Kingston Health Sciences Centre

VENIPUNCTURE

LEARNING GUIDE

Kingston Health Sciences Centre
Centre des sciences de la santé de Kingston

Prepared by: Nursing Education
Date: 1992 January
Revised: 2021 October

This learning guide has been developed
By
Kingston Health Sciences Centre Nursing Education Staff

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NOTE: This learning guide contains information that is current at the time of publication and distribution. Policies and procedures are reviewed regularly and change frequently. Please refer to related policies and procedures on the Intranet.

1.0 Introduction

This learning guide has been prepared to provide the theoretical information related to the skill of venipuncture (also known as phlebotomy). Venipuncture is a procedure in which a vein is accessed transcutaneously using a needle. Venipuncture is carried out to withdraw a specimen of blood for diagnostic testing.

1.1 Authorization Process

The Health Care Provider (HCP) authorized in this procedure may perform venipuncture.

The authorization process includes:

- Attendance at an instructional class, and review of the Kingston Health Sciences Centre (KHSC) Venipuncture Learning Guide;
- Successful completion of the Venipuncture Authorization Test (achieving a mark of at least 80%);
- Observation of a venipuncture demonstration by a Clinical Learning Specialist (CLS) or Delegate; and
- One (1) return demonstration to the CLS or Preceptor/Delegate

Student Authorization

Nursing (RN and RPN) and Respiratory Therapy (RT) students may perform venipuncture when the following conditions are met:

- Venipuncture theory, including classroom experience, is part of the student's curriculum
- The student completes the KHSC learning guide test with a score of 80%, or greater. The test is to be graded by the school.
- Venipuncture is commonly practiced by the HCP on the assigned clinical unit
- The student is in their consolidating experience at the end of their educational program and is under the **direct** supervision of the Preceptor/Delegate

NOTE: While consolidating students may perform the interventions under certain conditions, only HCPs are eligible for authorization. This process will not authorize the student for these interventions.

1.2 Expected Competencies for the Learner

1. Complete the authorization test successfully, with a score of no less than 80%;

2. Select appropriate veins for venipuncture;

3. Choose appropriate equipment for the specific situation and specific patient;

4. Carry out the necessary precautions to prevent complications and to ensure the safety of the patient and of self;

5. Apply the tourniquet or blood pressure cuff correctly;

6. Use appropriate methods to dilate the veins;

7. Insert and withdraw the needle using correct techniques;

8. Obtain samples using correct procedures, label and forward as appropriate; and

9. Document the procedure, and observe, report and record indications of possible complications or untoward responses.

2.0 Overview of the anatomy and physiology of the blood vessels

The blood vessels form a closed system of tubes that serves to transport blood to all parts of the body and back to the heart.

Arteries

Arteries transport blood to the various body tissues under comparatively high pressure. The pumping action of the heart and the elasticity of the arterial walls create this pressure. The heart forces the blood into these elastic tubes. The tubes then recoil, sending the blood along in pulsating waves. The strong elastic walls of the arteries ensure that the flow of blood is fast and efficient.

Veins

Veins function to conduct blood from the peripheral tissues to the heart. Vein walls are thinner than the walls of arteries, containing less smooth muscle and elastic tissue. Blood pressure in the veins is extremely low compared to the pressure in the arterial part of the circulatory system. The blood must exit the venous system into the vena cava and the heart at even lower pressure if it is to keep moving. There is a special mechanism to achieve this. Veins possess a unique system of valves, formed by folds in the tunica intima (the inner wall of the veins), and these folds are present in pairs, serving to direct the flow of blood toward the heart.

Arteries require more protection than veins, and therefore are placed where injury is less likely to occur. Whereas many veins are superficially located, most arteries lie deep in the tissues and are protected by muscle. Occasionally, you may find what is known as an aberrant artery located superficially in an unusual place.

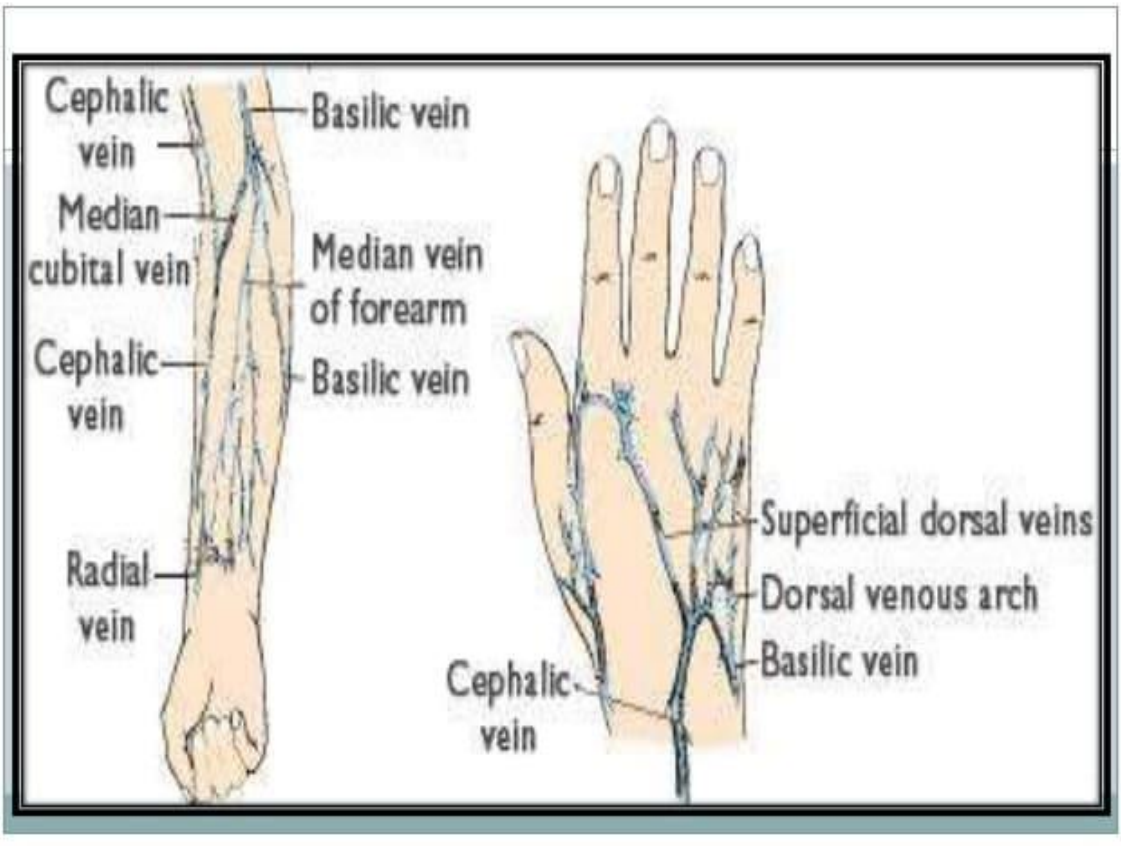
Arteries pulsate and veins do not. A method to ensure that you **do not** puncture an artery is to palpate the vessel that you have located for a pulse. **If a pulse is present, select another blood vessel.**

3.0 Selection of a Vein

The upper extremities are the preferred sites for venipuncture in adults. Upper and lower extremities and scalp are often used in neonates and pediatrics.

The ideal veins for venipuncture are located in the **antecubital fossa**, i.e., the inner aspect of the elbow joint. Veins often are more superficial as they cross joints. In the antecubital fossa, the **cephalic, basilic and median cubital veins** usually are easily accessible. After numerous venipunctures and intravenous (IV) administration, this area may become bruised or scarred. As a result, the veins in this area may feel 'cord-like' or may lack dimension when palpated. In this case, select an alternate site.

Another suitable site for venipuncture is the **dorsum (back) of the hand**, where the metacarpal veins and the **dorsal venous arch** are located. Venipuncture in this area is more painful for the patient as it contains smaller and more fragile veins. Therefore, use a smaller gauge of needle, i.e., a **Vacutainer** ® brand safety-lok blood collection set (butterfly set). The hands are the first choice when collecting a blood specimen from patients with chronic kidney disease. Saving arm veins for patients with chronic kidney disease and patients on dialysis is to ensure a fistula/graft can be created when needed.



The vein that you select for venipuncture must have several qualities:

- Dimension or 'bounce' when palpated, not flat;
- Softness: it cannot be hard and 'cord-like';
- Located in limb opposite to existing IV site;
  (If there is no appropriate vein in the opposite limb, then the venipuncture site may be in the same limb, but **below** the IV site); and
- Free of swelling, redness and/or warmth.

Additional Recommendations

- Blood should not be collected from an arm with a hemodialysis fistula, arm that is being "saved" for the creation of a fistula, cannula or vascular graft.
- Presence of sclerosis or inflammation, past history of mastectomy with or without lymph node removal or other diseases affecting local circulation or increasing the risk of infection or extensive scarring may contraindicate blood collection
- DO NOT PERFORM PHLEBOTOMY ON ANY SIZE HEMATOMA
- If possible, limbs being used for intravenous (IV) therapy should not be used for venipuncture.

Exception:

If there are no other veins available for venipuncture, except those in the limb being used for IV therapy, venipuncture may be performed:

- Distal (preferred) or proximal to the IV site.
- The IV infusion must be turned off completely for at least 2 minutes before the venipuncture, and until venipuncture is complete.
- When the venipuncture is distal to the IV site, apply the tourniquet between the IV and the venipuncture site.

Note: The venipuncture must be documented as being performed distal or proximal to an infusion site and from which limb.

4.0 Preparation of Equipment

As previously noted, the condition of the selected vein may differ from procedure to procedure, depending on the site selected. Vein condition also may vary from patient to patient. Therefore, the HCP should vary the equipment selected to meet the specific needs of the situation.

Equipment:

- Specimen labels or pre-printed patient labels and requisitions
- Biohazard specimen bag(s)
- Gloves
- Antiseptic: alcohol swab (adults and pediatrics), chlorhexidine 2% alcohol free swab (neonates)
- Tourniquet
- Blood tubes
- Vacutainer® holder
- Needles (double ended straight) or winged-butterfly
  - Adults: 20-21 gauge
  - Pediatric: 23-25 gauge
  - Neonates: 23-25 gauge
- Appropriate size syringe to aspirate blood, and a blood transfer device to transfer samples into tubes when syringe used.
- 2 x 2 gauze and tape or bandage
- Sharps disposal container
- Ice, as needed
- Warming devices, as need
- Blood Cultures: Refer to Laboratory Users' Handbook Appendix

What equipment you will see at KHSC

The BD Vacutainer ® Eclipse™ blood collection needle

The straight needle features a safety shield that allows for one handed activation to cover the needle immediately upon withdrawal from the vein. It is very easy to dispose of in the sharps container, without risk of blood contamination or needle-stick.

NOTE: This is the preferred method for obtaining samples. Grant (2003) suggests that the use of a conventional needle and syringe produces lower hemolysis rate. This system may not be appropriate for patients with smaller vessels or when blood sampling is performed from the dorsum of the hand.

The BD Vacutainer ® push button collection set (butterfly)

In-vein needle activation at the push of a button. Upon completion of the blood collection with the **needle still in the vein** the HCP can activate the button with the tip of the finger. Needle will retract from the vein automatically.

This is suitable for small veins, fragile veins, and difficult veins therefore, is the set used for veins located in the hand and lower limb.
NOTE: You are required to use this set for blood cultures.

The BD Vacutainer ® holder

One time use. It connects to the straight needle and the butterfly needle.

The BD Vacutainer® blood transfer device

One time use. When a syringe is used to collect blood this device is used to transfer the blood from the syringe to the blood collection tubes.

4.0 Application of a Tourniquet

To ensure that there is adequate distention of the selected vein, the HCP may apply a tourniquet or blood pressure cuff at least 5 to 10 cm (2 to 4 inches) above the chosen site.

- Apply the tourniquet lightly, to constrict **only** the venous return, while still maintaining the arterial flow to the area.
- Application for preliminary site location should not exceed **one minute**.
- Once the tourniquet has been applied, check for a pulse distal to it, thereby ensuring that arterial flow is present, and therefore, that it has not been applied too tightly. A loose tourniquet would be demonstrated by insufficient distention of the vein and the ability to insert more than 2 fingers under the tourniquet.
- One time single use
- You may also use a blood pressure cuff as a device to distend the vein. The necessary pressure varies with each patient. A cuff pressure above the patient's systolic pressure would impede the arterial flow. If the pressure is below the patient's diastolic pressure, venous flow will not be obstructed and therefore, vein distention will be unlikely. The ideal cuff pressure to ensure vein distention lies between the patient's systolic and diastolic pressures.
- Blood pressure cuffs are ideal for situations when discomfort is increased by using a tourniquet, i.e., for 'hairy' patients, edematous patients, and patients with fragile 'tissue-paper-like' skin.

Further Actions to Distend the Vein

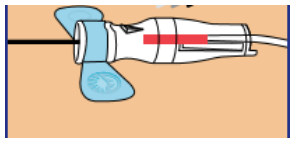
Even with correct application of a tourniquet, some veins do not distend adequately or demonstrate a sufficient dimension to permit venipuncture. To ensure adequate distention of the vein, you may do one or more of the following:

HCP Actions	Comments/Suggestions
Place the limb in a dependent position (below the level of the heart).	• Do not do this if the limb is edematous.
Apply warm compresses (a warm towel or disposable heat pack, or immerse in warm water, or use infant warmer).	• Cloth should not be warmed in the microwave as internal temperatures are not regulated. • Cloth should extend to cover the palm of the hand where the heat loss occurs.
Note: Vein tapping is discouraged. Patient can form a fist but there should not be any vigorous hand exercise (i.e., fist pumping). Vigorous hand exercises can cause hemolysis.	

6.0 Performing Venipuncture

The HCP carries out the following actions:

HCP Actions	Comments/Suggestions
1. Prepare equipment, blood tubes, specimen labels and requisitions.	• Check to ensure all addressograph labels/pre-printed patient labels and requisitions are legible, correct and complete. • Determine the times for timed blood work • Assemble the needle and the Vacutainer® holder **Note:** Never use a blood collection set without a holder (or syringe attached)
2. Refer to KHSC - Order of Draw Chart and Laboratory Users' Handbook to determine appropriate blood tubes and volumes and any special handling instructions. For blood culture instructions, refer to Laboratory Users' Handbook Appendix – Blood Culture Collection.	Order of Draw https://khscnow.kingstonhsc.ca/document/14689 Laboratory User's Handbook https://khscnow.kingstonhsc.ca/labs/document/1324
3. Complete an identity check using 2 patient identifiers, ensuring that the specimen labels and requisitions match the patient's identification bracelet.	Administration Policy 13-010 Patient Identification
4. Position the patient comfortably, providing support for the arm. Wash hands and apply gloves.	
5. After applying the tourniquet 5 to 10 cm (2 to 4 inches) above the selected site, palpate the vein, swab the site with 70% alcohol (or chlorhexidine 2% alcohol free for neonates) and allow skin to air dry before commencing.	• The HCP will wear clean examining gloves • Do not repalpate after cleaning. • If the vein must be touched again the site should be re-cleansed.

HCP Actions	Comments/Suggestions
6. To stabilize the vein, pull the skin taut over the vein with the thumb of your non-dominant hand. Hold the butterfly needle by the wings of the straight needle at the hub in your dominant hand with the bevel of the needle up. Position the blood tube in the Vacutainer® holder (without puncturing the tip of the vacationer needle).	
7. Insert the needle at an angle of 15 – 30 degrees.	• If using a butterfly needle, access to the vein will be indicated by the presence of "flash" directly behind and below the activation button. 

HCP Actions	Comments/Suggestions
8. Push the first blood tube to the end of the Vacutainer® holder until the needle punctures the tube. Release the tourniquet as soon as possible after blood flow has been established. Allow the tube to fill until the vacuum is exhausted and blood flow ceases. When blood flow ceases, hold Vacutainer holder securely and remove/disconnect the tube.	**If blood does not flow**: • Tip the needle slightly to ensure that the opening is not occluded by the wall of the vein. • Withdraw the needle slightly as it may have been pushed too far. • Stroke the vein toward the needle as the vacuum in the tube may have caused collapse of the vein; **OR** • Check the vacuum by using another tube. • DO **NOT** REMOVE and then reuse the same tube, as the vacuum to produce suction will have been lost.
9. **Multiple tubes of blood need to be collected**: • Have all the tubes required readily available. • Refer to the Clinical Labs of KHSC Order of Draw for the order and the mixing requirements • Hold the Vacutainer® securely to remove one tube and insert another one; and • Immediately after drawing a tube, gently mix by inversion 8 times* to prevent clotting. • Do not mix vigorously.	• All tubes (except red and gold tops) have additives • Remember that vigorous mixing may cause hemolysis • *Refer to KHSC for mixing requirements, average mixing is 8 times

HCP Actions	Comments/Suggestions
10. Remove the last blood tube from the Vacutainer before removing the needle from the vein.	
11. Place 2x2 gauze gently over the site without applying pressure and when using: • A straight needle: quickly but carefully withdraw the needle from vein and activate the safety mechanisms • A butterfly set: activate the safety mechanism while needle is in the vein Discard needle and holder into a sharps container. DO NOT RECAP THE NEEDLE	
12. Apply pressure over the venipuncture site with a sterile 2x2. Instruct the patient to maintain this pressure for 3-5 minutes to prevent bleeding and sub-cutaneous hematoma. Apply 2x2 and tape to puncture site.	• If the patient has a clotting disorder or is receiving anticoagulant therapy, ensure that pressure on the venipuncture site is maintained for a least 5 minutes. • Following antecubital fossa venipuncture, bending of the arm is not recommended as this can cause bleeding.

HCP Actions	Comments/Suggestions
13. Label all tubes with patient-specific specimen labels. Initial all labels and write the time of collection. Indicate time of collection on requisitions and sign. Verify that patient information on tubes and requisitions match.	
14. Document in Interprofessional Progress Notes or on unit-specific flow sheet: • Date, time, method and location of sampling (if it was performed distal or proximal to the IV site) • Number of attempts • Gauge and type of needle used (Pediatric and neonates) • Amount of blood obtained (Pediatric and neonates) • Blood tests completed • Any unusual problems and follow interventions • Patient's tolerance of procedure • Patient and Family education	

Note: When performing venipuncture if not successful after two attempts, defer obtaining the blood sample to another authorized staff member. Subsequently there must be consideration as to whether appropriate venipuncture sites have been exhausted, and whether the prescriber should be notified before subjecting the patient to further attempts.

Note: For neonates, two NICU nurses may make a maximum of three attempts each to successfully perform venipuncture without notification of the prescriber. Also there must be consideration of whether IV sites are being exhausted. If access seems doubtful, the prescriber should be notified before the six attempts are complete.

7.0 Review of Safety Precautions

For all venipuncture procedures, use standard precautions to ensure the safety of the patient, the individual performing phlebotomy, and others in contact with the blood.

7.1 For Patient Safety

- Ensure that there is a Prescriber's order to collect blood specimens, and check that the correct test is to be carried out on the correct patient at the correct time, with appropriate patient preparation (e.g., fasting) completed.
- Complete an identity check to ensure that the label and requisition match the patient's identification bracelet.
- Ensure that the site is cleansed prior to venipuncture. The antiseptic must be allowed to air dry to be effective. Venipuncture through wet alcohol causes stinging discomfort to the patient.
- Once cleansed, do not re-palpate the site, as this contaminates the venipuncture site and, in the case of blood cultures, can cause false contamination of the specimen.
- After needle removal, apply pressure over the venipuncture site for 3 - 5 minutes.

7.2 For Staff Safety

- Wash hands.
- Don gloves however; remember this will not protect you from needle sticks.
- Some individuals performing phlebotomy prefer to glove the non-dominant hand (that is, the hand that is used for clean-up of possible blood contaminated 2x2s).
- Do not recap the needle. All venipuncture trays should be equipped with a sharps disposal container.
- Bag all blood specimens prior to transportation to the laboratories, in order to confine possible blood spills.

8.0 Complications

8.1 Complications at the venipuncture site

COMPLICATION	POSSIBLE CAUSE	HCP INTERVENTIONS
Pain	· Improper technique · Puncture of artery · Nerve irritation	· Follow procedure · Reassure patient
Hematoma	· Needle goes through the vein wall · Inadequate pressure applied after needle removal	· Insert bevel up, with short thrust · Use proper technique
Bleeding	· Inadequate hemostasis · Anticoagulant use	· Apply direct pressure to venipuncture site until bleeding stops
Infection	· Contaminated equipment/ fingers · Insufficient cleaning, without allowing anti-septic to dry	· Use aseptic technique · Do <u>not</u> re-palpate after cleaning · Allow antiseptic to air dry
Phlebitis	· See causes of infection · Frequent sampling from same site	· See infection interventions · Rotate sites · Avoid warm and reddened areas
Thrombosis	· Frequent sampling from same site	· Rotate venipuncture sites · Avoid areas of bruising · Use proper technique
Nerve Damage	· Hitting the nerve (normally found deep and near the arteries)	· Palpate first and appropriately choose veins

8.2 Complications with the blood sample

Factors that increase the risk of hemolysis

- Use of a needle too small a gauge or too large of a gauge for the vessel
- Under filling a collection tube
- Mixing a tube vigorously
- Failing to let the alcohol dry
- If using a syringe: pressing the syringe plunger to force the blood into the collection tube (increasing the sheer force of the red blood cell)

9.0 Bibliography

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WHO guidelines on drawing blood: best practices in phlebotomy (2010)
Updated Phlebotomy Procedures – Procedures for the Collection of Diagnostic

Blood Specimens by Venipuncture, 6th ed, 2010. (American Society of Phlebotomy Technicians – based on – Clinical Laboratory Standards Institute)

Laboratory Users' Handbook, 7.8 Edition (November 2019)

QMP-LS Ontario Laboratory Accreditation Requirements and Guidance Information, V5.1 (2011).

Policies and Procedures

Clinical Policy and Procedure B-4580 Venipuncture for Obtaining a Blood Sample

Administration Policy 20-045 Lab Specimen Requisitions and Labels

Administration Policy 13-010 Patient Identification

Venipuncture Authorization Test

Note: The test is to be completed on Knowledge NOW. Must achieve a score of 80% or greater.

1. Veins differ from arteries in having
   a. higher pressure, thicker walls, valves, no pulse
   b. lower pressure, thinner walls, valves, no pulse
   c. no pressure, thinner walls, no valves, no pulse
   d. lower pressure, elastic walls, valves, pulse

2. Essential safety measures for the **HCP** include
   1. wear gloves
   2. dispose of needles in sharps disposal container
   3. use a syringe to transfer blood to specimen containers
   4. wash hands
   5. avoid bagging specimens
   6. glove the dominant hand only
   7. bag all specimens for transport to laboratory

      a. 1, 2, 5, 6
      b. 1, 2, 4, 7
      c. 2, 3, 6, 7
      d. 3, 4, 5, 6

3. Essential measures to ensure **patient safety** include
   1. complete identity check
   2. cleanse site
   3. do not allow antiseptic to dry at site prior to needle insertion
   4. do not re-palpate site once cleaned
   5. insert needle at 80º angle
   6. remove tourniquet after removing the needle
   7. apply pressure to site after needle withdrawal
   8. use the same site whenever possible

      a. 1, 3, 7, 8
      b. 2, 4, 5, 6
      c. 2, 5, 6, 7
      d. 1, 2, 4, 7

4. You can tell that a tourniquet has been secured too tightly by
   a. absence of pulse distal to tourniquet site
   b. distention of vein at proposed site
   c. cyanosis above and below tourniquet site
   d. collapse of vein at proposed site

5. Vein dilation may be achieved by all of the following **except** which of the following:

   a. having patient close their fist
   b. lowering the level of the limb to below the heart
   c. applying warm compresses
   d. tapping the vein

6. **Three** potential complications of venipuncture are

   1. infection
   2. extravasation
   3. pain
   4. bleeding
   5. clotting
   6. low blood pressure

   a. 1,2,5
   b. 1,3,4
   c. 2,3,6
   d. 3,4,6

7. To prevent the development of **hematoma**, the individual authorized in phlebotomy will insert the needle
   a. with the bevel up
   b. with the bevel down
   c. parallel to the skin
   d. with a rapid, deep thrust

8. To prevent the development of **phlebitis**, the individual authorized in phlebotomy will
   a. wear gloves
   b. rotate sites
   c. use a tourniquet
   d. apply pressure following needle withdrawal

9. After the specimen has been taken
   a. apply moderate pressure on the needle site during withdrawal
   b. remove the needle as quickly as possible
   c. use a 2x2 to apply pressure to site after withdrawal
   d. release tourniquet after needle withdrawal

10. If possible, when a patient has an intravenous (IV) running, where should you select a site for venipuncture?
    a. the opposite extremity
    b. the same extremity above the IV site
    c. dorsum of hand on same extremity
    d. use the lower extremities

Venipuncture Authorization Record

Name: _____

Successful completion requires 100% compliance with criteria.

	Performance Criteria	Demonstrated
1.	Explains the procedure to the patient.	
2.	Gathers the appropriate equipment	
3.	Identifies the patient using 2 patient identifiers: right patient for the right test.	
4.	Selects the most appropriate vein.	
5.	Selects and applies the tourniquet/BP cuff correctly.	
6.	Demonstrates knowledge of vein dilation methods and selects the most appropriate method.	
7.	Demonstrates the correct method of cleansing the site.	
8.	Demonstrates venipuncture successfully	
9.	Demonstrates correct method of removing the needle and application of pressure.	
10.	Disposes of used supplies correctly.	
11.	Ensures that the tubes and requisitions are labeled correctly and bags the blood specimen.	

Please check off the following when completed:

- ☐ Learning Guide
- ☐ Authorization Test
- ☐ In-service/observation of demo

Clinical Learning Specialist or Delegate: _____ Date: _____