Component I: **CORE**

Module 7: **Blood Collection Process**

Purpose: **To prepare the learner how to collect a quality blood specimen for laboratory diagnostic purposes.**

Suggested time frame: **21 hours**

Objectives: **Upon completion of this 21 hour module, the learner will be able to:**

1. Demonstrate the procedure for proper patient identification.
2. Select equipment used in the venipuncture procedure.
3. List the factors to consider before blood collection.
4. Select an anatomical site to perform the venipuncture.
5. Preparation of the anatomical site.
6. Perform the venipuncture procedure.
7. Describe the theory and procedure for arterial puncture
8. Describe the procedures to perform a skin puncture.

Resources:

References:

Mcall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Component I: **CORE**

Module 7: **Blood Collection Process**

Topic 1: **Patient Identification**

Purpose: **To prepare the learner on the importance of proper patient identification and describe what information is verified, how to handle discrepancies, and what to do if a patient's ID band is missing.**

Suggested time frame: **1 hour**

Objective: **Upon completion of this topic, the learner will be able to:**

1. Define key terms.
2. Explain the importance of proper patient identification.
3. Describe the process of confirming the patient's identity.
4. Demonstrate the procedure for checking the patient's identification bracelet.
5. Describe how the phlebotomist should handle ID discrepancies.
6. Describe the procedure for a "missing" ID band.
7. Describe the special identification procedures for emergency rooms and infants.

Vocabulary:

Patient identification Identification (ID) band Requisition

References:

Mcall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Module 7: Blood Collection Process **Topic 1: Patient Identification**

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms. A. Review the terms listed in the vocabulary section B. Spell the listed terms accurately C. Pronounce the terms correctly D. Use the terms in their proper context	Lecture
2. Explain the importance of proper patient identification. A. Obtaining specimens from the wrong patient can lead to serious, even fatal consequences. 1. Erroneous lab results resulting in improper diagnosis. 2. Medication errors. 3. Blood transfusion errors. a. Patient receives a transfusion of the wrong blood type. b. Leading to hemolytic transfusion reaction or death. B. Grounds for dismissal of the person responsible. C. Lead to malpractice lawsuit against that person and organization.	Lecture Copies of hospital policies & procedure • Instructor provides examples
3. Describe the process of confirming the patient's identity. A. Ambulatory patients 1. Must have a complete physician's order 2. Ask patient a. Name and date of birth b. Unusual name, ask them to spell their name. B. Out patients 1. Must have complete physician's order 2. May be registered with admitting 3. Compare request with patient ID band if applicable, including: a. Name b. Medical record number c. Ask patient their date of birth C. Inpatients - Compare request with patient ID band. 1. Name 2. Medical record number 3. Ask patient their date of birth and name. D. New technologies - Bar-coding	Lecture Demonstration
4. Demonstrate the procedure for checking the patient's identification bracelet. A. Locate the ID bracelet B. Compare the information on the requisition with the ID band	Lecture Demonstration Sample ID bands

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Name 2. Medical record number 3. Ask patient their date of birth C. Ask the patient for their name and date of birth.	
5. Describe how the phlebotomist should handle ID discrepancies. A. Inform patient's nurse of discrepancy B. Specimens should not be obtained until discrepancy is resolved and the patient's identity is verified.	Lecture Demonstration
6. Describe the procedure for a "missing" ID band. A. ID band missing from patient's wrist. 1. Check patient's ankle. 2. Ask the nurse. B. Identification should never be verified from an ID band that is not attached to the patient. 1. Have patient's nurse verify identity of patient with the ID band and place the band on the patient before the specimen is drawn. 2. Verify the patient's identity according to objective 3.	Lecture
7. Describe the special identification procedures for emergency rooms and infants. A. Emergency room identification 1. Use of special ID band or numbering system to connect specimens with the patient. 2. Varies with facility protocols. B. Infant identification. 1. ID band is usually located on the infant's ankle. a. Examples are typically "Jones, Baby Boy" b. Twins or multiples are labeled "Jones, Twin A" or "Jones, Twin B" 2. Identification can be confirmed by a parent or relative.	Lecture

Component I: **CORE**

Module 7: **Blood Collection Process**

Topic 2: **Selection of Equipment**

Purpose: **To prepare the learner how to select the proper equipment for venipuncture based on patient assessment and testing required.**

Suggested time frame: **2 hours**

Objective: **Upon completion of this topic, the learner will be able to:**

1. Define key terms.
2. List the equipment and supplies needed to collect blood by venipuncture.
3. Contrast antiseptics and disinfectants.
4. Explain the purpose of using a tourniquet.
5. List and describe evacuated tube and syringe system components.
6. Identify types of additives used in blood collection.
7. Describe the principle behind, and list the order of draw for the evacuated tube system and the syringe system.

Vocabulary:

Sepsis	Bacteriostatic	Bacteriocidal
Metabolism of glucose	Order of draw	

References:

Mcall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. List the equipment and supplies needed to collect blood by venipuncture. A. Gloves 1. Powdered 2. Powder Free 3. Latex Free B. Antiseptics 1. 70% Isopropyl alcohol 2. Providone-Iodine 3. Tincture of Iodine 4. 0.5% Chlorhexidine gluconate (Patients allergic to iodine) C. Gauze pads or Cotton balls D. Tape or Bandages 1. Tape a. Plastic b. Paper c. Self adhesive gauze 2. Adhesive bandages a. Adults only b. Adhesive bandages should never be used on babies younger than two years of age due to danger of aspiration and suffocation. E. Sharps containers. F. Slides 1. Pre-cleaned 1x3 glass microscope slides 2. Used to make blood smears. G. Pen H. Watch I. Tourniquet 1. Latex 2. Latex Free J. Needles 1. Multi-sample needles 2. Hypodermic needles 3. Butterfly needles K. Evacuated tube system 1. Multi-sample needle 2. Tube holder 3. Evacuated tubes	Lecture Demonstration

Objectives & Content	Recommended Teaching Strategies & Evaluation
L. Syringe System 1. Syringe a. Barrel b. Plunger 2. Hypodermic needle	
3. Contrast antiseptics and disinfectants. A. Antiseptics - Bacteriostatic, that is to inhibit the growth of bacteria. B. Disinfectants - Bacteriocidal, kill bacteria. 1. Used on surfaces and instruments 2. Not safe for use on human skin. a. Household bleach in a 1:10 solution will kill the virus causing AIDS and hepatitis. b. Used to wipe surfaces and clean up blood spills.	Lecture
4. Explain the purpose of using a tourniquet. A. Cause veins to enlarge making them easier to find and puncture. B. A blood pressure cuff may be used in place of a tourniquet.	Lecture Demonstration
5. List and describe evacuated tube and syringe system components. A. Evacuated tube system components 1. Preferred method of blood collection. 2. Multi-sample needle - Used to draw multiple tubes from one venipuncture. 3. Adapter or tube holder - Used to receive the threaded needle on one end and the evacuated tubes on the other. 4. Evacuated tubes - Blood is collected directly into the tube during venipuncture. B. Syringe system components 1. Used for patients with difficult veins to directly control the pressure of blood withdrawal from the vein. 2. Hypodermic needles - Sizes used are generally 20 to 23 gauge for blood collection. 3. Syringe a. Various sized with 2 to 10 ml most commonly used. b. Parts i. Graduated barrel ii. Plunger	Lecture Demonstration Components of an Evacuated Tube System - Appendix 7.1 Evacuated Tube Needle - Appendix 7.2

Objectives & Content	Recommended Teaching Strategies & Evaluation
6. Identify types of additives used in blood collection. A. A tube additive is any substance placed within a tube other than the coating of the tube or tube stopper. B. Anticoagulants are substances that prevent blood from clotting. 1. Tubes containing anticoagulants yield whole blood specimens. 2. Blood specimens that are centrifuged yield plasma. C. Types of additives 1. EDTA (Ethylenediaminetetrsaacetic acid) is available in dipotassium (K_2) or disodium (Na_2) freeze dried powder, or tripotassium (K_3) liquid base. a. Prevents clotting by binding calcium in the form of potassium or sodium salt. b. The anticoagulant of choice for whole bloodhematology testing i. It preserves cell morphology and inhibits platelet clumping. ii. Because the cells and plasma will separate over time, specimens must be mixed for a minimum of 2 minutes prior to testing. • Blood smears must be made within 1 hour of collection in EDTA • Prolonged contact will change the staining characteristics of the formed elements. c. It is contained in lavender stopper tubes. 2. Heparin is most commonly available in the formations of lithium and sodium. a. Heparin prevents clotting by inhibiting the conversion of prothrombin to thrombin. b. The anticoagulant of choice for plasma chemistry testing. c. It is contained in green stopper tubes and royal blue stopper tubes with green labels. i. Green stopper tubes are often used for STAT chemistry testing. ii. Saves the time required for a serum specimen to clot. 3. Sodium Citrate prevents coagulation by binding	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
calcium a. The anticoagulant of choice for coagulation studies. b. Coagulation studies are performed on plasma. c. Tubes have light blue stoppers. 4. Potassium oxalate prevents coagulation by precipitating calcium. a. Oxalate, along with an antiglycolytic agent (sodium fluoride and lithium iodoacetate) is used to collect plasma for glucose testing. b. Tubes have gray stoppers. 5. Acid Citrate Dextrose (ACD) prevents coagulation by binding calcium. a. Acts as a red cell nutrient and a preservative by maintaining cell viability. b. Used for certain immunohematology tests and transplant compatibility testing. c. Tubes have yellow stoppers. 6. Antiglycolytic agents inhibit glycolysis or metabolism of glucose by the cells of the blood. a. The most common of these are sodium fluoride and lithium iodoacetate. Glucose is stable for: i. 24 hours in iodoacetate. ii. Up to three days in sodium fluoride. b. These agents are typically combined with anticoagulants to provide plasma specimens. c. Tubes have gray stopper. 7. Clot activators enhance coagulation. a. Provide increased surface for platelet activation i. Glass or silica particles ii. Inert clays • Siliceous earth • Celite iii. Clotting factors such as thromboplastin and thrombin. b. Glass and silica particles are the clot activators in serum separator tubes. 8. Polymer (Thixotropic) gel separators a. Contain an inert synthetic substance that:	

Objectives & Content	Recommended Teaching Strategies & Evaluation
i. Forms a physical barrier between the cellular portion of the specimen and the serum or plasma portion when the specimen is centrifuged. ii. Prevents the cells from continuing to metabolize glucose in the serum or plasma. b. Gel separators serum tubes (SST) have gold plastic or mottles red/gray rubber stoppers. c. Gel separator plasma tubes (PST) have light green plastic or mottled green/gray rubber stoppers.	
7. Describe the principle behind, and list the order of draw for the evacuated tube system and the syringe system. A. Evacuated tube system - glass and plastic 1. Designed to reduce interference in specimen testing a. May be caused by carryover of additives between tubes b. Minimizes the effects of tissue thromboplastin on coagulation specimens. 2. Order of Draw for glass tubes - according to NCCLS Standards a. Sterile – Blood cultures b. Red – Non-additive c. Light blue i. Sodium Citrate and others for coagulation studies ii. If a light blue tube is the first or only tube to be drawn, a discard tube should be drawn first to eliminate contamination from tissue thromboplastin picked up during needle penetration. d. Red - Additive e. Green – Heparin f. Lavender – EDTA (K_3 or Na_2) g. Gray – Oxalate/Fluoride 3. Easy way to remember evacuated tube order of draw. a. "Stop, red light, rest, green light, go." The first letter of each word in the phrase stands for a tube: S=sterile, R=red, L=light blue, R= Red additive, G=green, L=lavender, and G=gray.	Lecture Demonstration Quiz

Objectives & Content	Recommended Teaching Strategies & Evaluation
4. Order of Draw for plastic tubes a. Sterile - blood cultures b. Light blue c. Red d. Green - Heparin e. Lavender - EDTA f. Gray - Oxalate/Fluoride g. <u>WARNING</u>: order of draw for plastic tubes is subject to change. Check the current standards. B. Syringe system for glass and plastic 1. Designed to deliver blood first to those tubes most affected by microclot formation. 2. Order of Draw for glass a. Sterile – Blood cultures b. Red – Non additive c. Light blue – Sodium Citrate and others for coagulation studies. d. Red - Additive e. Green – Heparin f. Lavender – EDTA (K_3 or Na_2) g. Gray – Oxalate/Fluoride 3. Easy way to remember syringe system tube order of draw. a. "Stop, red light, rest, green light, go." The first letter of each word in the phrase stands for a tube: S=sterile, R=red, L=light blue, R= Red additive, G=green, L=lavender, and G=gray. 4. Order of Draw for plastic a. Sterile - Blood Cultures b. Light blue - Sodium Citrate, etc. c. Red d. Green - Heparin e. Lavender 0 EDTA f. Gray - Oxalate/Fluoride g. WARNING: order of draw for plastic tubes is subject to change. Check the current standards.	

Component I: **<u>CORE</u>**

Module 7: **Blood Collection Process**

Topic 3: **Factors to consider before blood collection**

Purpose: **To prepare the learner to various physiologic factors that affect the constituents of the blood and the factors that can affect the basal state.**

Suggested time frame: **2 hours**

Objectives: **Upon completion of this topic, the learn will be able to:**

1. Define key terms.
2. Describe basal state and the factors that influence this state.
3. Explain the importance of test collection priorities as related to specimen integrity and quality patient care.
4. List factors to consider in site selection.
5. Identify vascular access devices managed by nurses.
6. List patient related complications associated with blood collection.
7. List the specimen related complications associated with blood collection.
8. Describe Quality Control (QC)

Vocabulary:

Fasting	Cutdown	Basal state
Hemoconcentration	Lipemic	Blind probing
Diural variations	STAT	NPO
Edema	Hemotoma	Central line
PICC line	Fistula	Emesis basin
Reflux	Seizure	Sclerosed veins
Dialysis	Aspiration	Indwelling line
Mastectomy	Patency	Cortisol
SGOT levels	AST levels	

References:

Mcall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. Describe basal state and the factors that influence this state. A. Basal state is when the body is at rest, usually in the morning. B. Factors that affect this are the following: 1. Age - Red blood cell (RBC) and white blood cell (WBC) values are higher in newborns than adults. 2. Altitude - RBC values are higher at higher elevations. 3. Dehydration - Loss of fluids causes hemoconcentration, which increases the number of RBC's. 4. Diet a. Ingestion of sugar-laden foods - increases glucose levels dramatically but should return to normal within 2 hours. b. Ingestion of fatty foods - increases lipid content from 1 to 10 hours causing the serum or plasma to appear lipemic. 5. Diurnal variations a. WBC and iron levels are lower in the morning. b. Cortisol and testosterone levels are highest in the morning. 6. Drugs - Many drugs are toxic to the liver, increasing SGOT and AST levels. 7. Environment - Temperature and humidity are known to affect test values. 8. Exercise - Muscular activity will elevate lactic acid, creatinine, and protein levels. 9. Gender - RBC, Hgb and Hct normal values are higher for males. 10. Position - RBC levels are higher than the basal state after a patient stands for 15 minutes. 11. Increases in body fluid during pregnancy dilute RBCs, leading to lower RBC counts. 12. Smoking increases cortisol and WBC counts 13. Stress increases WBC counts.	Lecture Discussion
3. Explain the importance of test collection priorities as related to specimen integrity and quality patient care.	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
A. Fasting 1. Patient must abstain from eating or drinking except water for approximately 12 hours prior to collection of the specimen. 2. The phlebotomist must verify if the patient is fasting of has eaten. 3. If the patient ate, the phlebotomist should check with the patient's nurse or physician to find out whether the test should still be performed. 4. If the test is still wanted, the phlebotomist should document on the requisition slip that the patient was not fasting. 5. Commonly ordered fasting tests. a. Glucose b. Cholesterol c. Triglycerides d. Lipids B. Timed 1. Tests that are requested at a particular time 2. Important that the specimen is collected as near to the time requested as possible. 3. Actual specimen collection time must be noted on the requisition as well as the specimen container. 4. Commonly ordered timed tests. a. Glucose tolerance tests b. Cardiac enzymes c. Coagulation studies d. Therapeutic drug monitoring peaks and troughs. C. STAT 1. Comes from the Latin word "statim", meaning immediately. 2. These tests are performed on patients whose condition has become critical and results are urgently needed to respond to this situation. 3. These tests have the highest priority and should also be processed and results reported immediately. 4. Common response tests. a. 15 minutes to have specimen collected. b. 15 minutes to have specimen back in the lab and processed. c. 30 minutes to test and report the results. d. Overall time is 60 minutes from time of order to time of result. D. Routine 1. These test are commonly ordered to monitor the patient's progress.	

Objectives & Content	Recommended Teaching Strategies & Evaluation
2. There is no immediate urgency involved. 3. Most routine tests are ordered for the early morning rounds. E. Specimen integrity and quality patient care. 1. Specimens are processed and resulted to provide the physician with quality information and plan treatment for the patient. 2. Specimen integrity is maintained through prompt response to collection and processing requirements in order to report quality results.	
4. List factors to consider in site selection. A. Burns and Scars 1. Veins are difficult to palpate and penetrate in scarred areas. 2. Healed burn sites may have impaired circulation and may yield erroneous test results. 3. New burn sites are painful and susceptible to infection. B. Cutdowns 1. Veins are difficult to palpate and penetrate in scarred areas. 2. Apply tourniquet and draw below the cutdown site. C. Damaged Veins 1. Hardened or sclerosed veins are difficult to penetrate. 2. Often yield erroneous results owing to impaired blood flow. D. Edema 1. Results from accumulation of fluid in the tissues. The tissue is fragile, easily injured by a tourniquet and antiseptics. 2. Choose another site. E. Hematoma 1. A swelling or mass of blood (usually clotted). 2. Erroneous results may occur due to decreased blood flow. 3. Perform venipuncture distal to the hematoma. F. Mastectomy 1. Stoppage of lymph flow caused by lymph node removal on the same side of the mastectomy may yield erroneous results. 2. Draw on opposite side. 3. For the patient with mastectomies on both sides obtain written direction from the physician regarding potential draw sites. G. Obesity 1. Veins are usually deep and difficult to find.	Lecture Discussion

Objectives & Content	Recommended Teaching Strategies & Evaluation
2. Tourniquets may be too short. 3. Use median cubital vein between the double crease. 4. Second choice is the cephalic vein found by rotating the hand to a prone position. H. Intravenous (IV) Therapy 1. Blood should not be drawn from the arm with the IV line. 2. If no other site is available, the specimen should be collected below the IV insertion site, NEVER above a running IV. 3. Procedure for blood collection on the arm with the IV. a. Have the nurse turn off the IV for a minimum of 2 minutes. b. Apply the tourniquet below the IV. c. Select a vein other than the one with the IV. d. Draw a discard tube before collecting test specimens. e. Have the nurse restart the IV. f. Indicate on the requisition that the specimen was collected from the arm with the IV.	
5. Identify vascular access devices managed by nurses. A. Central Venous Catheter (CVC) 1. Inserted into a large vein such as the subclavian and advanced into the superior vena cava, proximal to the right atrium. a. The exit end is surgically tunneled under the skin to a site several inches away in the chest. b. Several inches of tubing protrude from the site c. Are normally covered with a transparent dressing. 2. CVCs include Broviac, Groshong and Hickman. 3. These types of lines can be used to obtain blood specimens but are never accessed by a phlebotomist, only by a registered nurse. 4. Special procedures are necessary for specimen collection. B. Implanted Port 1. A small chamber attached to an indwelling line. a. The chamber is implanted under the skin. b. Access is gained by inserting a noncoring needle through the skin into	Lecture Discussion

Objectives & Content	Recommended Teaching Strategies & Evaluation
the self-sealing septum of the chamber. 2. These can be used to obtain blood specimens but are never accessed by a phlebotomist, only by a registered nurse. 3. Special procedures are necessary for specimen collection. C. Peripherally Inserted Central Catheter (PICC) 1. Inserted into the peripheral venous system and threaded into the central venous system. a. It does not require surgical insertion. b. PICC lines are generally inserted into the basilic or cephalic vein with an exit in the antecubital area. 2. Because PICC lines tend to collapse on aspiration, drawing blood from a PICC line is not recommended. D. Arterial Line 1. Most commonly inserted into the radial artery. a. Used to provide continuous measurement of a patient's blood pressure. b. Also used for collection of blood gas specimens. 2. These can be used to obtain blood specimens but are never accessed by a phlebotomist, only by a registered nurse. 3. Special procedures are necessary for specimen collection. E. Heparin Lock 1. A special winged needle set. a. Can be left in a patient's vein for up to 48 hours. b. It is used to administer medication. 2. These can be used to obtain blood specimens but are never accessed by a phlebotomist, only by a registered nurse. 3. Special procedures are necessary for specimen collection. F. Arteriovenous Shunt 1. An artificially created connection between an artery and a vein. 2. It is created to provide access for dialysis. 3. Never apply a blood pressure cuff or tourniquet to or perform venipuncture on an arm with a shunt. G. Cannula 1. A temporary external shunt used for dialysis and blood drawing. 2. Cannulas are never accessed by a phlebotomist,	

Objectives & Content	Recommended Teaching Strategies & Evaluation
only by a registered nurse. 3. Special procedures are necessary for specimen collection. H. Arteriovenous Fistula 1. A permanent fusing of a vein with an artery. 2. The connection is close to the surface of the skin and the loop created can usually be seen and felt. 3. It is used for dialysis and should not be used for the phlebotomy procedures. 4. Specimen should be drawn from the other arm.	
6. List patient related complications associated with blood collection. A. Allergies to antiseptics, adhesives, or latex, use alternatives 1. 0.5% Chlorhexidine gluconate 2. Paper tape 3. Vinyl gloves and tourniquets. B. Excessive Bleeding 1. Will occur with patients on anticoagulant therapy. 2. Pressure must be maintained over the venipuncture site until the bleeding stops. a. If the patient is still bleeding after 5 minutes notify the nurse. b. Do not leave until the bleeding stops or the nurse takes charge of the situation. C. Fainting (syncope) is more likely to occur with outpatients who may have a history of fainting during the venipuncture procedure. 1. Have the patient lie down for the procedure if possible. 2. If the patient faints during the procedure, a. Remove the tourniquet b. Withdraw the needle c. Talk to the patient d. Have the patient lower their head and breathe deeply e. Loosen a tight collar or tie f. Apply cold compress to forehead and back of neck g. Initiate emergency protocols if the patient does not respond. D. Hematoma is a bruise caused by leaking blood into the tissues around the venipuncture site. 1. It can be painful to the patient as well as unsightly. 2. If a hematoma forms during the venipuncture, a. Release the tourniquet	Lecture Demonstration Case Examples - Appendix 7.3 Blood Volume Calculation Exercise - Appendix 7.4 Calculating Blood Volume for Neonates and Infants - Appendix 7.5

Objectives & Content	Recommended Teaching Strategies & Evaluation
b. Withdraw the needle c. Hold pressure over the site. E. Inadvertent Arterial Puncture is usually recognized by the bright red color of the blood or the fact that it spurts or pulses into the tube. 1. It is important to hold pressure over the site for a full 5 minutes. 2. Arterial specimens can be submitted for testing but should be noted since some values are different for arterial specimens. F. Infection following venipuncture 1. Rare but not unheard of. 2. Minimize the risk of infection by: a. Using proper aseptic technique b. Reminding the patient to keep the bandage on for at least 15 minutes. G. Nausea/Vomiting 1. A patient who becomes nauseous should be reassured and made comfortable. a. An emesis basin should be used as a precaution. b. Ask the patient to breath slowly and deeply. 2. Ask for assistance with the patient if needed. H. Convulsions 1. If needle and tourniquet are in the arm, remove them as quickly as possible. 2. Prevent client from self-injury. 3. Move anything that could harm the patient. 4. Protect patient's head from striking any object. 5. Do not restrain. 6. Call for assistance. 7. Record date, time and circumstances (use required institutional form). I. Nerve Damage 1. Caused by excessive or blind probing while performing the venipuncture and can lead to permanent damage of a nerve. 2. Injuries such as this may result in a lawsuit. J. Pain 1. A small amount is associated with routine venipuncture. 2. Putting the patient at ease prior to blood collection helps make the procedure less painful. 3. Allowing the alcohol to dry completely will prevent a stinging sensation. 4. Excessive or blind probing can be very painful to the patient and should be avoided. K. Petechiae are small red spots that appear on the skin	

Objectives & Content	Recommended Teaching Strategies & Evaluation
when a tourniquet is applied. 1. They are caused by a defect of the capillary walls or platelet function. 2. They are not an indication of the phlebotomist doing something wrong but an indication that the patient may bleed excessively. L. Reflux- is a backflow into the patient's veins from the collection tube and may cause adverse reactions. 1. The contents of the collection tube should not be in contact with the stopper 2. The phlebotomist should keep the patient's arm in a downward position during the blood collection. M. Seizures can happen and the phlebotomist should terminate the procedure immediately. 1. Hold pressure over the site without restricting the patient's movement. 2. Never put anything into the patient's mouth. N. Vein collapse is caused by too much vacuum for the size of the vein. 1. From too large a tube or pulling to forcefully on the plunger of a syringe. 2. From the tourniquet tied too tightly or too close to the venipuncture site. O. Vein damage has caused impaired patency of a vein from: 1. Numerous venipunctures in the same area over an extended period of time. a. Build up scar tissue b. Decrease patency (impaired blood flow). 2. Blind probing and improper technique. P. Blood loss due to phlebotomy 1. Minimum blood volume requirements for: a. Analytical instruments b. A standard tube size c. Separating plasma or serum for multiple departments, reference laboratory. d. Repeat testing after Quality Control failure e. Add-on testing ordered after specimen is drawn f. Adequate dilution with an anticoagulant or additive. 2. Strategies to reduce blood volume loss a. Coordinating all requests into a single blood draw b. Scheduling blood draws on a frequent basis to eliminate STAT draws c. Asking for review of duplicate requests	

Objectives & Content	Recommended Teaching Strategies & Evaluation
d. Calculating blood volume for neonates and infants. e. Maintaining daily tally of blood loss when clinical indicated and in the case of neonates. i. Anemia or cardiac arrest can occur if neonate looses more than 10% of its blood volume. ii. Knowing the total blood volume for a particular neonate or infant will help avoid negative consequences of blood withdrawal for testing. f. Suggesting review of standing orders g. Assisting the laboratory in reducing turn around times for test results through efficient, accurate, & timely pre-analytical processes.	
7. List the specimen related complications associated with blood collection. A. Hemoconcentration 1. Caused by prolonged application of the tourniquet 2. Results from the plasma portion of the blood filtering into the tissue. 3. It can also be caused by vigorous hand pumping, probing, long-term IV therapy, sclerosed or occluded veins. B. Hemolysis 1. The destruction of red blood cells and liberation of hemoglobin into the fluid portion of the specimen. 2. The serum or plasma is pink to red in color. 3. Specimens must be redrawn. 4. Hemolysis can be caused by: a. Mixing additive tubes too vigorously b. Drawing blood from a hematoma c. Pulling the plunger too quickly. d. Using too small a needle e. Using too large a tube on a small needle f. Forcing the blood from a syringe into evacuated tubes g. Not wiping away the first drop of blood from a skin puncture. h. Excessive squeezing of the site during a skin puncture. C. Partially Filled Tubes 1. All tubes are designed to be full.	Lecture Discussion

Objectives & Content	Recommended Teaching Strategies & Evaluation
a. Light blue top tubes are not acceptable for testing if partially filled. b. Other tubes may be accepted for some testing but may have erroneous results. c. Do not combine the contents of partially filled tubes. 2. Specimens should be recollected instead. D. Specimen Contamination 1. Using the wrong antiseptic to clean the venipuncture site or skin puncture site a. Using alcohol prior to obtaining ethanol specimens. b. Iodine contamination in skin puncture specimens will elevate uric acid, phosphate and potassium. 2. Not allowing the antiseptic to dry prior to blood collection a. Traces of iodine in blood cultures by not allowing it to dry may inhibit growth. b. Alcohol can cause hemolysis in skin punctures by not allowing it to dry. 3. Improper cleaning of the site - Touching the site after cleaning may contaminate cultures. 4. Powder from gloves may contaminate neonatal screening specimens.	
8. Describe Quality Control (QC) A. A component of the Quality Assurance Program. B. A form of procedure control. C. Ensures that correct criteria for specimen integrity are met (i.e. collection, storage, transport temperature, determining patient preparation, timed draws. D. Areas of phlebotomy subject to QC 1. Patient preparation examples include: a. Giving the patient Glucola for a glucose tolerance test. b. Correctly cleaning the phlebotomy area for blood culture testing. 2. Specimen collection examples include: a. Proper patient identification (checking arm band - inpatient, or asking the patient his/her name - outpatient. b. Having all the equipment you need when and where you need it, including puncture devices, evacuated tubes, cleansing materials, bandages, etc. c. Assuring that the equipment functions correctly by checking expiration dates d. Checking tubes for cracks.	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
e. Checking new lots of evacuated tubes for: i. Adequate vacuum ii. Adequate additive iii. Integrity of stopper iv. Ease of removal of stopper v. Tube strength during centrifugation. f. Proper labeling of the sample immediately after the specimen is drawn. i. If manually labeling specimens, ensure that information is clear and readable. ii. When using computer-generated labels, ensuring that the information is correct on the label. g. Using proper techniques as describes in institutional policy. h. Knowing when a specimen request: i. Is most critical ii. Has special collection criteria that might save the patient unnecessary medication iii. Has special collection criteria that may reduce the length of stay based on results of testing. 3. Documentation to record problems, standardize procedures, inform appropriate staff of patient preparation procedures, record equipment checks, refrigerator temperatures, incident or occurrence reports, etc. 4. Specimen handling that includes transportation and processing to maintain specimen integrity. a. Mix contents of tubes with additives by gently inverting 5 -10 times as soon as it is drawn. b. Transporting specimens in an upright fashion to: i. Avoid breakage ii. Aid clot formation iii. Keep blood off the stopper; this could lead to aerosols when open. 5. Specimen processing performed using appropriate protective equipment.	

Component 1: **CORE**

Module 7: **Blood Collection Process**

Topic 4: **Select anatomical site**

Purpose: **To prepare the learner select a venipuncture site that will be successful and with minimal discomfort to the patient.**

Suggested time frame: **30 minutes**

Objectives: **Upon completion of this topic, the learn will be able to:**

1. Discuss key terms.
2. Identify the major arm veins and hand veins subject to venipuncture.
3. Describe the procedure for locating veins.

Vocabulary:

Pumping	Palpate	Anebrachial
Thrombosed	Antecubital fossa	Median Cubital Vein
CephalicVein	Basilic Vein	Dorsal Metacarpals

References:

McCall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. Identify the major arm veins and hand veins subject to venipuncture. A. Median Cubital 1. First choice vein for venipuncture 2. Usually large and well anchored 3. Easiest and least painful to puncture. 4. Least likely to bruise B. Cephalic 1. Second choice vein for venipuncture 2. Harder to palpate than the median cubital but is also well anchored. C. Basilic 1. Third choice vein for venipuncture 2. Easy to palpate but is not well anchored. 3. It tends to roll and bruise more easily. 4. It is more painful to the patient and it is possible to inadvertently puncture the median nerve or brachial artery. D. Alternate sites for venipuncture 1. Not well anchored. 2. Tend to roll and bruise easily. 3. Can be more painful to the patient 4. Sites a. Accessory Cephalic b. Median Antebrachial c. Dorsal Metacarpal	Lecture Discussion Arm & Hand Veins - see Appendix 3.19 & 3.21
3. Describe the procedure for locating veins. A. Use the tip of the index finger to palpate (feel) the vein. 1. This will help determine the size, depth and direction of the vein. 2. Select a vein that is large and does not move easily. B. If you have trouble feeling a vein, close your eyes while feeling. This enhances your sense of touch. C. A good vein has a bounce or resilience to it. An artery will pulsate. D. Avoid veins that are hard and cordlike. 1. They are difficult to penetrate with a needle. 2. Roll easily 3. May not have adequate blood flow to collect a good sample. E. Landmark the site using the corner of a clean alcohol	Lecture Demonstration Class participation

Objectives & Content	Recommended Teaching Strategies & Evaluation
pad. F. Never draw above a running IV. G. Never draw from an arm with a shunt. H. If no suitable vein is found on one arm, try the other. I. If no suitable arm veins are found try the back of the hand.	

Component 1: **CORE**

Module 7: **Blood Collection Process**

Topic 5: **Preparation of anatomical site**

Purpose: **To prepare the learner how to properly cleanse the venipuncture site to prevent microbial contamination**

Suggested time frame: **30 minutes**

Objectives: **Upon completion of this topic, the learn will be able to:**

1. Discuss key terms.
2. Describe procedure for cleaning routine venipuncture sites.
3. Describe procedure for cleaning venipuncture sites for blood culture collection.

Vocabulary:

Concentric circles	Alcohol prep pad	Blood culture prep kit
Tincture of iodine	Microbial contamination	

References:

McCall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. Describe procedure for cleaning routine venipuncture sites. A. Cleansing the site with an antiseptic helps prevent microbial contamination of the specimen and the patient. 1. It will not sterilize the site. 2. The recommended antiseptic is 70% isopropyl alcohol. B. Clean the site using: 1. A circular motion starting in the center of the site 2. Move outward in ever widening concentric circles C. Use sufficient pressure to remove surface dirt and debris. D. Allow the area to dry for 30 seconds to 1 minute; the evaporation process helps destroy microbes E. Do not recontaminate the site by drying the alcohol with unsterile gauze. F. Do not blow or fan the site; this may introduce airborne contaminants. G. Do not touch the site after cleaning. If it is necessary to repalpate the vein, the site must be cleaned again. H. Do not clean a gloved finger with the same pad that has cleaned the patient. This moves the microbes back to the patient.	Lecture Demonstration
3. Describe procedure for cleaning venipuncture sites for blood culture collection A. Begin by preparing the aerobic and anaerobic bottle with 70% Isopropyl alcohol. B. Cleanse the site with an antiseptic to help prevent microbial contamination of the specimen and the patient. 1. It will not sterilize the site. 2. The recommended antiseptic is 70% isopropyl alcohol. 3. Break the ampule to soak the sponge. C. Clean the site using a circular motion starting in the center of the site and moving outward in ever widening concentric circles for a minimum of 1 minute. D. Use sufficient pressure to remove surface dirt and debris. E. Allow the area to dry for 30 seconds to 1 minute; the evaporation process helps destroy microbes. F. Break the iodine ampule. G. Clean the site using a circular motion starting in the	Lecture Demonstration

Objectives & Content	Recommended Teaching Strategies & Evaluation
center of the site and moving outward in ever widening concentric circles. H. Allow the area to dry for 30 seconds to 1 minute; the evaporation process helps destroy microbes. I. Do not recontaminate the site by: 1. Drying the alcohol with unsterile gauze. 2. Blowing or fanning the site. This may introduce airborne contaminants. 3. Touching the site after cleaning. If it is necessary to repalpate the vein, the site must be cleaned again. 4. Cleaning a gloved finger with the same pad that has cleaned the patient. You are just moving the microbes back to the patient. J. Order of draw for blood cultures 1. Syringe method - anaerobic to aerobic. 2. Evacuated tube method - aerobic to anaerobic.	

Component 1: **CORE**

Module 7: **Blood Collection Process**

Topic 6: **Venipuncture Procedure**

Purpose: **To prepare the learner to properly perform a venipuncture using various phlebotomy techniques.**

Suggested time frame: **12 hours**

Objectives: **Upon completion of this topic, the learn will be able to:**

1. Discuss key terms.
2. List the steps in the venipuncture procedure.
3. Discuss procedure for the inability to obtain blood or specimen.
4. Describe post puncture care.
5. Perform the venipuncture procedure with an evacuated tube system.
6. Perform the venipuncture procedure with the syringe system.
7. Perform the venipuncture procedure with a butterfly needle.
8. Translate time from traditional 12-hour clock to 24-hour clock.

Vocabulary:

Anchors Resheathing Safety device
Dorsal hand vein

References:

McCall, R. E., & Tankersley, C. M. (1998). *Phlebotomy Essentials* (2nd ed.). Philadelphia, PA: Lippincott-Raven Publishers.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define the key terms A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. List the steps in the venipuncture procedure A. Review the test requisition B. Identify the patient C. Verify diet restrictions D. Assemble equipment and supplies E. Wash hands and put on gloves F. Reassure patient G. Position patient H. Apply tourniquet I. Select venipuncture site J. Release tourniquet K. Cleanse the site L. Verify equipment and tube selection M. Reapply tourniquet N. Pick up blood drawing equipment and remove needle sheath O. Anchor the vein P. Insert the needle into the vein 1. The needle should be inserted at a 15 to 30 degree angle. 2. The needle should follow the path of the vein until you sense that the needle is in the vein. Q. Fill the tubes - allow evacuated tubes to fill smoothly and completely. R. Release the tourniquet S. Withdraw the needle 1. Place a folded square of gauze over the venipuncture site, but DO NOT press down on the gauze while the needle is still in the vein. 2. Withdraw the needle in one smooth motion. T. Apply pressure to the site with gauze or cotton. U. Dispose of the needle holder assembly V. Label the tubes W. Observe any special handling instructions X. Check the patient's arm and apply bandage Y. Dispose of contaminated materials Z. Thank the patient AA. Remove gloves and wash hands BB. Transport specimen to the lab	Lecture Demonstration
3. Discuss procedure for the inability to obtain blood specimen. A. Failure to obtain blood can be caused by any one of a	Lecture Proper & Improper Needle

Objectives & Content	Recommended Teaching Strategies & Evaluation
number of factors. 1. Tube position and vacuum a. Check the tube to see that it is properly seated and the needle has penetrated the stopper. b. Reseat the tube to make certain the needle sleeve is not pushing the tube off the needle. c. If you suspect that the tube may have lost its vacuum, try another tube. 2. Needle Position - determine visually if any of the following have occurred. a. Needle bevel against the vein wall i. Blood flow can be impaired if the needle bevel is up against either the upper or lower wall of the vein. ii. Try rotating the bevel slowly. b. Needle too deep i. Needle may have penetrated all the way through the vein. ii. This can happen on needle insertion or as the tube is pushed onto the needle if the tube holder is not held steady. iii. Withdrawing the needle slightly should establish blood flow. iv. The needle position must be corrected quickly as the blood will leak into the tissues and form a hematoma. c. Needle not deep enough i. If needle is not completely inserted into the vein, blood may fill the tube very slowly. ii. Push the needle gently into the vein to obtain the correct blood flow. iii. Partial needle insertion can cause blood to leak into surrounding tissues and start to form a hematoma. iv. If a hematoma is started, immediately remove the tourniquet and withdraw the needle. d. Needle has slipped beside the vein. i. Slip the tube off of the needle so that you do not risk losing the	Positioning - Appendix 7.6

Objectives & Content	Recommended Teaching Strategies & Evaluation
vacuum. ii. Withdraw the needle until just the bevel is under the skin. iii. Anchor the vein securely and redirect the needle into the vein. e. Needle position cannot be determined. i. If you cannot determine the position of the needle, you may have to use your fingers to relocate the vein. ii. Remove the tube from the needle and withdraw the needle until the bevel is just under the skin. iii. If your gloved finger has been cleaned with alcohol, you may feel the arm above the point of needle insertion and try to determine needle position. Do not feel too close to the needle, as this is painful for the patient. iv. Once you have relocated the vein, redirect the needle into the vein and proceed with the venipuncture. v. If you can't relocate the vein, withdraw the needle in the proper manner and hold pressure over the site. vi. Do not blindly probe the arm in an attempt to locate the vein. • This is painful to the patient. • Can lead to inadvertent puncture of an artery. 3. Collapsed Vein a. Can be caused by the vacuum draw of a tube or the pressure created by pulling on a plunger of a syringe. b. You can tell a vein is collapsed because the vein will disappear as soon as the needle penetrates it. c. Tightening the tourniquet by grasping the ends with one hand and twisting them together may be enough to reestablish blood flow. d. Alternatives: i. Use your finger to apply pressure to the vein several	

Objectives & Content	Recommended Teaching Strategies & Evaluation
inches above the needle. ii. Romove the tube from the needle and wait a few seconds for the blood flow to reestablish. iii. Use a smaller-volume tube iv. Pull more slowly on the syringe. e. If blood flow does not reestablish, withdraw the needle and attempt a second venipuncture at another site. B. Failure to obtain a specimen 1. Acceptable reasons a. Patient refusal b. Patient unavailable c. Phlebotomist attempted but was unable to draw blood. 2. The phlebotomist should only try two times to obtain a specimen. 3. If still unsuccessful: a. Another phlebotomist should try. b. The patient's nurse or physician should be notified. c. Most hospitals require the phlebotomist to fill out a form stating that the specimen was not obtained and the reason why.	
4. Describe post puncture care. A. Apply pressure to the site with a gauze pad for 3-5 minutes. Failure to apply pressure will result in leakage of blood and hematoma formation. B. Examine the patient's arm to see if bleeding has stopped. C. If bleeding has stopped, apply an adhesive bandage or tape over several folded gauze squares over the site. D. Instruct the patient to remove the bandage after a minimum of 15 minutes to avoid irritation. E. If the patient is allergic to adhesive bandages, apply paper tape over a clean folded gauze square. F. If the patient has sensitive skin or is allergic to paper tape, wrap gauze around the arm and place tape over the gauze. G. Instruct patient not to carry or lift heavy objects with that arm for one hour.	Demonstration
5. Perform the venipuncture procedure with an evacuated tube system.	Demonstration & Practice
6. Perform the venipuncture procedure with the syringe system.	Demonstration & Practice

Objectives & Content	Recommended Teaching Strategies & Evaluation
7. Perform the venipuncture procedure with a butterfly needle.	Demonstration &Practice
8. Translate time from traditional 12-hour clock to 24-hour clock.	Military & Standard Time Chart - Appendix 7.7 (a) Minutes/Segment Conversion Table - Appendix 7.7 (b)

Component 1: **CORE**

Module 7: **Blood Collection Process**

Topic 7: **Arterial Puncture**

Purpose: **To inform the learner of the theory and procedure for arterial puncture.**

Suggested Time Frame: 1 hour

Objectives: **Upon completion of this module, the learner will be able to:**

1. Discuss key terms.
2. State the primary reason for performing an arterial puncture procedure.
3. Describe the sites that can be used for arterial puncture.
4. Describe the need for collateral circulation and the tests used to determine the presence of collateral blood flow.
5. List equipment and supplies needed for arterial puncture.
6. Describe patient assessment and preparation procedures, including administration of local anesthetic, prior to performing puncture for arterial blood gasses (ABGs).
7. Describe the proper performance of radial arterial blood gases.
8. List complications associated with arterial puncture.
9. List factors that may affect the integrity of the blood gas sample and the criteria for sample rejection.

Vocabulary:

Allen's test	Arterial blood gases (ABGs)	Arterial puncture
Arteriospasm	Brachial Artery	Collateral circulation
Femoral artery	Radial artery	Steady state
Thrombus formation	Gas exchange	Chlorhexidine
Luer adapter	Wheal	Doppler ultrasonic flow indicator

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define, spell and use key terminology A. Review the terms listed in the vocabulary. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context and define.	Lecture
2. State the primary reason for performing an arterial puncture procedure. A. Evaluate gas exchange in the lungs B. Diagnose and manage respiratory disease 1. Measure pO2, PCO2 and pH. 2. Oxygenation 3. Ventilation 4. Acid-base balance	Lecture
3. Describe the sites that can be used for arterial puncture. A. Radial Artery - located on the thumb side of the wrist and is readily accessible in most patients. 1. Advantages d. Presence of collateral circulation e. Less chance of hemotoma following the procedure 2. Disadvantages a. Considerable skill is required to puncture due to its small size b. Difficult to locate on patients with low cardiac output. C. Brachial Artery - second choice for arterial punctures; located in the medial anterior aspect of the antecubital fossa near the insertion of the biceps muscle. 1. Advantages a. Artery is large, easy to palpate and puncture. b. Has adequate collateral circulation. 2. Disadvantages a. Deeper than the radial artery. b. Lies close to the basilic vein as well as the median nerve, both of which may be inadvertently punctured. c. Increased risk of hematoma following procedure. D. Femoral Artery - largest artery located superficially in the groin lateral to the pubis bone. It is performed by physicians and specially trained emergency room personnel. 1. Advantages a. Large, easily palpated and punctured. b. Accessible during low cardiac output.	Lecture Arteries of the Upper Limb - see Appendix 3.22 Arteries of the Lower Limb - see Appendix 3.23

Objectives & Content	Recommended Teaching Strategies & Evaluation
2. Disadvantages a. Poor collateral circulation. b. Increased risk of infection. c. Inadvertent femoral vein puncture.	
4. Describe the need for collateral circulation and the tests used to determine the presence of collateral blood flow. A. Area is supplied with blood from more than one artery. B. Allen test 1. Have the patient make a tight fist. 2. Using the middle and index fingers of both hands, apply pressure to the patient's wrist, compressing and occluding both the radial and ulnar arteries at the same time. 3. While maintaining pressure, have the patient open the hand slowly. The hand should appear blanched or drained of color. 4. Lower the patient's hand and release pressure on the ulnar artery. 5. The patient's hand should flush pink within 15 seconds. 6. Record the results on the request slip. 7. Positive Allen test a. The hand flushes pink within 15 seconds, indicating presence of collateral circulation. b. Proceed with ABG collection 8. Negative Allen test a. The hand does not flush pink within 15 seconds, indicating the inability of the ulnar artery to supply blood to the hand (absence of collateral circulation) b. Radial artery should not be used and another site should be selected C. Doppler ultrasonic flow indicator.	Lecture
5. List equipment and supplies needed for arterial puncture. A. Antiseptic solution for cleaning the site. 1. Providone-iodine 2. Chlorhexidine B. Optional anesthetic of 0.5% lidocaine C. A 22 gauge needle. D. Heparin containing syringe for collection and one plastic syringe with 25 gauge needle to administer anesthetic. E. Latex block or other safety device. F. Luer tip cap. G. A container of ice water H. Sterile gauze I. Labels	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
J. Oxygen analyzer	
6. Describe patient assessment and preparation procedures, including administration of local anesthetic, prior to performing puncture for arterial blood gasses (ABGs). A. Must have a physician's order B. Identify patient C. Explain procedure and obtain consent. D. Determine if patient is on anticoagulant therapy or allergic to anesthetic. E. Patient should have been in a steady state for at least thirty minutes prior to obtaining ABGS. F. Administration of anesthetic may help patients that may hold their breath, cry or hyperventilate, all of which may affect blood gas results.	Lecture
7. Describe the proper performance of radial arterial blood gases. A. Receive physician's order B. Assemble and transport equipment to patient's bedside. C. Identify patient and explain procedure. D. Record patient's temperature, respiratory rate, and breathing mixture on lab slip. E. Wash hands and put on gloves. F. Prepare the ABG syringe with heparin if applicable. G. Prepare anesthetic syringe if applicable. H. Position patient's arm with palm facing up. I. Access collateral circulation using the allen's test J. Have patient flex wrist to a 30-45 degree angle to stretch the soft tissue over the firm ligaments and bone. K. Locate the artery on the thumb side using index and middle fingers; never use the thumb as it has a pulse and can be misleading. L. Prepare the site first with alcohol and the providone iodine. Allow it to dry without touching it with any unsterile object. M. Administer anesthetic by forming a raised wheal under the skin. Wait 2 minutes. N. Expel any remaining heparin from the ABG syringe and hold like a dart. O. Warn the patient, insert the needle bevel up at a 45 degree angle away from the hand facing the blood flow. P. Advance the needle until the artery is pierced and a flash of blood will appear in the hub. 1. Stop advancing the needle 2. The blood will pump into the syringe until the desired amount is collected. Q. If missed, redirect the needle. 1. Do not probe 2. Probing is painful and may lead to:	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
a. Hematoma b. Thrombus formation c. Damage to the artery. R. Withdraw needle and place gauze over the site. 1. Apply pressure for a minimum of 5 minutes. 2. Longer if the patient is on anticoagulant therapy. 3. Never allow patient to hold pressure. S. Eject any air bubble from the specimen and embed needle into latex cube. T. Mix specimen by inversion or rolling. U. Remove needle and replace with luer cap. V. Label specimen and place on ice. W. After pressure has been applied for 5 minutes, 1. Check for swelling or bruising and clean site with alcohol. 2. Wait 2 minutes and check the site again. 3. Check pulse distal to site. 4. If absent or faint, alert RN to call MD immediately. 5. If normal, apply pressure bandage. X. Dispose of used equipment properly. Y. Thank patient. Z. Deliver specimen to lab as soon as possible.	
8. List complications associated with arterial puncture. A. Discomfort B. Infection C. Hematoma D. Arteriospasm E. Thrombus formation	Lecture
9. List factors that may affect the integrity of the blood gas sample and the criteria for sample rejection. A. Specimen integrity 1. Air bubbles 2. Delay in cooling or analysis 3. Obtaining a venous sample in error. 4. Too much or too little anticoagulant 5. Use of improper anticoagulant. 6. Improper mixing 7. Improper syringes. B. Criteria for rejection 1. Inadequate volume 2. Clotted specimen 3. Improper or absent labeling 4. Use of the wrong syringe 5. Specimen not on ice. 6. Too long delay in delivery to lab. 7. Air bubbles.	Lecture

Component 1: **CORE**

Module 7: **Blood Collection Process**

Topic 8: **Skin Puncture**

Purpose: **To inform the learner to follow standard operating procedures to perform a competent and effective skin puncture.**

Suggested Time Frame: 2 hour

Objectives: **Upon completion of this module, the learner will be able to:**

1. Define key terms.
2. List the types of equipment used to perform skin punctures.
3. Identify laboratory tests that have different reference values when collected by skin puncture and those tests that cannot be performed by skin puncture.
4. State indications for performing skin puncture on adults, infants and children.
5. Describe the procedure for selecting a skin puncture site.
6. Describe limitations and precautions of collection sites.
7. Describe the procedure for collecting skin puncture specimens from adults, infants and children.
8. Perform the skin puncture procedure.

Vocabulary:

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Define, spell and use key terminology. A. Review the terms listed in the vocabulary. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context and define.	Lecture
2. List the types of equipment used to perform skin punctures. A. Lancet 1. Single use, safety lancet for adult and child finger skin punctures. 2. Single use, safety lancet for infant heel skin punctures. B. Microcollection containers 1. Small plastic containers used for small quantities of blood. 2. Color coded to indicate presence and type of additive that corresponds to tubes used in venipuncture. C. Warming devices 1. Used to increase blood flow to the skin puncture area. 2. Can increase blood flow as much as seven times. 3. Provide a uniform temperature that does not exceed 42 degrees Celsius. 4. Alternative warming methods are a towel or diaper wet with warm tap water. Do not get the water so hot that it scalds the patient. D. See also the general blood collection equipment described in topic 2 of this module.	Lecture Demonstration Types of Lancets - Appendix 7.8
3. Identify laboratory tests that have different reference values when collected by skin puncture and those tests that cannot be performed by skin puncture. A. Tests with different reference values in skin puncture specimens than venipuncture specimens. 1. Glucose - higher in skin puncture blood. 2. Total protein - lower in skin puncture blood. 3. Calcium - lower in skin puncture blood. 4. Potassium a. Lower in skin puncture blood. b. Potassium values are more likely to be falsely elevated in skin puncture specimens owing to tissue fluid contamination and hemolysis of the specimen.	Lecture
B. Tests that cannot be performed by skin puncture.	

1. Erythrocyte sedimentation rates. 2. Coagulation studies 3. Blood Cultures	
4. State indication for performing skin puncture on adults, infants, and children. A. Performed on adults. 1. When there are no accessible veins. 2. To save veins for other procedures. 3. When patient has clot forming tendencies. 4. When performing certain bedside procedures such as glucose monitoring. B. Performed on infants and children. 1. Preferred method of obtaining blood since venipuncture is difficult and may damage veins and surrounding tissues. 2. Removing a large blood volume can lead to anemia and cardiac arrest. 3. Screening tests for PKU are designed to be performed on skin puncture blood only.	Lecture
5. Describe the procedure for selecting a skin puncture site. A. General 1. Warm and pink in color. 2. Free of scars, cuts, bruises and rashes. 3. Do not choose a site that is cold or bluish in color. 4. Do not choose a site that is swollen. B. Infants 1. The heel is recommended on infants less than 1 year old. 2. Skin puncture must be performed in an area where there is little risk of puncturing the bone. 3. To avoid puncturing bone, heel puncture should be performed on the plantar surface of the heel. 4. Medial to the imaginary line extending from the middle of the great toe to the heel or lateral to an imaginary line drawn from between the fourth and fifth toes to the heel. 5. The puncture should not exceed 2.4 mm in depth.	Lecture
6. Describe limitations and precautions of collection sites. A. Heelsticks 1. Puncture of the bone can cause painful osteomyelitis or bone infection as well as osteochondritis, inflammation of the bone and cartilage.	Lecture

2. Additional punctures may spread infection.	

3. Do not exceed 2.4 mm in depth. 4. Do not puncture through previous puncture site. 5. Do not puncture the area between the imaginary boundaries. 6. Do not puncture the posterior curvature of the heel. 7. Do not puncture the area of the arch. 8. Do not puncture areas of the foot other than the heel. B. Fingersticks 1. Do not puncture the side or very tip of the finger, the distance between the skin and bone is half as much as in the central portion of the end of the finger. 2. Do not puncture parallel to the grooves of the fingerprint, as it will cause blood to run down the finger, making collection difficult. 3. Do not puncture the index finger as it is calloused and harder to poke. 4. Do not puncture the little finger as the amount of tissue between the skin surface and the bone is thinnest in this finger. 5. Do not puncture the fingers of infants and very young children. The amount of tissue between skin surface and bone is so small that bone injury is very likely.	
7. Describe the procedure for collecting skin puncture specimens from adults, infants and children. A. Assemble skin puncture equipment 1. 70% Isopropyl alcohol prep pads 2. Sterile gauze pads 3. Sterile lancet or other skin puncture device 4. Warming device (if applicable) 5. Collection tubes B. Warm the site 1. Increases arterial blood flow into the area 2. The specimen obtained will be referred to as an arterialized specimen. C. Clean the site 1. Clean with 70% Isopropyl alcohol 2. Do not clean with Providone-iodine as it interferes with a number of tests. a. Bilirubun b. Uric acid c. Phosphorus d. Potassium	Lecture

3. Allow the site to sir dry to minimize alcohol	

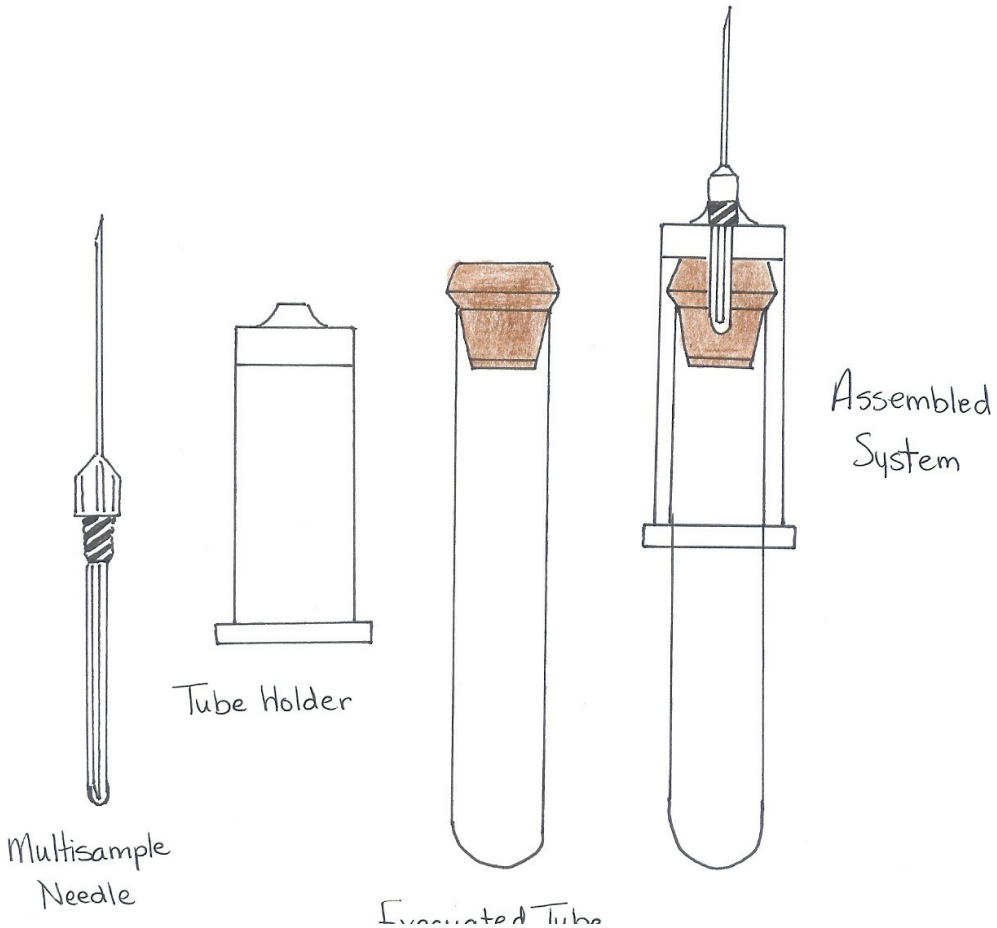
contamination and hemolysis of the specimen. D. Perform the skin puncture 1. Fingerstick a. Support the arm on a firm surface. b. Have the patient extend the hand with the palmar surface facing up. c. Select and clean the site and allow to air dry. d. Grasp the finger firmly between your thumb and index finger. e. Puncture perpendicular to the whorls of the fingerprint. f. Dispose of the puncture device promptly in a sharps container. g. Apply firm pressure toward the site. h. Wipe away the first drop of blood. i. Position the site downward and continue to apply moderate pressure proximal to the site. j. Collect specimens - Lavender, Green and Red k. Touch the container to the drop of blood and let the drop run down the wall of the tube. l. Tap the tube gently to encourage the blood to settle at the bottom of the tube. Do not scoop the blood against the surface of the skin, as this will cause hemolysis. m. Cap the tube and mix additive tube 8 to10 times. n. When collection is finished, apply pressure to the site with clean gauze until bleeding stops. o. Keep the site elevated while pressure is applied. p. Do not apply bandages to infants and children under 2 years old as it may become a choking hazard. q. Label the specimens with the appropriate information. r. Follow any special specimen handling requirements. s. Thank the patient. t. Dispose of contaminated material and remove all equipment from the area. u. Remove gloves and wash hands. v. Transport specimen to the lab.	

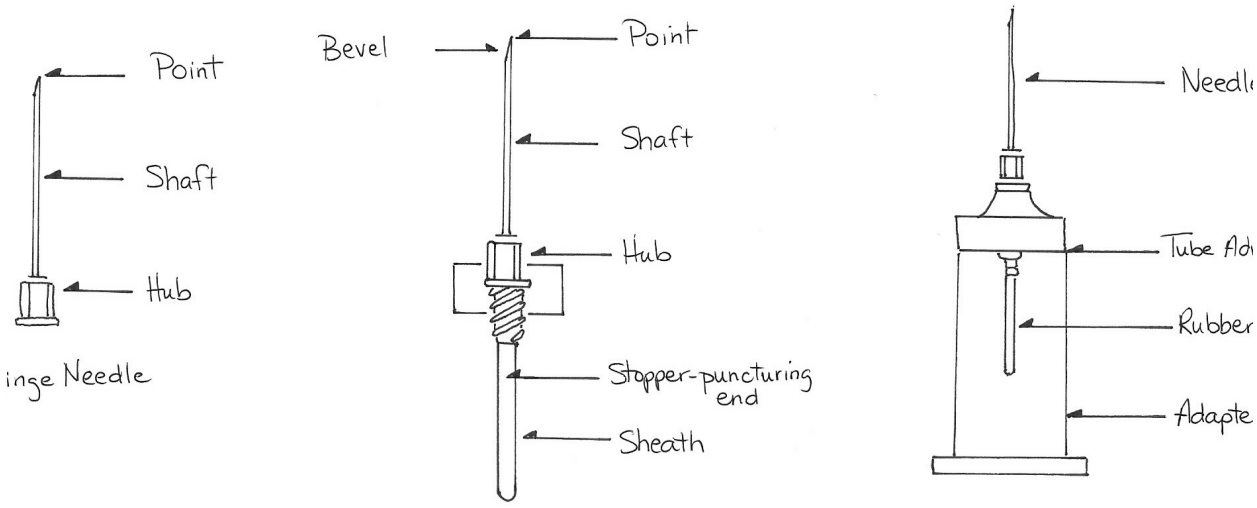
2. Heelstick	

a. Grasp the heel firmly but gently with the index finger wrapped around the foot supporting the arch. b. The thumb should be wrapped around the ankle and below the puncture site. c. Perform the puncture perpendicular to the lines of the footprint. d. Dispose of the puncture device promptly in a sharps container. e. Apply firm pressure toward the site. f. Wipe away the first drop of blood. g. Position the site downward and continue to apply moderate pressure proximal to the site. h. Collect specimens - Lavender, Green and Red i. Touch the container to the drop of blood and let the drop run down the wall of the tube. j. Tap the tube gently to encourage the blood to settle at the bottom of the tube. Do not scoop the blood against the surface of the skin, as this will cause hemolysis. k. Cap the tube and mix additive tube 8 to 10 times. l. When collection is finished, apply pressure to the site with clean gauze until bleeding stops. m. Keep the site elevated while pressure is applied. n. Do not apply bandages to infants and children under 2 years old as it may become a choking hazard. o. Label the specimens with the appropriate information. p. Follow any special specimen handling requirements. q. Thank the patient. r. Dispose of contaminated material and remove all equipment from the area. s. Remove gloves and wash hands. t. Transport specimen to the lab.	
8. Perform the skin puncture procedure.	Demonstrate & Practice

Components of an Evacuated Tube System

2002 Phlebotomy Model Curriculum - Appendix 7.1





2002 Phlebotomy Model Curriculum - Appendix 7.2

Evacuated Tube Needle

Patient & Specimen Complications: Case Examples

Flynn;

1. Belom v. St. Franci Cabrini Hospital, 427 So2d 541, 544 (LaApp, 1983) - Negligent blood sample collection by a medical technician caused hemorrhage.

2. Facalora v Aetna Casualty and Surety Co., 144, So2d 544 (LaApp 1962) - A patient fainted and fell, causing injuries; a radiology technician and supervising physician were found negligent for not being alert to and prepared for the patient's condition.

3. McCormick v. Auret (GA 1980) - Failure to use sterile equipment during venipuncture led to nerve damage secondary to infection.

Garza;

1. Helmann v. Sacred Heart Hospital - Failure to follow proper isolation techniques, such as proper hand washing and prevention of cross contamination, is a concern. The patient in this action has hip surgery and was in the same room as a patient who became infected with Staphylococcus aureus. Both patients were handled by a health care worker who did not change gloves or wash hands between patients. The hip patient then became infected causing additional surgery and complications. Negligence on the part of the health care worker was identified as the cause of the injury as a result of deviation from the accepted standard of care.

2. A health care worker was not trained properly and inserted a venipuncture needle 2 inches above the antecubital fold. The needle went through the vein, the muscle, and into a nerve, severely injury in the patient's arm, which remained permanently damaged.

3. A phlebotomist collected blood at an excessive angle of insertion causing nerve injury and a malpractice suit. There were also errors evident for the collection of the specimens violating the standard of care.

Blood Volume Calculation Exercise

Infant Blood Volume = 100 mL per kg
Factor to change pounds to kg = 0.454

1. **Baby weighs 4.9 pounds. What is the maximum blood loss in liters and mL?**

2. **Baby weighs 3 pounds. What is the maximum blood loss in liters and mL?**

3. **Baby weighs 6.2 pounds. What is the maximum blood loss in liters and mL?**

4. **Baby weighs 5.3 pounds. What is the maximum blood loss in liters and mL?**

5. **Baby weighs 8 pounds. What is the maximum blood loss in liters and mL?**

Blood Volume Calculation Exercise (Answers)

Infant Blood Volume = 100 mL per kg
Factor to change pounds to kg = 0.454

1. Baby weighs 4.9 pounds. What is the maximum blood loss in liters and mL?
Change weight to kg – 4.9 lbs x 0.454 = 2.2 kg

Multiply 2.2 kg x 100 mL for total volume = 220 mL

Change blood volume in mL/kg to liters - 220 mL/1,000 mL = 0.22 L

10 % of .22 L = 0.022 L or 10% of 220 mL = 22 mL of blood maximum loss

2. Baby weighs 3 pounds. What is the maximum blood loss in liters and mL?
Change weight to kg – 3.0 lbs x 0.454 = 1.4 kg

Multiply 1.4 kg x 100 mL for total volume = 140 mL

Change blood volume in mL/kg to liters - 140 mL/1,000 mL = 0.14 L

10 % of .14 L = 0.014 L or 10% of 140 mL = 14 mL of blood maximum loss

3. Baby weighs 6.2 pounds. What is the maximum blood loss in liters and mL?
Change weight to kg – 6.29 lbs x 0.454 = 2.8 kg

Multiply 2.8 kg x 100 mL for total volume = 280 mL

Change blood volume in mL/kg to liters - 280 mL/1,000 mL = 0.28 L

10 % of .28 L = 0.028 L or 10% of 280 mL = 28 mL of blood maximum loss

4. Baby weighs 5.3 pounds. What is the maximum blood loss in liters and mL?
Change weight to kg – 5.39 lbs x 0.454 = 2.4 kg

Multiply 2.4 kg x 100 mL for total volume = 240 mL

Change blood volume in mL/kg to liters - 240 mL/1,000 mL = 0.24 L

10 % of .24 L = 0.024 L or 10% of 240 mL = 24 mL of blood maximum loss

5. Baby weighs 8 pounds. What is the maximum blood loss in liters and mL?
Change weight to kg – 8.0 lbs x 0.454 = 3.6 kg

Multiply 3.6 kg x 100 mL for total volume = 360 mL

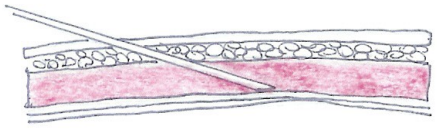
Change blood volume in mL/kg to liters - 360 mL/1,000 mL = 0.36 L

10 % of .36 L = 0.036 L or 10% of 360 mL = 36 mL of blood maximum loss

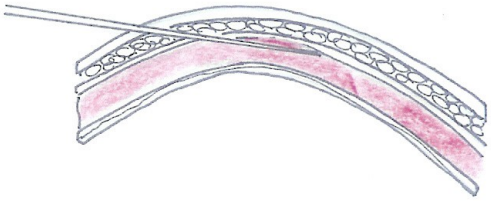
Calculating blood volume for neonates and infants

i. Infant blood volume is 100 mL per kg.
ii. *Example*: Calculate the blood volume of a baby who weighs 5.5 lbs.
    - Change the weight from pounds to kilograms (5.5 lb x 0.454 = 2.5 kg)
    - Multiply 2.5 kg by 100 for total blood volume in milliliters (2.5 kg x 100 = 250 mL)
    - Change blood volume in mL/kg to liters (250 mL/1,000 mL = 0.25 L)
iii. 10% of 0.25 L = 0,025 L or 10% of 250 mL = 25 mL of blood

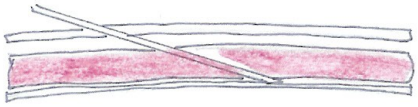
Proper & Improper Needle Positioning



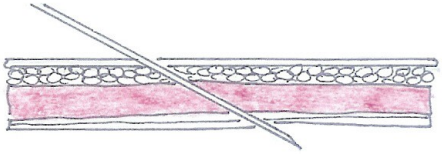
A. Correct insertion technique; blood flows freely into the needle.



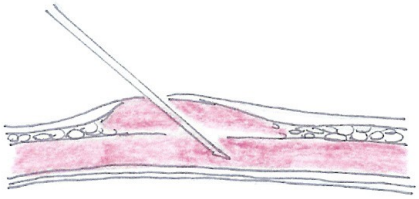
B. Bevel on vein upper wall does not allow blood to flow.



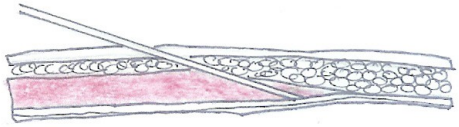
C. Bevel on vein lower wall does not allow blood to flow.



D. Needle inserted too far.

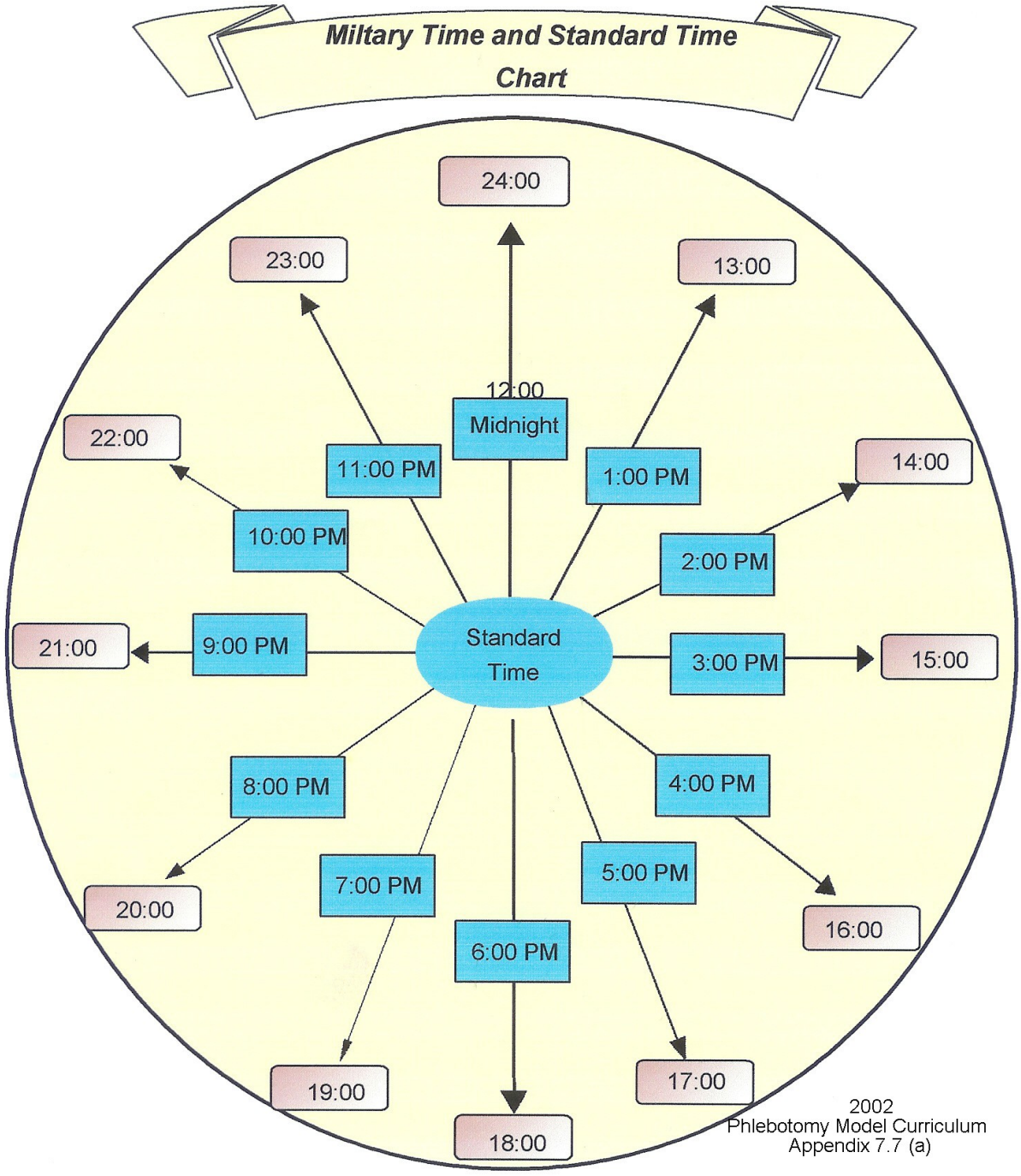


E. Needle partially collapsed and causes blood leakage into tissue



F. Collapsed vein.

2002 Phlebotomy Model Curriculum - Appendix 7.6


Miltary Time and Standard Time Chart
24:00
23:00
13:00
12:00
Midnight
22:00
11:00 PM
1:00 PM
14:00
10:00 PM
2:00 PM
21:00
9:00 PM
Standard Time
3:00 PM
15:00
8:00 PM
4:00 PM
20:00
7:00 PM
5:00 PM
16:00
6:00 PM
19:00
17:00
18:00
2002
Phlebotomy Model Curriculum
Appendix 7.7 (a)

MINUTES/SEGMENT CONVERSION TABLE

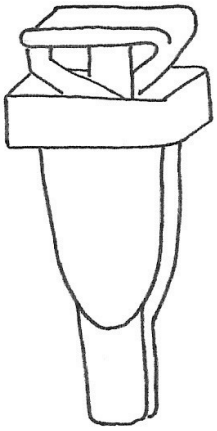
2002 Phlebotomy Model Curriculum - Appendix 7.7 (b)

Minutes	Segment	Minutes	Segment
1	.02	31	.52
2	.03	32	.53
3	.05	33	.55
4	.07	34	.57
5	.08	35	.58
6	.10	36	.60
7	.12	37	.62
8	.13	38	.63
9	.15	39	.65
10	.17	40	.67
11	.18	41	.68
12	.20	42	.70
13	.22	43	.72
14	.23	44	.73
15	.25	45	.75
16	.27	46	.77
17	.28	47	.78
18	.30	48	.80
19	.32	49	.82
20	.33	50	.83
21	.35	51	.85
22	.37	52	.87
23	.38	53	.88
24	.40	54	.90
25	.42	55	.92
26	.43	56	.93
27	.45	57	.95
28	.47	58	.97
29	.48	59	.98
30	.50	60	.100

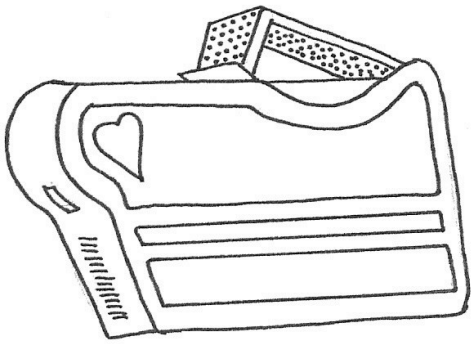
TYPES OF LANCET

2002 Phlebotomy Model Curriculum - Appendix 7.8

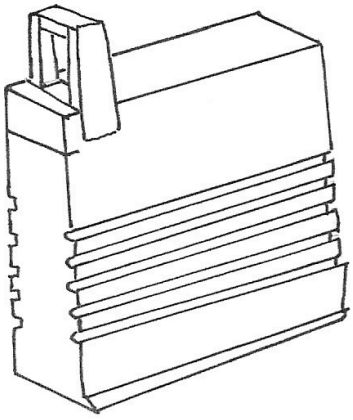
Blood Lancet



Safety Flow Lancet



Tenderlett Lancet



Tenderfoot Lancet