper Torso



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4. Change the site dressing.

   A. Dressings are changed every 72 hours and whenever they become wet or loose. Hickman and Broviac dressings may be changed every 48 hours for the first 3 weeks until site heals and then every 72 hours.
   B. Obtain dressing kit or assemble equipment.
      1. Providine; iodine swabs & ointment.
      2. Alcohol swabs.
      3. Dressing; 4x4 gauze and 1" adhesive tape or transparent dressing.
      4. Sterile gloves.
      5. Mask (optional, according to hospital policy).
      6. Clean gloves.
      7. Bag to dispose of old dressing.
   C. Explain procedure to patient.
   D. Place patient in a comfortable supine position with head turned away from catheter during dressing change to reduce airborne bacteria.
   E. Wash hands thoroughly.
   F. Open bag, placing it away from sterile field but still within reach.
   G. Put on clean gloves and romove old dressing (being careful not to pull catheter).
   H. Inspect old dressing for signs of infection and discard in bag.
   I. Check catheter insertion site for sign of infiltration or infection.
      1. Redness.
      2. Swelling.
      3. Irritation.
      4. Tenderness.
      5. Drainage.
   J. Clean skin around catheter with alcohol swaps.
      1. Wipe outward from insertion site in a circular manner.
      2. Clean 3 times using a new alcohol swap each time.
      3. Let alcohol dry, otherwise alcohol may combine with betadine forming tincture of iodine which is very irritating to the skin.
   K. Clean the skin around the site with providone iodine (betadine) swaps in the same manner as with alcohol.
   L. Do not use solutions containing actone as they may react with catheter and cause them to disintegrate.
   M. May use betadine ointment at insertion site (according to hospital policy).
   N. Redress the site with either a sterile 4x4 and tape all edges occlusively or a transparent semipermeable dressing.
   O. If catheter is taped (not sutured) to skin replace soiled tape with sterile tape using the chevron method.
   P. Label the dressing with date, time, and your initials.
   Q. Discard all used items properly.

03.01 **TASK: Perform Selected IV Therapy Functions for the Stable Patient with CV Lines (cont.)**

5. Change IV tubing.
   - A. Tubing is changed every 24 to 72 hours, or as directed by the hospital's policy.
   - B. Maintain strict aseptic technique.
   - C. To prevent air embolism, be sure and clamp catheter every time the catheter hub is open to air.
   - D. If no catheter clamp, have patient perform the valsalva maneuver when catheter hub is open to air.
   - E. All tubing connections should have leur lock connections or be taped.
   - F. If possible, change the tubing and the solution at the same time, using the same procedure as with peripheral IV equipment, except: have patient perform the val salva maneuver when catheter is open to air to prevent air embolism (if catheter doesn't have a clamp).
   - G. Procedure for changing the solution.
     1. Explain procedure to patient.
     2. Gather equipment - new solution.
     3. Wash hands.
     4. Clamp catheter (with padded clamp or slide clamp on catheter).
     5. Remove cap and seal from new container.
     6. Remove spike from old container and reinsert it into new bottle.
     7. Hang new bottle.
     8. Open catheter clamp.
     9. Adjust flow rate.
   - H. Procedure for changing the tubing and solution simultaneously.
     1. Explain procedure to patient.
     2. Wash hands.
     3. Hang new IV bag and primed tubing on IV pole.
     4. Stop flow in old tubing.
     5. Clamp CL catheter.
     6. Quickly disconnect the old tubing and connect the new tubing as described above.
   - I. Flushing the catheter.
     1. To maintain potency, routinely flush the catheter.
     2. The flushing procedure varies according to:
        - a. Hospital policy.
        - b. Medication administration schedule.
        - c. Type of catheter.
     3. Recommended flushing solutions.
        - a. Heparinized saline.
          - (1) 10u/ml for peds.
          - (2) 100u/ml to 1000u/ml for adults.
        - b. Normal saline - research has demonstrated n/s to be an effective flushing solution.

4. Flushing procedure:
   a. Explain procedure to patient.
   b. Wash hands.
   c. Clean cap with alcohol sway (70% alcohol solution) and allow to dry.
   d. Inject flush solution.
   e. After flushing, maintain positive pressure by keeping thumb on plunger of syringe while withdrawing needle. This prevents back flow and potential clotting in the line.
5. Remember to flush <u>each</u> port that is not connected to a continuous infusion.

J. Changing the cap.
1. Indications for changing the caps.
   a. Repeated punctures of injection port ↑ risk of infection.
   b. Pieces of rubber stopper may break off after repeated punctures. raising the risk of embolism.
2. Frequency - every 72 hours (or according to hospital policy).
3. Procedure:
   a. Explain procedure to patient.
   b. Wash hands.
   c. Clean connection site with alcohol or betadine swap.
   d. Clamp the catheter or instruct patient to perform valsalva maneuver.
   e. Quickly disconnect the old cap and connect the new cap, using aseptic techniques.

6. Recognize complications and adverse reactions; take appropriate nursing actions.
   A. Local complications.
      1. Hematoma.
         a. Signs and symptoms.
            (1) Discoloration adjacent to venipuncture site.
            (2) Swelling adjacent to venipuncture site.
         b. Nursing intervention.
            (1) Elevate extremity.
            (2) Apply warm compresses (dependent on institutional policy, may need physician order).
         c. Preventive measures.
            (1) Check patient's medical history for:
               (a) Blood dyscrasia.
               (b) Anticoagulant therapy.
               (c) Chemotherapy.
            (2) Insert venipuncture cannula with bevel up and at a 25-30° angle.
            (3) When discontinuing IV site, apply pressure at discontinued site with extremity elevated.
            (4) When venipuncture attempt is unsuccessful, do not reapply tourniquet to same extremity without sufficient time lapse to prevent renewed bleeding.
            (5) Do not apply tourniquet above an obvious hematoma site.
            (6) Good patient teaching.
      2. Infiltration.
         a. Signs and symptoms.
            (1) Swelling of tissue adjacent to IV site.
            (2) Poor or no blood return at IV cannula.
            (3) Slowing of IV infusion with eventual cessation.
            (4) Skin adjacent to site is cool to touch.
            (5) Patient complaint of discomfort or pain.
         b. Nursing intervention.
            (1) Discontinue immediately.
            (2) Elevate extremity.
            (3) Apply warm compresses (check institutional policy).
            (4) Notify physician if vesicant agent involved.
         c. Preventive measures.
            (1) Tension loop in administration set.
            (2) Utilization of armboard if applicable.
            (3) Proper application of restraints.
            (4) Frequent monitoring of status of infusion.
            (5) Employing safety precautions during patient transporting.
            (6) Good patient teaching.

3. Phlebitis.
   a. Types.
      (1) Sterile - chemical - due to pH of drug or solution.
      (2) Mechanical - due to irritating movement of cannula.
      (3) Septic - due to contamination factors.
   b. Signs and symptoms.
      (1) Tenderness.
      (2) Redness.
      (3) Warm to touch.
      (4) Induration.
      (5) Swelling.
      (6) Possible temperature elevation.
   c. Nursing intervention.
      (1) Discontinue site.
      (2) Elevate extremity.
      (3) Apply warm compresses (check institutional policy).
   d. Preventive measures.
      (1) Aseptic skin prep prior to cannula insertion.
      (2) Avoid multiple venipuncture attempts.
      (3) Secure anchoring of cannula.
      (4) Provide adequate hemodilution of cannula.
      (5) Good daily maintenance of infusion/site.
      (6) Appropriate site selection for order.
      (7) Site rotation every 48-72 hours.
4. Thrombophlebitis.
   a. Signs and symptoms - same as phlebitis plus:
      (1) Vein becomes hard and tortuous.
      (2) Extremely painful to touch.
      (3) Aching of entire extremity.
      (4) Slowing of infusion rate.
   b. Nursing intervention.
      (1) Discontinue site.
      (2) Notify physician of observations.
      (3) Provide therapeutic processes per physician orders.
   c. Preventive measures - same as for phlebitis plus avoid lower extremities for venipuncture.

SPECIAL PRECAUTION - thrombophlebitis is accompanied by the inherent danger of EMBOLUS.

5. Infection at site.
   a. Signs and symptoms.
      (1) Pain at site.
      (2) Redness.
      (3) Inflammation.
      (4) Swelling.
      (5) Temperature elevation.
      (6) Purulent drainage.
   b. Nursing intervention.
      (1) Discontinue site and culture cannula tip and drainage; order for culture may be institutional policy.
      (2) Notify physician.
      (3) Provide therapeutic process as ordered by physician.
   c. Preventive measures.
      (1) Adherence to aseptic technique.
      (2) Good daily maintenance of infusion/site.
6. Cellulitis.
   a. Signs and symptoms.
      (1) Redness.
      (2) Swelling.
      (3) Warm to touch.
      (4) Pain.
      (5) Induration.
      (6) May or may not be weeping.
   b. Nursing intervention.
      (1) Discontinue site.
      (2) Notify physician.
      (3) Provide therapeutic process as ordered by physician.
   c. Preventive measures - same as for infection at site.
7. Nerve damage.
   a. Signs and symptoms.
      (1) Tingling of extremity.
      (2) Numbness in fingers, hand, or arm.
   b. Nursing intervention.
      (1) Remove armboard and/or restraints.
      (2) Relocate IV site to other extremity.
   c. Preventive measures.
      (1) Use well-padded armboards.
      (2) Proper application of restraints.

B. Systemic Complications.

1. Pyrogenic reaction (septicemia).

a. Occurs when pyrogens are introduced into the bloodstream, producing a febrile reaction; could be staph or strep organisms.

b. Signs and symptoms.

(1) Chills.
(2) Fever.
(3) General malaise.
(4) Headache.
(5) Backache.
(6) Nausea and vomiting.
(7) Vascular collapse.
(8) Shock.

c. Nursing intervention.

(1) Stop infusing solution, but aseptically reserve for potential future testing.
(2) Reestablish IV at new site with new sterile solution, administration set, and cannula.
(3) Monitor vital signs.
(4) Notify physician.
(5) Provide therapeutic processes as prescribed by physician.

d. Preventive measures.

(1) Aseptic technique.
(2) Confirm sterility of equipment.
(3) 24-hour limit on infusing solution.

2. Pulmonary embolus.

a. Occurs when a substance, usually a blood clot, becomes free-floating and is propelled by the venous circulation to the right side of the heart and on into the pulmonary artery.

b. Signs and symptoms.

(1) Sudden onset of chest pain.
(2) Tachycardia.
(3) Dyspnea.
(4) Cough productive of reddish-pink sputum.

c. Nursing intervention.

(1) Remain with patient.
(2) Administer O_2.
(3) Complete bed rest.
(4) Call physician.
(5) Provide therapeutic processes as ordered by physician.

d. Preventive measures.
   (1) Blood or plasma must be infused through an adequate filter to remove any particulate matter.
   (2) Avoid veins in lower extremities.
   (3) Positive pressure should be used to relieve clot formation.
   (4) Dissolve reconstituted drugs completely and use filter when advisable.
   (5) Examine solutions for any particulate matter.

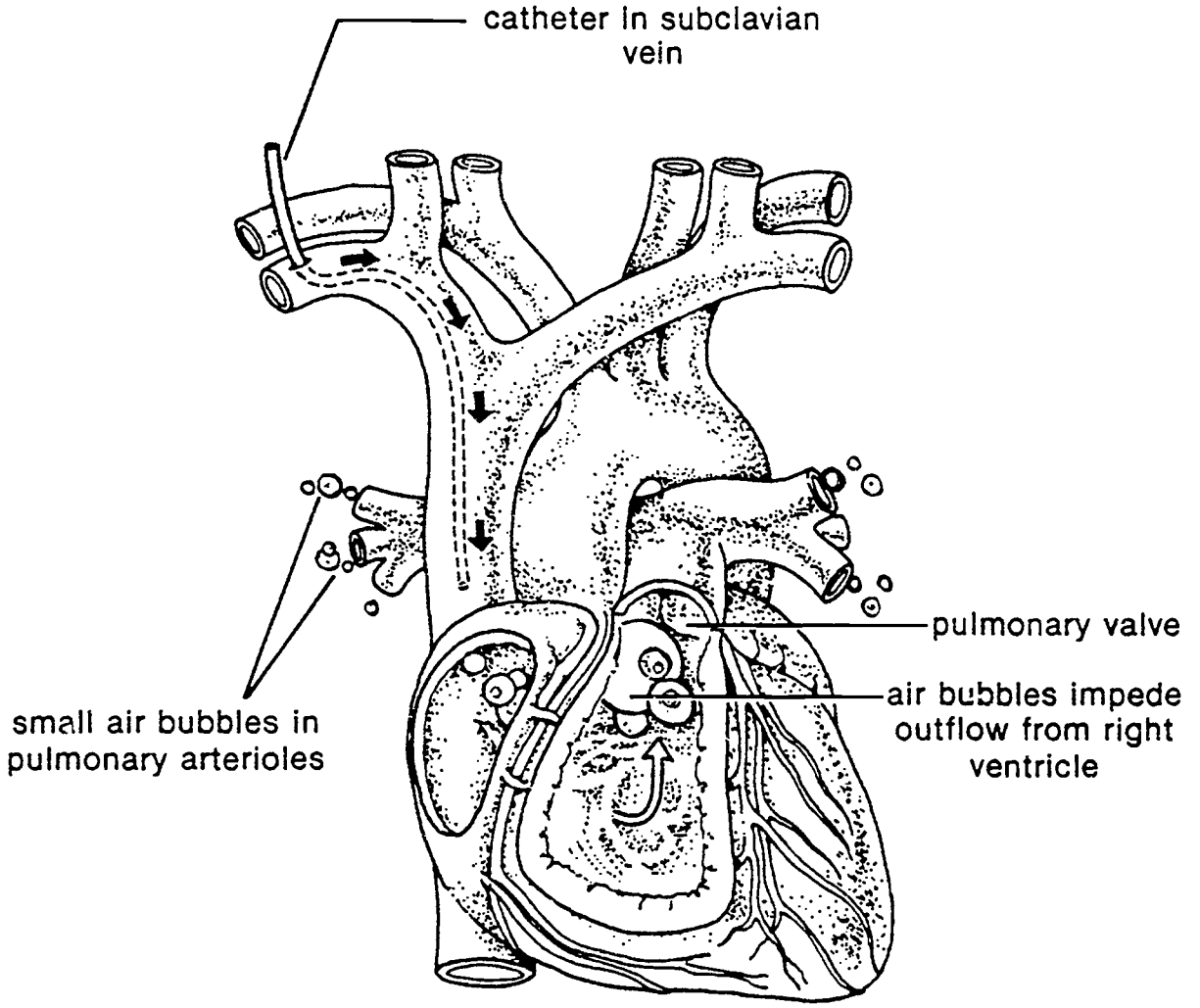
3. Air embolism (HO 1).
   a. Small bubbles accumulate and form tenacious bubbles that block the pulmonary capillaries.
   b. Signs and symptoms.
      (1) Sudden onset of pallor.
      (2) Cyanosis.
      (3) Dyspnea.
      (4) Cough.
      (5) Weak, rapid pulse.
      (6) Drop in blood pressure.
      (7) Syncope.
      (8) Shock.
      (9) Loss of consciousness.
   c. Nursing intervention.
      (1) Stop source of air.
      (2) Place patient on left side in Trendelenburg's position. (HO 2).
      (3) Administer O_2.
      (4) Notify physician immediately.
      (5) Provide therapeutic processes as prescribed by physician.

      SPECIAL PRECAUTION: Unless treatment is instituted immediately, death can rapidly ensue.
   d. Preventive measures.
      (1) Luer-lok connections.
      (2) Reinforcement of connections with tape.
      (3) Avoid bypassing electronic infusion pump housing for IV piggyback infusions.
      (4) Proper gown changing.
      (5) Use shoulder-snap gowns for central venous line patients.
      (6) Have patient perform Valsalva's maneuver during central line insertion and tubing changes.
      (7) Monitor IV closely to prevent "run-dry".

4. Circulatory overlaod.
   a. Signs and symptoms.
      (1) Venous distention - engorged neck vein.
      (2) Increased blood pressure.
      (3) Rise in venous pressure.
      (4) Rapid respirations with dyspnea.
      (5) Cough.
      (6) Wide variance between fluid intake and output.
   b. Nursing intervention.
      (1) Remain with patient.
      (2) Slow infusion to KVO rate.
      (3) Place patient in sitting position to facilitate breathing.
      (4) Monitor vital signs carefully.
      (5) Call physician.
      (6) Provide therapeutic processes as prescribed by physician.
   c. Preventive measures.
      (1) Infusions should be maintained at flow rate ordered and should be appropriate for patient's clinical condition.
      (2) Positive pressure should never be applied by nurse to infuse solution.
      (3) Never play "catch-up" when fluids are behind schedule.
      (4) Make sure physician is aware of 24-hour IV piggyback fluid volume.
5. Speed shock.
   a. Signs and symptoms.
      (1) Flushed face and headache.
      (2) Syncope.
      (3) Shock.
      (4) Cardiac arrest.
   b. Nursing intervention.
      (1) Slow IV to KVO rate.
      (2) Notify physician.
      (3) Provide therapeutic processes as prescribed by physician.
      (4) Resuscitate if necessary.
   c. Preventive measures.
      (1) Administer drugs at manufacturer's recommended rate.
      (2) Administer fluids at prescribed rate.
      (3) Keep flow control clamp out of reach of disoriented, confused patients and/or pediatric patients.
      (4) Monitor flow rate at least once per hour.

6. Catheter emboli.
   a. Types.
      (1) Immediate discovery - discovered at time of occurrence.
      (2) Delayed discovery - discovered at time site was discontinued.
   b. Signs and symptoms - obvious fragmentation of cannula.
   c. Nursing intervention.
      (1) If immediate discovery.
         (a) Remain with patient.
         (b) Apply tourniquet to involved extremity at torso junction.
         (c) Notify physician immediately.
         (d) Provide therapeutic processes as prescribed by physician.
         (e) Save portion of catheter removed.
      (2) If delayed discovery.
         (a) Notify physician immediately.
         (b) Provide therapeutic processes as prescribed by physician.
         (c) Always save portion of catheter originally removed.
   d. Preventive measures.
      (1) Proper cannula insertion technique.
      (2) Do not use scissors to cut away site dressing.
      (3) Confirm cannula integrity prior to insertion.

Air Embolism



In venous air embolism, air enters the right ventricle through a systemic vein and impedes the outflow of blood.

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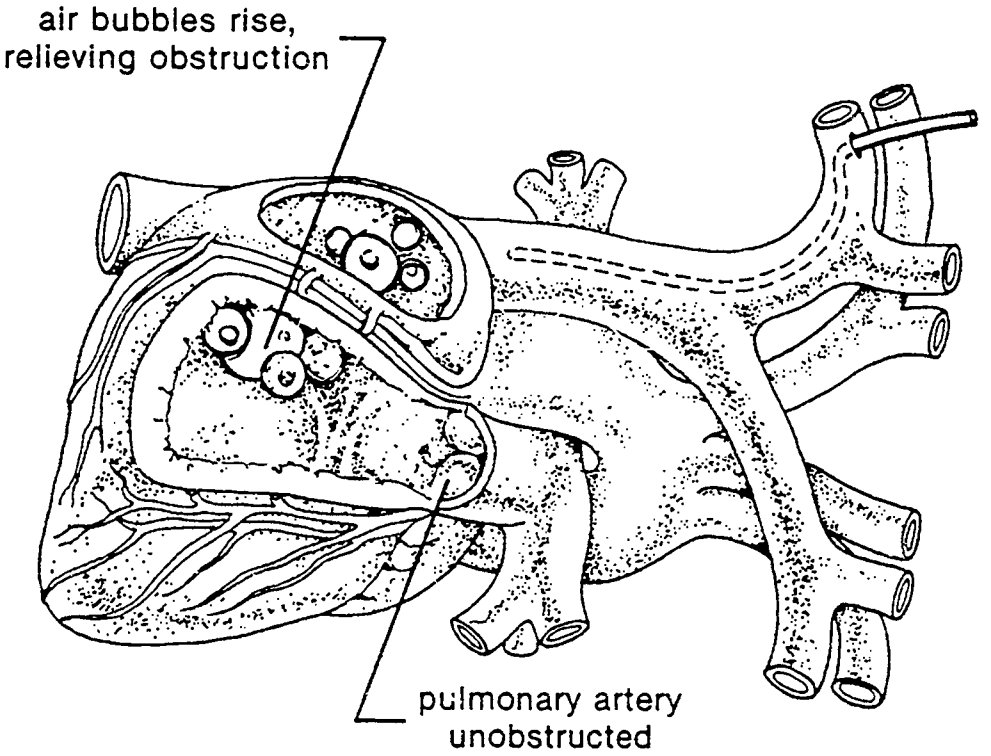
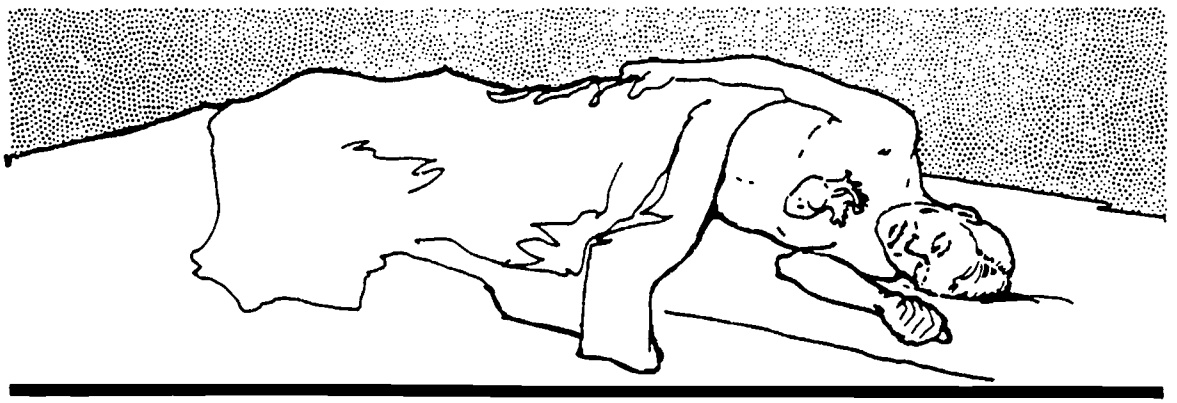
Positioning the Patient with Air Embolism





Placing the patient in the left lateral and Trendelenburg's position relieves the obstruction of blood flow through the pulmonary artery.

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7. Identify appropriate nursing interventions for the patient with a central line.

A. Prepare the patient for central line placement and IV therapy.
1. Assess the patient's knowledge base and concerns regarding central lines.
(Refer to 02.02 number 2.)
2. Discuss reasons for central line placement.
a. Long term therapy.
b. Administration of hypertonic solutions or caustic medications.
c. Saving or allowing peripheral veins to heal.
d. Decreased peripheral IV "sticks".
3. Describe procedure.
a. Patient position: with subclavian or jugular vein - Trendelenburg position with towel placed under back, between the scapulae, head turned away from insertion site.
b. Need to lie still during procedure.
c. Doctor will be wearing sterile gown, gloves, and mask.
d. Sterile drapes will be placed on patient including side of head.
e. May feel a stinging sensation with administration of local anesthetic, and pressure with insertion of catheter.
f. Catheter may be anchored with suctures.
g. Dressing will be changed every 2 to 3 days.
h. Report to nurse if:
(1) Dressing becomes loose or wet.
(2) Tubing becomes dislodged.
(3) There is increased pain and/or pressure at insertion site.
(4) Patient experiences shortness of breath.
i. Patient may have to sign a written consent.

B. Pneumothorax: usually associated with subclavian or internal jugular lines.

Is usually minimal and may not require intervention, unless on positive pressure ventilation. May be initially asymtamatic and then ↑ s/s.
1. Monitor closely for following symptoms:
a. Chest pain.
b. Dyspnea (↑ resp. rate).
c. Cyanosis.
d. ↓ or absent breath sounds on affected side.
2. Nursing Interventions:
a. Monitor patient for these signs and symptoms for at least 8 hrs. after catheter insertion.
b. Report signs and symptoms to nurse.

C. Air Embolism: signs and symptoms - resp. distress, weak pulse, ↓ BP, change of or loss of conciousness.
   1. Nursing Interventions.
      a. Place patient on left side in Trendelenburg's position.
      b. Notify nurse immediately.
   2. Prevention: Use leur-lock tubing, pumps with air detector capacity, always clamp catheter first when changing infusion tubing.

D. Thrombosis: signs and symptoms - edema at puncture site, erythema, swelling of arm, neck and face, pain along vein, fever, malaise, trachycardia.
   1. Nursing Interventions: notify nurse immediately.
   2. Prevention: maintain steady IV flow with pump, or flush according to hospital policy, dilute irritating solutions, use 0.22 micron filter for infusion.

E. Local Infection: signs and symptoms - redness, exudate, warmth, tenderness, swelling, fevers, chills, malaise.
   1. Nursing Measures: notify nurse, culture site, monitor temperature, document findings antibiotics.
   2. Prevention: sterile techniques with dressing changes, no wet or soiled dressings, occulusive dressings, no unnecessary movement of catheter at insertion site.

F. Systemic Infection: sign and symptoms - fever, chills, malaise, n&v, ↑ urine glucose.
   1. Nursing Interventions: notify nurse, monitor vs's, Q2-4h, document findings and interventions.
   2. Preventions: sterile techniques with tubing changes, use 0.22 micron filter, keep system closed as much as possible, teach patient aseptic techniques.

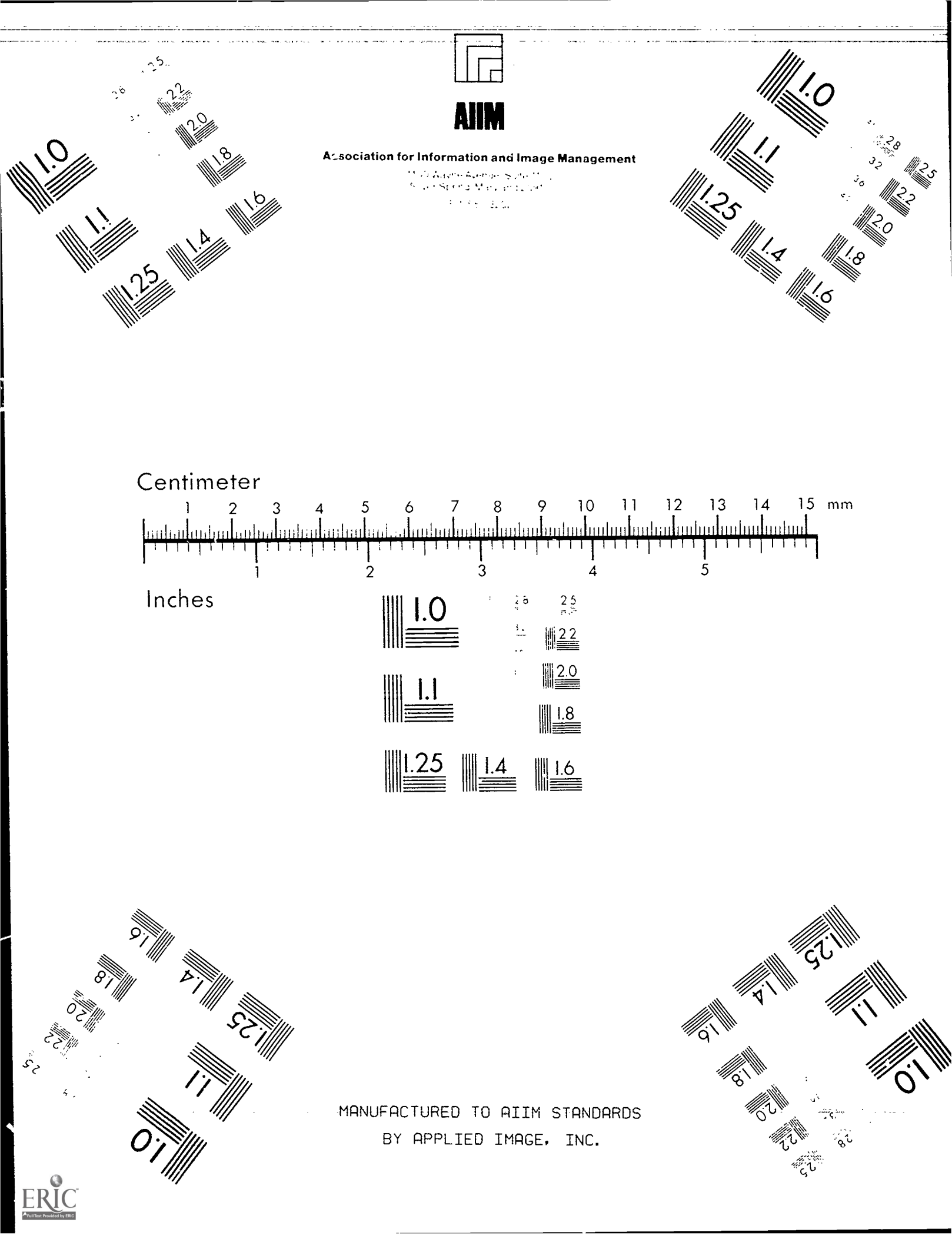
G. Nursing Interventions: Dressing changes every other day, with strict sterile techniques, change tubing every 72 hours, flush catheter per protocal (changing the cap), documentation of assessments and interventions, monitor vs, monitor signs and symptoms of hypovolemia and hypervolemia, prevent catheter kinks (loop tubing and secure with tape).

8. Identify the unique characteristics and precautions associated with CV lines and how these differ from standard IV lines.

   A. Advantages.
      1. Catheters are inserted into larger veins with higher flood flow which allows for more rapid dilution of fluid; therefore hypertonic fluids and initating or caustic medications can be infused.
      2. Eliminates the need for repeated peripheral venipunctures; therefore·
         a. Decreases patient's anxiety.
         b. Preserves or restores peripheral veins.
      3. Provides a port to draw blood.
      4. Provides a mean to monitor CVP (central venous pressure).
   B. Disadvantages.
      1. Increased risk of complications and life threatening conditions.
         a. Puemothorax.
         b. Air embolism.
         c. Thrombus.
         d. Vessel perforation.
      2. Requires more time and skill to insert.
      3. More costly.
      4. Vigorous upper body movement (ie. swimming, lifting heavy objects) may displace the catheter tip.

03.01 **TASK: Perform Selected IV Therapy Functions for the Stable Patient with CV Lines** (cont.)

9. Document procedures and patient's reactions.
   - A. The type, amount & rate of infusion.
   - B. Dressing changes, including the appearance and location of catheter and site, as well as how patient tolerated procedure.
   - C. Tubing & solution changes.
   - D. Cap changes.
   - E. Flushings, including any problems encountered, and the amount and type of solution used.
   - F. Others solutions infused.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03.02 TASK: Administer Peripheral and/or Central Line Parenteral Nutrition and Lipids

1. Define total parenteral nutrition (TPN) and hyperalimentation (HA) and lipids.

   A. TPN - total parenteral nutrition.
   B. HAF - Hyperalimentation fluid; these solutions are hypertonic with an osmolarity of 1800-2400 mOsm/liter. Electrolytes, vitamins, micronutrients & water meet daily requirements. Adults use 0.8-1.0 g of glucose/kg/day, therefore most pts. do not require much, if any, extra insulin. Central = 20-25% dext., peripheral = 5-10% dextrose.
   C. Lipids - perform the same as digested fat.
      1. 10% & 20% can be safely given peripherally or centrally.
      2. History.
         a. Development began in early 1960's in the Harrison Department of Surgical Research at the University of Pennsylvania Hospital.
         b. First successfully treated patient - a severely ill infant suffering from a small bowel atresia.

03 02 **TASK: Administer Peripheral and/or Central Line Parenteral Nutrition and Lipids** (cont.)

2. Enumerate reasons for the purpose of TPN.

A. If illness or surgery prevents eating, parenteral nutrition may be needed. Nutritional assessment may reveal decreased food intake, increased metabolic need, or a combination.
B. The most common nutritional deficiency involves proteins and calories.
C. Through gluconeogeenesis the body mobilizes & converts glycogen to glucose turea, then the body gets energy from adipose tissue. The body then taps visceral and somatic body proteins (albumin and transferrin are visceral, muscle and tissue are somatic). This results in a negative nitrogen balance.
D. Disorders that require TPN commonly include: cancer, GI disorders, chronic heart failure, alcoholism, burns, infections.
E. Reasons to receive TPN: debilitating illness lasting more than 2 weeks, no oral intake for more than 7 days, 10% weight loss, albumin less than 3.5, no tolerance of enteral feedings, excessive nitrogen loss, renal or hepatic failure.
F. Indications: inability to ingest nutrients by enteral route in quantity sufficient to meet nutritional requirements, any clinical condition that prevents a patient from utilizing the gastrointestinal tract for maintenance or achievement of anabolism.

3. Identify components of the TPN solution.

   A. Hepatime - liver disease.
   B. Renamine - renal disease.
   C. Dextrose - most calories come from this.
   D. Amino Acids - supply protein to replace essential amino acids and prevent protein loss.
   E. Fat - supplied as lipids, provide 40% - 60% of daily calories.
   F. Electrolytes - type and amount added depends on patient's nutritional needs.
   G. Vitamins - to ensure normal body functions, one ampule of fat and water soluable vitamins. biotin, folic acid, and iron may be added.
   H. Trace elements (microelements) - promote normal metabolism, i.e. zinc, copper, chromium, iodine, selenium, and manganese.
   I. Water - amount depends on patient's condition.
   J. Medications - other medications such as insulin or zantac may be added.

4. Identify nursing responsibilities related to TPN infusion.

A. Watch blood glucose levels, usually start low & build, then taper off. Most hospitals have a protocol for monitoring blood glucose (finger sticks).
B. Patient teaching - explain TPN and goals of treatment.
C. Recommendatons of practice.
   1. Blood should be tested for glucose at least every 6 hours.
   2. Daily weight should be obtained.
   3. Daily intake & output monitoring.
   4. Encourage active physical exercise to promote protein anabolism.
   5. Monitor vital signs every 8 hours.
   6. Observe skin turgor.
   7. Dependent/generalized edema should be immediately recognized and reported.
   8. Observe and note physical and mental changes.
   9. Close regular monitoring of blood levels.
   10. Initial infusion of TPN solution should be increased only in gradual systematic increments in flow rate/volume.
   11. Routine discontinuation of TPN solution involves gradual and systematic decrease in flow rate/volume.
   12. Nurse must be aware that certain drugs may interfere with accurate results and interpretations of urinary glucose tests.
D. Solution should be stored in refrigerator & put at room temperature 30 minutes before infusion.
E. Maintain strict aseptic technique. TPN is a great growth medium and a central line provides systemic access.
F. Check each bag/bottle each 24 hours.
G. Maintain excellent site care.
H. Use a pump & maintain flow rates.
I. Change tubing every 24 hours or per policy.
J. Administer no other solutions into TPN.
K. Accurate I and O.
L. Monitor lab values.
M. Lipids: use special filter (1.2 micron), check for separation, do not hang for more than 12 hours, watch for reaction.
N. Fat emulsions available in the U.S. today.
   1. Intralipid; 10% & 20%.
   2. Lyposin; 10% & 20%.
   3. Travalmulsion; 10% & 20%.
   4. Soyacal; 10% & 20%.
O. Calories provided.
   1. 10% - 1.1 calorie per ml.
   2. 20% - 2 calories per ml.

P. Flow rate.
   1. 10% fat emulsion (begin infusion at 1 ml/min. for first 15-30 minutes, if no complications develop, increase reate to correspond with ordered time span for infusion; should not infuse in less than 4 hours, or should not infuse for longer than 12 hours).
   2. 20% fat emulsion (begin infusion at 0.5 ml/min. for first 15-30 minutes, if no complications develop, increase rate to correspond with ordered time span for infusion; should not infuse in less than 8 hours, should not infuse for longer than 12 hours).

Q. Nursing considerations.
   1. Inspect the emulsion for separation or an oily appearance. Discard if present.
   2. Use non-PCV tubing supplied by the manufacturer.
   3. Do not filter.
   4. Do not retain partially used containers.
   5. May be infused as a solo infusion or simultaneously with the dextrose-amino acids solution, through a "Y" - connector located near the infusion site.
   6. Patient's ability to eliminate infused fat from the circulation should be monitored.

5. Administer central line and TPN.

6. Recognize potential/actual complications of TPN infusion; take appropriate nursing actions.

COMPLICATIONS	SIGNS AND SYMPTOMS	INTERVENTIONS
Catheter-related complications		
Dislodged catheter	Catheter out of the vein	•Place a sterile gauze pad on the insertion site and apply pressure.
Cracked or broken tubing	Fluid leaking out of the tubing	•Apply a padded hemostat above the break to prevent air from entering the line
Pneumothorax and hydrothorax	Dyspnea, chest pain, cyanosis, decreased breath sounds	•Suction. •Chest tube will be inserted.
Sepsis	Fever, chills, leukocytosis, erythema or pus at insertion site	•Remove catheter and culture tip. •Give appropriate antibiotics.
Metabolic complications		
Hyperglycemia	Fatigue, restlessness, confusion, anxiety, weakness, and (in severe cases) delirium or coma; polyuria; dehydration; elevated blood and urine glucose levels	•Initial infusion should begin slowly. •Start insulin therapy or adjust TPN flow rate.
Hypoglycemia	Sweating, shaking, irritability when infusion is stopped	•Infuse dextrose 10%
Hyperosmolar nonketotic syndrome	Confusion, lethargy, seizures, coma, hyperglycemia, dehydration, glycosuria	•Stop dextrose. •Give insulin and 0.45% sodium chloride to rehydrate.
Hypokalemia	Muscle weakness, paralysis, paresthesia, arrhythmias	•Increase potassium supplementation.
Hypomagnesemia	Tingling around mouth, paresthesia in fingers, mental changes, hyperreflexia	•Increase magnesium supplementation.
Hypophosphatemia	Irritability, weakness, paresthesia, coma, respiratory arrest	•Increase phosphate supplementation.

Hypocalcemia	Polyuria, dehydration, elevated blood and urine glucose levels	•Increase calcium supplementation.
COMPLICATIONS	**SIGNS AND SYMPTOMS**	**INTERVENTIONS**
Metabolic acidosis	Increased serum chloride level, decreased serum bicarbonate level	•Use acetate or lactate salts of sodium or hydrogen.
Hepatic dysfunction	Increased serum transaminase, lactate dehydrogenase, and bilirubin levels	•Use special hepatic formulations. •Decrease carbohydrate and add I.V. lipids.
Mechanical complications		
Clotted catheter	Interrupted flow rate, hypoglycemia	•Reposition catheter. Attempt to aspirate clot. •If unsuccessful, instill urokinase to clear catheter lumen, as ordered.
Air embolism	Apprehension, chest pain, tachycardia, hypotension, cyanosis, seizure, loss of consciousness, cardiac arrest	•Clamp catheter. •Place patient in the Trendelenburg position on left side. •Give oxygen as ordered. •If cardiac arrest occurs, use cardiopulmonary resuscitation.
Thrombosis	Erythema and edema at insertion site; ipsilateral swelling of arm, neck, and face; pain at the insertion site and along vein; malaise; fever; tachycardia	•Remove catheter promptly. •Administer heparin, if ordered. •Venous flow studies may be done.
Too rapid an infusion	Nausea, headache, lethargy	•Check the infusion rate. •Check the infusion pump if you are using one.
Extravasation	Swelling of tissue around the insertion site; pain	•Stop I.V. infusion •Assess patient for cardiopulmonary abnormalities. Chest X-ray may be performed.
Phlebitis	Pain, tenderness, redness, and warmth	•Apply gentle heat to the insertion site. •Elevate the insertion site, if possible.

03.02 **TASK: Administer Peripheral and/or Central Line Parenteral Nutrition and Lipids** (cont.)

7. Document procedures and patient's reactions.

SEE 03.03 number 2

03.03 **TASK: Perform Legal Accurate Documentation of all Related Functions, Observations, Patient Responses/Reactions**

1. Enumerate criteria for legal documentation.

   SEE number 2 below.

2. Identify what is to be documented and how often.

   A. Document appearance of insertion site at least every shift.
   B. Document status of dressing (ie: dry of any drainage, occulsive dressing intact).
   C. IV infusing and how (ie: pump/gravity).
   D. Flushes.
   E. Patient's reactions to procedures, and comments on site comfort/discomfort.
   F. Dressing changes.

APPENDIX B

EQUIPMENT AND SUPPLIES LIST

PART II COURSE EQUIPMENT AND SUPPLIES LIST

Per class of 10 students:

- TPN orders and labels — 4/class
- 30 cc vials NS — 4/class
- IV arms — 3/class
- IV pumps — variety
- IV poles — 5/class
- Central line models — 3/class
- Variety of central lines
  - Single lumen
  - Double lumen
  - Triple lumen
  - Hickman
  - Groshong
  - Pont-a-cath
- Tape — 10 rolls/class
- Alcohol prep pads — 5 boxes/class
- Non-sterile gloves — 2 boxes/class
- Betadine Swab pads — 2 boxes/class

Per student:

- 2 x 2 gauze — 5
- 4 x 4 gauze — 5
- 250 cc fluid bags — 1
- IV tubing — 1 regular and 1 secondary
- Tegaderm (small) — 2
- Tegaderm (large) — 2
- Bandaids — 2
- Jelcos (Angios) — 2
- 3 cc syringes — 3
- IV start kit — 1
- Butterfly catheter — 1
- Betadine swabsticks — 2 pkgs.
- Sterile gloves — 1 pkg.
- Mask — 2

CHECKLISTS FOR PART II

Learner's Name:_____ Date:_____

PART II - TASK 2.05

Checklist for Insertion of the Intravenous Over-the-Needle Cannula

Equipment:

Cannulas	Antimicrobial agent
Time strip	Tubing and tubing change label
Container of solution	Dressing
IV standard	Pen
Tape	Tourniquet
Protective gloves	Alcohol - skin bactericidal
Puncture-proof container	

		Yes	No
1.	Identify the patient.		
2.	Control the environment: a) provide privacy. b) adjust lighting. c) adjust height of bed if needed.	____ ____ ____	____ ____ ____
3.	Wash hands.		
4.	Assess patient's medical/surgical history.		
5.	Based on assessment, select vein.		
6	Apply tourniquet.		
7.	Apply measures to dilate vein.		
8.	Palpate vein.		
9.	Release tourniquet.		
10.	Arrange supplies in order of sequential use in assessible place: a) open cannula package. b) tear tape. c) prepare dressing.		
11.	Place protective paper towel or cloth under proposed site.		
12.	Clip excessive hair.		
13.	Apply tourniquet.		
14.	Palpate vein.		

Insertion of the Intravenous Over-the-Needle Cannula (cont.)	Yes	No
15. Cleanse site. a) Clean center to periphery. b) Clean for at least one minute with friction. c) Allow to dry.	____ ____ ____	____ ____ ____
16. Put on protective gloves.		
17. Inform patient of stick.		
18. Aseptically insert stylet, bevel up.		
19. Ascertain blood return.		
20. Advance stylet slightly.		
21. Advance catheter.		
22. Release tourniquet.		
23. Remove stylet while applying digital pressure.		
24. Place stylet in puncture-proof container.		
25. Aseptically connect administration set to cannula hub.		
26. Initiate flow of infusion slowly.		
27. Observe for sign of infiltration.		
28. Anchor cannula with tape according to manufacturer's guidelines.		
29. Apply antimicrobial agent to site.		
30. Apply dressing and secure with tape.		
31. Remove gloves.		
32. Apply label to dressing. a) Type, gauge and length of cannula b) Date and time c) Initials/name	____ ____ ____	____ ____ ____
33. Regulate flow rate per ordered rate.		

Insertion of the Intravenous Over-the-Needle Cannula (cont.)		
34. Advise patient of restrictions, precautions.		
35. Dispose of used equipment and rubbish according to institutional policy.		
36. Charge for supplies used.		
37. Document procedure.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART II - TASK 3.01

Checklist for Central Line Dressing Change

Equipment:

Dressing Kit or:
Antimicrobial agent on swabs
Alcohol swabs
1" adhesive tape
Sterile gloves
Disposal bag
Ointment if used
Sterile 4x4 gauze pads or transparent dressing
Hydrogen peroxide
Masks and gown if policy of facility

		Yes	No
1.	Verify need for dressing change.		
2.	Obtain dressing kit or assemble equipment.		
3.	Identify patient.		
4.	Explain procedure to patient.		
5.	Control the environment: a) provide privacy b) adjust lighting c) adjust height of bed		
6.	Place the patient in a comfortable, supine position, then ask patient to turn head away from catheter site.		
7.	Wash hands thoroughly.		
8.	Open bag (to dispose of old dressing).		
9.	Put on clean gloves (and mask according to policy).		
10.	Remove old dressing, being careful not to pull catheter.		
11.	Inspect old dressing for signs of infection then discard.		
12.	Check insertion site for evidence of infection.		
13.	Put on sterile gloves after removing clean gloves.		
14.	Clean skin around catheter with alcohol three times, wiping outward from insertion site in a circular motion.		
15.	Let alcohol dry completely.		

Checklist for Central Line Dressing Change (cont.)		Yes	No
16.	Clean skin around catheter with providone-iodine in same manner as above.		
17.	Redress with transparent dressing or 4x4 gauze dressing (may apply providone-iodine ointment according to hospital policy).		
18.	Retape the catheter if tape is soiled.		
19.	Label dressing with date, time, initials.		
20.	Dispose of used equipment and supplies.		
21.	Chart dressing change procedure.		

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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Learner's Name:_____ Date:_____

PART II - TASK 3.02

Checklist for Administration of TPN

Equipment:

TPN solution (unchilled)
Administration set
tape
I.V. pole (as needed)

		Yes	No
1.	Collect equipment.		
2.	Verify type and amount of solution ordered with Dr. order.		
3.	Verify accuracy of added medicants and amount ordered.		
4.	Check expiration date of solution.		
5.	Check glass bottles for chips/cracks.		
6.	Observe for clarity of solution and presence of particulate matter.		
7.	Wash hands.		
8.	Remove container cover and discard, if applicable.		
9.	Remove administration set tubing from box.		
10.	Close roller control clamp.		
11.	Insert administration set spike into container.		
12.	Squeeze chamber to fill at least 1/3.		
13.	Open clamp slightly and allow tubing to fill slowly while inverting med-ports and tapping to clear air.		
14.	Close roller clamp.		
15.	Tape time strip to solution container to indicate rate of flow.		

Administration of TPN (cont.)		Yes	No
16.	Label administration set tubing with time and date for change and initials.		
17.	Suspend from IV standard or connect to infusion control device, if applicable.		
18.	Identify patient.		
19.	Validate allergy history.		
20.	Alleviate patient's concerns by explaining and answering questions regarding: a) purpose of the therapy b) procedure to be employed c) equipment to be used d) limitations/restrictions related to IV therapy e) demonstrate ambulation, if applicable.	____ ____ ____ ____ ____	____ ____ ____ ____ ____

Comments:

Satisfactory Demonstration: _____ Yes _____ No

_____ Student's Signature

_____ Evaluator's Signature

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TEST FOR PART II

TEST
IV Therapy for LPNs
Part II

1. When selecting a site to start an IV, you should consider which of the following?
   a: physician preference
   b: nurse convenience
   c: time required to start IV
   d: condition of the veins
2. LPNs may NOT do which of the following?

   a. hang a medicated IV on a central line
   b. give a saline flush to a peripheral line
   c. give 5,000u Heparin via a central line
   d. hang a bag of TPN with lipids in it

3. Responsibility to the patient and the nursing profession by the LPN include all of the following EXCEPT:

   a. hanging the correct medication
   b. having a RN check all IV medications
   c. hanging only medications premixed by the pharmacy
   d. knowing how to calculate drip rates for IVs

4. LPNs may perform all functions as outlined in the Nurse Practice Act under which of the following conditions?

   a. all that the RN gives permission to do
   b. the ones that were covered in LPN school
   c. the ones the RNs are too busy to perform
   d. the ones covered by the institution's policy

5. Which of the following criteria should be used to select an IV site?

   a. use the dominant hand/arm
   b. use proximal veins first
   c. use veins that are NOT sclerotic
   d. use of leg veins are always OK

6. Superficial veins are located in which layer of the skin?

   a. subcutaneous tissue
   b. dermis layer
   c. subdermis layer
   d. epidermis layer

7. Nerves that cause pain during IV insertion are located in which layer of the skin?

a. subcutaneous tissue
b. dermis layer
c. subdermis layer
d. epidermis layer

8. All of the following factors can lead to increased risk of infection EXCEPT:

a: site selection
b: blood flow
c: handwashing
d: technique

9. Which layer of vein can be damaged by an IV catheter and cause thrombus formation?

a. tunica media
b. tunica externa
c. tunica veina
d. tunica intima

10. The elderly are at increased risk for infection related to IV insertion due to all of the following EXCEPT:

a: medication use
b: decreased T cells
c: dry skin
d: less adipose tissue

11. Which of the following sites contains the most nerve endings and is therefore generally painful to insert?

a. digital veins
b. cephalic veins
c. antecubital veins
d. metacarpal veins

12. Which of the following sites generally does not impair mobility?

a. digital veins
b. cephalic veins
c. antecubital veins
d. metacarpal veins

13. All of the following are venous changes that are commonly seen in the elderly EXCEPT:

a. looser tissue
b. sclerotic veins
c. smaller veins
d. tortuous veins

14. Which site is preferred for the pediatric patient?

a. dorsal hand veins
b. antecubital fossa
c. veins around the wrist
d. dorsal foot veins

15. To prevent an air embolism, the most appropriate nursing intervention would be to:

a: always have pateint turn on the Left side for tubing changes
b: always use sterile technique when changing central line dressings
c: always have patient perform valsalva when changing peripheral IV tubing
d. always clamp central lines during tubing/cap changes

16. Which of the following statements best defines total parenteral nutrition?

a. isotonic solution with vitamins and nutrients
b. hypertonic solution with vitamins and nutrients
c. hypotonic solution with vitamins and nutrients
d. isotonic solution with large amounts of dextrose

17. Which statement is true of 20% lipids?

a. 20% lipids can not be given with TPN
b. 20% lipids can only be given peripherally
c. 20% lipids can be given either peripherally or centrally
d. 20% lipids can only be given centrally

18. All of the following are reasons to give TPN EXCEPT:

a. albumin <3.5
b. 5% weight loss
c. no tolerance of enteral feeding
d. debilitating illness > 2 weeks

19. A patient with liver disease would most likely receive which of the following TPN solutions?

a. hepatamine
b. renamine
c. nephramine
d. miniamine

20. Which of the following is the most appropriate nursing responsibility for the patient receiving TPN?

a. change the bag/bottle every 12 hours
b. monitor urine for spillage of sugar
c. monitor blood glucose by finger stick
d. store all solutions at room temperature

21.All of the following are reasons a patient may need an IV infusion EXCFPT:

a. transfuse blood
b. maintain hydration
c. draw blood
d. deliver TPN

22. A common nursing concern regarding IV insertion is:

a. fear of needles
b. needing to reassure the patient
c. getting sick from the insertion
d. harming the patient

23. Because of the risk of breaking the catheter due to bending, the nurse should avoid which of the following sites?

a. antecubital fossa
b. metacarpal veins
c. cephalic veins
d. basilic veins

24. Because all body fluids are considered contaminated, the following precautions should be taken when starting an IV.

a. wear a gown
b. recap needles
c. break needles
d. wear gloves

25. A physician's order for IV therapy must include all of the following EXCEPT:

a. type of solution
b. vein to be used
c. rate of solution
d. MD signature

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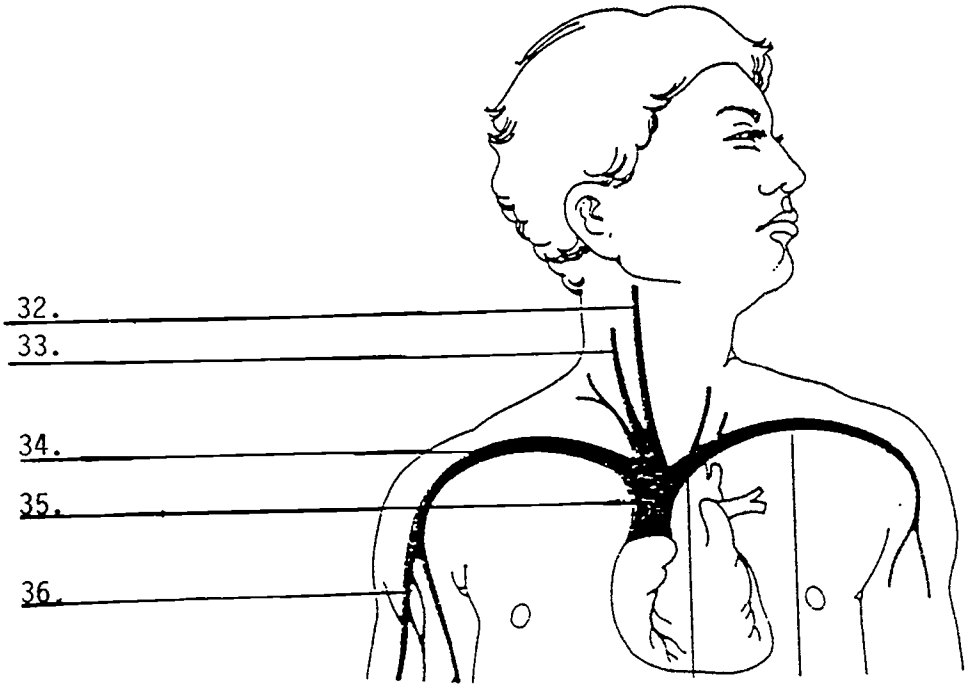
31. Describe the role/responsibility of the LPN in relation to PICC lines.

32. - 36. Label the veins of the chest.



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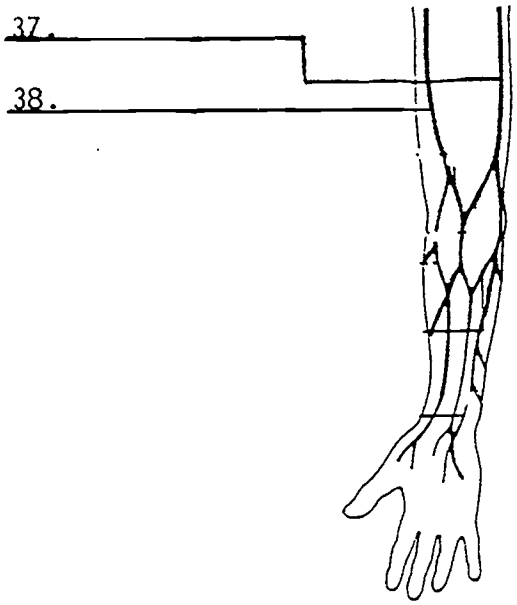

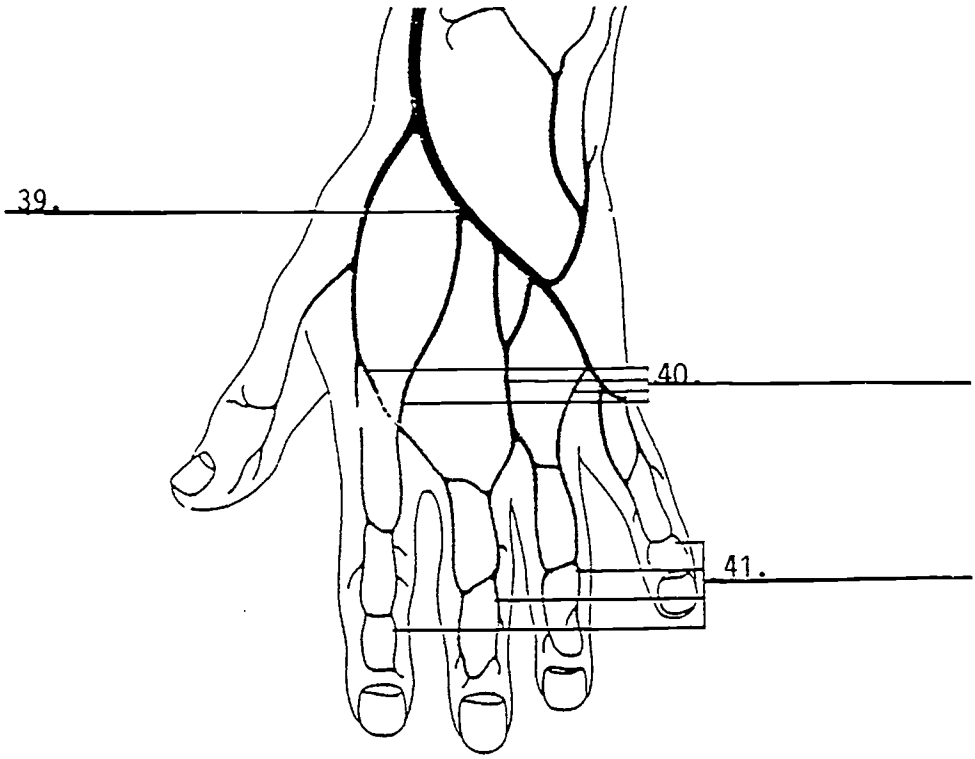

42. Why should a child's IV insertion be done in the treatment room?

43. Explain IV therapy to an 8 year old.

44 - 45. List 4 common components found in TPN.

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b. should be irrigated each week if not being used for IV therapy.
c. made of PVC or polyurethane
d. contains a dacron cuff

50. List 3 reasons a patient might have an IV infusion.

ANSWER KEY FOR PART II TEST

TEST
IV Therapy for LPNs
Part II

1. When selecting a site to start an IV, you should consider which of the following?
   a: physician preference
   b: nurse convenience
   c: time required to start IV
   (d): condition of the veins

2. LPNs may NOT do which of the following?

   a. hang a medicated IV on a central line
   b. give a saline flush to a peripheral line
   (c). give 5,000u Heparin via a central line
   d. hang a bag of TPN with lipids in it

3. Responsibility to the patient and the nursing profession by the LPN include all of the following EXCEPT:

   a. hanging the correct medication
   (b). having a RN check all IV medications
   c. hanging only medications premixed by the pharmacy
   d. knowing how to calculate drip rates for IVs

4. LPNs may perform all functions as outlined in the Nurse Practice Act under which of the following conditions?

   a. all that the RN gives permission to do
   b. the ones that were covered in LPN school
   c. the ones the RNs are too busy to perform
   (d). the ones covered by the institution's policy

5. Which of the following criteria should be used to select an IV site?

   a. use the dominant hand/arm
   b. use proximal veins first
   (c). use veins that are NOT sclerotic
   d. use of leg veins are always OK

6. Superficial veins are located in which layer of the skin?

   (a). subcutaneous tissue
   b. dermis layer
   c. subdermis layer
   d. epidermis layer

7. Nerves that cause pain during IV insertion are located in which layer of the skin?

a. subcutaneous tissue
b. dermis layer
c. subdermis layer
d. epidermis layer

8. All of the following factors can lead to increased risk of infection EXCEPT:

a: site selection
b: blood flow
c: handwashing
d: technique

9. Which layer of vein can be damaged by an IV catheter and cause thrombus formation?

a. tunica media
b. tunica externa
c. tunica veina
d. tunica intima

10. The elderly are at increased risk for infection related to IV insertion due to all of the following EXCEPT:

a: medication use
b: decreased T cells
c: dry skin
d: less adipose tissue

11. Which of the following sites contains the most nerve endings and is therefore generally painful to insert?

a. digital veins
b. cephalic veins
c. antecubital veins
d. metacarpal veins

12. Which of the following sites generally does not impair mobility?

a. digital veins
b. cephalic veins
c. antecubital veins
d. metacarpal veins

13. All of the following are venous changes that are commonly seen in the elderly EXCEPT:

a. looser tissue
b. sclerotic veins
c. smaller veins
d. tortuous veins

14. Which site is preferred for the pediatric patient?

ⓐ. dorsal hand veins
b. antecubital fossa
c. veins around the wrist
d. dorsal foot veins

15. To prevent an air embolism, the most appropriate nursing intervention would be to:

a: always have pateint turn on the Left side for tubing changes
b: always use sterile technique when changing central line dressings
c: always have patient perform valsalva when changing peripheral IV tubing
ⓓ. always clamp central lines during tubing/cap changes

16. Which of the following statements best defines total parenteral nutrition?

a. isotonic solution with vitamins and nutrients
ⓑ. hypertonic solution with vitamins and nutrients
c. hypotonic solution with vitamins and nutrients
d. isotonic solution with large amounts of dextrose

17. Which statement is true of 20% lipids?

a. 20% lipids can not be given with TPN
b. 20% lipids can only be given peripherally
ⓒ. 20% lipids can be given either peripherally or centrally
d. 20% lipids can only be given centrally

18. All of the following are reasons to give TPN EXCEPT:

a. albumin <3.5
ⓑ. 5% weight loss
c. no tolerance of enteral feeding
d. debilitating illness > 2 weeks

19. A patient with liver disease would most likely receive which of the following TPN solutions?

ⓐ. hepatamine
b. renamine
c. nephramine
d. miniamine

20. Which of the following is the most appropriate nursing responsibility for the patient receiving TPN?

a. change the bag/bottle every 12 hours
b. monitor urine for spillage of sugar
ⓒ. monitor blood glucose by finger stick
d. store all solutions at room temperature

21.All of the following are reasons a patient may need an IV infusion EXCEPT:

a. transfuse blood
b. maintain hydration
c. draw blood
d. deliver TPN

22. A common nursing concern regarding IV insertion is:

a. fear of needles
b. needing to reassure the patient
c. getting sick from the insertion
d. harming the patient

23. Because of the risk of breaking the catheter due to bending, the nurse should avoid which of the following sites?

a. antecubital fossa
b. metacarpal veins
c. cephalic veins
d. basilic veins

24. Because all body fluids are considered contaminated, the following precautions should be taken when starting an IV.

a. wear a gown
b. recap needles
c. break needles
d. wear gloves

25. A physician's order for IV therapy must include all of the following EXCEPT:

a. type of solution
b. vein to be used
c. rate of solution
d. MD signature

26. Which of the following interventions will help dilate a patient's vein?

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c. thrombosis
(d). pneumothorax

31. Describe the role/responsibility of the LPN in relation to PICC lines.

may not start

may not D/C

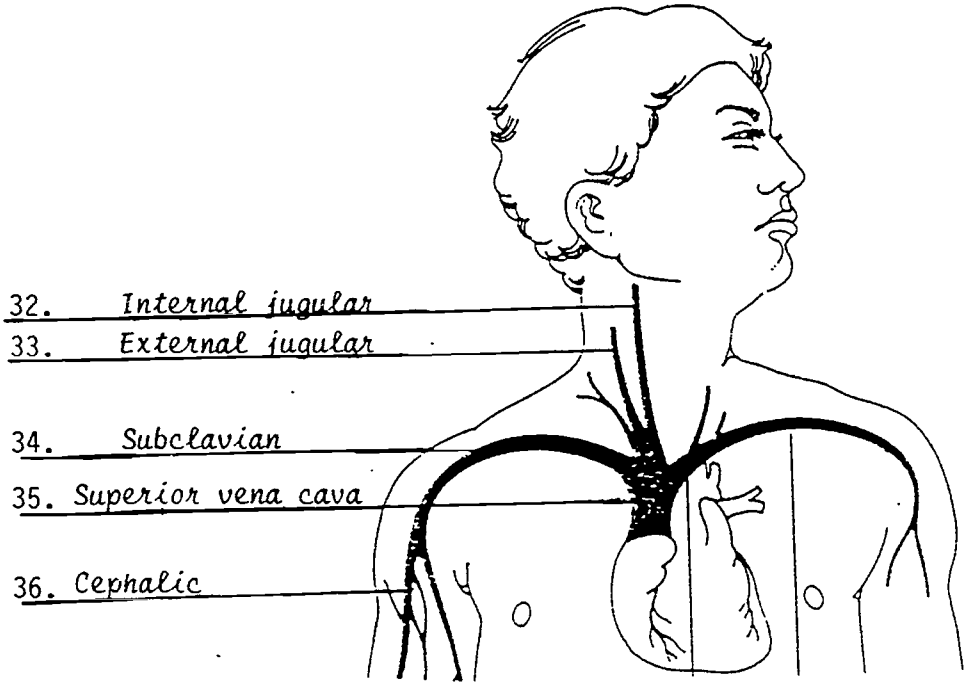
may hang fluids

may change dressings

may monitor site

may not draw blood

32. - 36. Label the veins of the chest.



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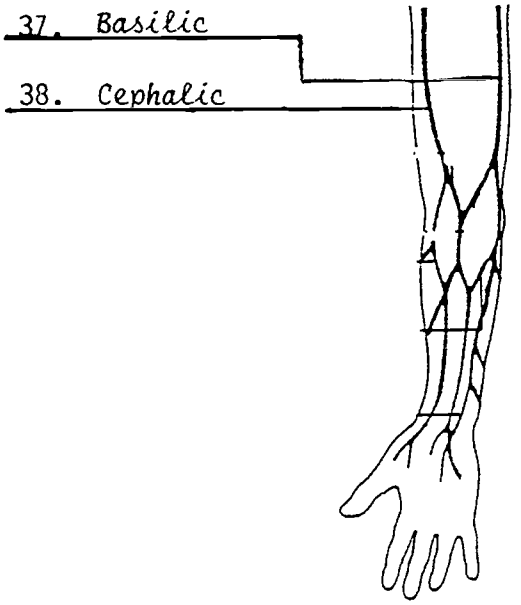

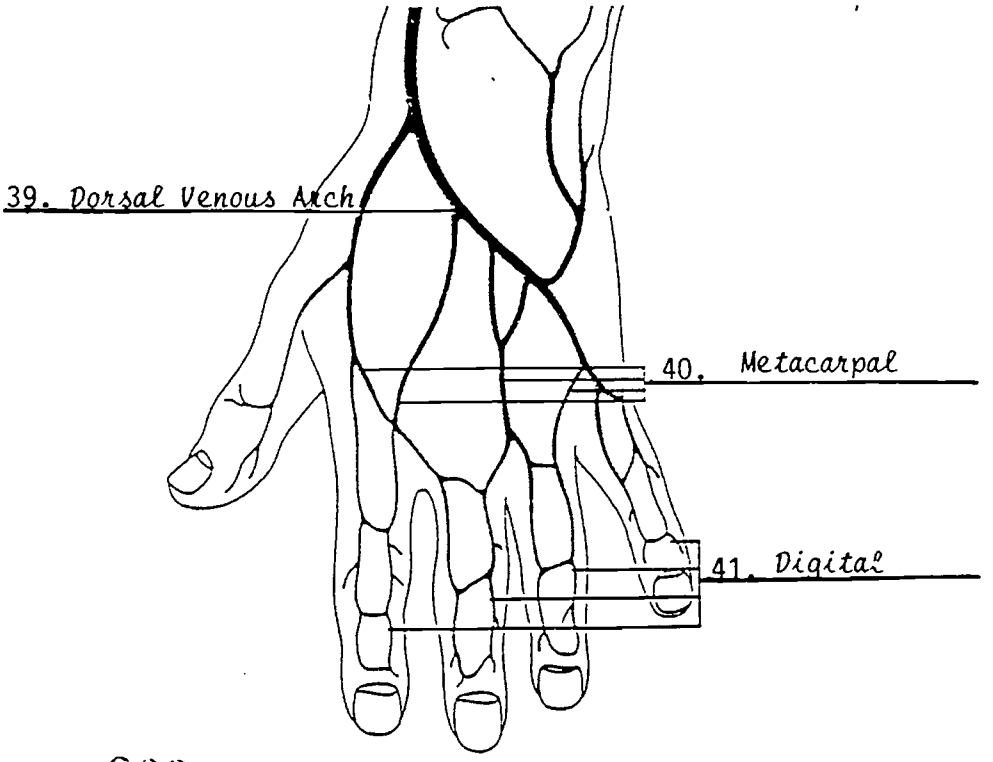

42. Why should a child's IV insertion be done in the treatment room?

Treatment room should be used so the child's room is "safe". Also, if there is a roommate, they will not be frightened.

43. Explain IV therapy to an 8 year old.

"We need to place a hollow tube (straw) into your arm (hand) to give you fluid (medicine). It will hurt when I first put it in, then it will not hurt any longer."

44 - 45. List 4 common components found in TPN.

Amino Acids (Freamine, hepatamine, etc.)
Vitamins
Trace elements
Dextrose
Meds (insulin, zantac)
Water, etc.

46 - 48. List 3 complications of central lines and the appropriate nursing intervention for each.

Infection - monitor site, pts. temperature...notify RN/MD, culture if ordered.
Pneumothorax - ↑HOB, O_2, auscultate breath sounds, prepare for chest tube, monitor v/s.
Airembolism - clamp tube, place pt. on L side, ↓HOB, O_2, monitor v/s.
See text for others

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50. List 3 reasons a patient might have an IV infusion.

Life line
Rehydration
Medication
Nutrition
etc.

REQUIREMENTS FOR COURSES

IN I.V. THERAPY FOR LPNs

REQUIREMENTS FOR COURSES IN I.V. THERAPY FOR LICENSED PRACTICAL NURSES

I. Course of Instruction

A. The curriculum shall be approved by the Board of Nursing and shall be administered by the Division of Vocational Education.

B. The curriculum shall consist of a minimum of 30 hours of instruction, to include theory instruction, simulated practice and supervised clinical practice.

C. The curriculum shall be competency-based and shall include measurable learner objectives.

D. The course shall be taught by a licensed professional nurse experienced in IV Therapy, who meets requirements for certification as a vocational education instructor.

II. Course Content

A. Legal responsibilities of the LPN administering IV Therapy.

B. Purposes of IV Therapy.

C. Fluids and electrolytes; acid/base balance.

D. Equipment and safety precautions.

E. Medications and solutions commonly used in IV Therapy.

F. Nursing Responsibilities:

1. Policies and procedures for hanging solutions, adjusting drip rates, flushing heparin/saline locks, filling solucets and volume controls, changing tubing, dressing change, discontinuing IVs.
2. Aseptic technique.
3. Safety factors.
4. Patient preparation.
5. Calculating drip rates: timing drip rates.
6. Observations and monitoring.
7. Documentation.

G. Complications and the Nurse's Responsibility:

1. Infiltration
2. Thrombophlebitis
3. Pyrogenic reaction
4. Speed shock
5. Air embolism
6. Circulatory overload

H. Special Considerations

1. Blood transfusions

   a. Indications for blood transfusions
   b. Major blood products and their uses
   c. Complications and adverse reactions

2. Central venous access lines

   a. Hanging medications
   b. Changing dressings
   c. Changing tubing
   d. Adjusting drip rates

3. Pediatric IV Therapy - limited to children 7 years and older (specified 2/2/92)

I. Venipuncture Technique

III. Verification of Competence - a certificate of program completion shall be evidence the LPN has met requirements and is qualified to perform functions identified in Board of Nursing Rules.

Adopted 8/15/91