EXERCISE 2: VENIPUNCTURE USING VACUUM COLLECTION SYSTEM

Skills 30 points

Objectives

1. Identify the routine site and three alternate sites for venipuncture.
2. List the three veins of the forearm used for venipuncture, describe where they are positioned, order of selection and the reason for the selection order.
3. State why the basilic vein is the last choice in vein selection.
4. Demonstrate concern for the safety and welfare of yourself and others by consistently using appropriate infection control techniques.
5. Demonstrate appropriate concern for your classmate and patients by explaining the procedure.
6. State the importance and proper method for identifying patients in the hospital and outpatient settings.
7. Describe and demonstrate the steps in the selection and preparation of the venipuncture site.
8. Describe the appearance of a properly applied tourniquet, maximum time it may be applied and the effects of tourniquet application and hand squeezing on the quality of the sample.
9. List and describe the equipment and supplies necessary for performance of the venipuncture.
10. Recognize proper needle insertion and withdrawal techniques including direction, angle, depth, aspiration and number of times the procedure may be attempted.
11. List, in chronological order, the correct steps in the proper performance of a venipuncture using the vacuum blood collection system
12. State the correct order of the draw.
13. State the reason that the correct order of the draw must be followed.
14. List ten stopper colors, additive present and laboratory tests which will be drawn into each.
15. Differentiate between whole blood, serum and plasma.
16. State the ratio of anticoagulant to blood in the light blue stopper tube.
17. State when, where and the minimum information which must be present for labeling blood samples.
18. Describe the steps to take when a patient faints or appears about to faint.
19. List and describe problems which may be encountered during blood collection.
20. State the maximum number of attempts for performing a venipuncture.
21. State the consequences of placing a tourniquet above an intravenous (IV) site.
22. State the problems which may occur if a sample is drawn above an IV and how this will affect the quality of the laboratory samples.
23. State the proper protocol when samples must be collected above an IV.
24. State the appropriate action which must be taken when a patient refuses to have their blood drawn.
25. List six reasons that a blood sample might be rejected by the laboratory.
26. List the steps to follow after an accidental needle stick.
27. Define “hematoma” and state the cause.
28. Perform three successful venipunctures on the artificial arm and one successful live draw with minimum stasis and trauma and no contamination.

Discussion

Clinical laboratories perform blood analyses on venous blood samples collected by phlebotomy. To collect a venous blood sample, the phlebotomist pierces the vein with a hypodermic needle and draws the blood into a syringe or uses a commercially available apparatus specifically designed for collecting venous blood, such as the vacuum collection system. The goal of venipuncture is to obtain a blood sample from the correct patient into the correct tube with minimal trauma or stasis. Venipuncture is an invasive procedure and requires a certain degree of skill.
Vacuum Blood Collection System
The vacuum system consists of a double-pointed needle, a plastic holder or adapter, and a series of vacuum tubes with rubber stoppers of various colors. The colors indicate the type of additive present. Another kind of holder is available, which allows resheathing of the needle with the holder after venipuncture. Blood collection using the evacuated tube collection system will produce the best blood samples for analysis by the laboratory. The blood goes directly from the patient into the appropriate test tube.

Blood Collection Needle
The vacuum collection needle is pointed at both ends, with one end shorter than the other. The long end of the needle is used for insertion into the vein; the shorter end is used to pierce the rubber stopper of the vacuum tube and usually is covered by a rubber sheath. The sheath makes it possible to draw several tubes of blood by preventing leakage of blood as tubes are changed; this is called a multi-draw or multi-sample needle. If the short end is not covered with a rubber sheath, it is a single sample needle and only one tube of blood can be collected.

There are several sizes of needles available; the size depends on the length and gauge of the needle that goes into the vein. Blood collection needle lengths range from 1 to 1 ½ inches. One inch needles are used for routine venipuncture, 1 ½ inch needles are used for patients with very deep veins. The gauge of a needle is a number that indicates the diameter of its lumen; the lumen, also called the bore, is the circular hollow space inside the needle. The higher the gauge, the smaller the lumen. The needle top is color coded to indicate the gauge. The most frequently used needle gauges used for phlebotomy are: 20g (yellow top), 22g (black top), and 21g (green top).

The bevel is the slanted opening at the end of the needle. The phlebotomist performs a venipuncture so that the bevel of the needle is facing upward when the needle is inserted into the vein. Blood collection needles come in single use, sterile packages, either peel apart envelopes or plastic cases.

Holder
The vacuum collection system holder is a plastic sleeve into which the phlebotomist screws the double pointed blood collection needle. Holders are available in two sizes, one for adult venipuncture and one for pediatric procedures. All holders are single use, with some having an integral safety device which is activated to cover the needle after use. The entire assembly (holder and needle) is disposed of in a sharps container after blood collection.

Blood Vacuum Collection Tubes
Blood vacuum collection tubes are glass or plastic tubes sealed with a partial vacuum inside by rubber stoppers. Most tubes used today are plastic, which has increased the safety of the procedure. The air pressure inside the tube is negative, less than the normal environment. After inserting the longer needle into the vein, the phlebotomist pushes the tube into the holder so that the shorter needle pierces the stopper. The difference in pressure between the inside of the tube and the vein causes blood to be aspirated and fill the tube. The tubes are available in various sizes for adult and pediatric phlebotomies. Adult tubes have volumes of 5, 7, 10 and 15 mL and pediatric tubes are available in volumes of 2, 3 and 4 mL.

Almost all vacuum tubes used today contain some type of additive. The different tube stopper colors indicate which type of additive is in the tube. The most common additive is an anticoagulant, which will keep the blood from clotting. The clear fluid in an anticoagulated specimen is called plasma. A specimen that does not contain an anticoagulant will clot, and the liquid portion is called serum. Other additives serve other functions. Some tubes may also contain a polymer gel which will create a physical barrier between the liquid portion of the sample and the cellular elements during centrifugation. It is of critical importance that the phlebotomist knows which type of tube to draw for each test ordered. The collection of the blood in the wrong type of tube will result in the patient having to be stuck again.
In the vacuum blood collection system, the additives in the tubes are the precise amounts needed to mix with the amount of blood that will fill the tube. It is important to completely fill each tube so that the ratio of blood to chemical additive is correct, otherwise the test results may not be accurate or the specimen will be rejected and will need to be recollected. For example, coagulation test performed in the light blue tube containing the anticoagulant sodium citrate require a ratio of 1 part anticoagulant to 9 parts blood.

The following table lists the stopper color, the additive in the vacuum tube, and the most common test for that tube. **MEMORIZE THIS TABLE.** This table contains only the most commonly used anticoagulants, there are many more. The tubes are listed in the correct order of the draw with the exception of the last three. For royal blue, put in the order based on the additive. For yellow (ACD) and black, refer to your institution’s SOP. **Daily quizzes will be given over this information.**

<table>
<thead>
<tr>
<th>STOPPER COLOR</th>
<th>ADDITIVE</th>
<th>SPECIMEN USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Blood Culture Bottles</td>
<td>Sodium polyanetholesulfonate (SPS) Additives to keep microorganisms alive.</td>
<td>Blood Cultures – uses whole blood</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Sodium Citrate Ratio: 1 part anticoagulant to 9 parts blood.</td>
<td>Coagulation studies: PT, PTT and fibrinogen – uses plasma</td>
</tr>
<tr>
<td>Red - plastic Gold SST</td>
<td>Clot activator</td>
<td>Tests using serum: chemistry, serology and immunohematology (blood bank)</td>
</tr>
<tr>
<td>Red/Black or</td>
<td>Clot activator and a polymer gel for serum separation</td>
<td>All tests using serum except blood bank</td>
</tr>
<tr>
<td>Green Green/Black-P</td>
<td>One of the following: sodium heparin lithium heparin ammonium heparin Heparin and polymer gel to separate plasma.</td>
<td>Blood chemistries utilizing plasma.</td>
</tr>
<tr>
<td>Tan</td>
<td>K2 EDTA</td>
<td>Lead levels – uses whole blood</td>
</tr>
<tr>
<td>Lavender (Purple)</td>
<td>K2 EDTA (ethylenediaminetetraacetic)</td>
<td>Hematology studies: CBC, WBC count, Hemoglobin, Hematocrit, Platelet count, Reticulocyte count, differential Uses whole blood</td>
</tr>
<tr>
<td>Pink</td>
<td>K3 EDTA</td>
<td>Blood bank testing using gel system. Uses plasma and red blood cells</td>
</tr>
<tr>
<td>Gray</td>
<td>• Potassium oxalate and sodium fluoride (plasma) • Na2EDTA and sodium fluoride (plasma) • sodium fluoride (serum)</td>
<td>Glucose, Blood Alcohol (ethanol) levels, lactic acid</td>
</tr>
<tr>
<td>Royal Blue</td>
<td>Color of tube label indicates additive: • purple – EDTA (plasma) • green – heparin (plasma) • red – none (serum)</td>
<td>Nutrients, toxicology and trace metal analysis for: Antimony Arsenic, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, and Zinc.</td>
</tr>
<tr>
<td>Black</td>
<td>Buffered Sodium Citrate</td>
<td>Westergren sedimentation rate Uses whole blood</td>
</tr>
<tr>
<td>Yellow</td>
<td>Acid Citrate Dextrose</td>
<td>Genetic and tissue testing Uses whole blood</td>
</tr>
</tbody>
</table>
The Clinical Laboratory Standards Institute (CLSI) provides national standards for clinical laboratories. The following “Order of the Draw” is based on these recommendations. The order of the draw is based on the additive present in the tube, not just the color of the tube stopper.

The sequence of collection of evacuated tubes in a routine multi-draw should be in this order and is based on the additive present in the tube:
1. Sodium polyanetholesulfonate (SPS) - yellow top or blood culture bottles
2. Sodium citrate - Light Blue coagulation tube, Black
3. No anti-coagulant – Red, Royal Blue with red label
4. No anti-coagulant with gel – serum separator tube (SST)- black/red mottled, gold
5. Heparin - Green or Royal blue with green label, tan
6. Heparin – with gel mottled Plasma Separator Tube (PST) - Green/Gray mottled
7. EDTA – Lavender (purple), pink, white, tan, Royal Blue with purple label
8. Sodium fluoride/potassium oxalate OR sodium fluoride/sodium EDTA OR sodium fluoride - Gray
9. Acid citrate dextrose (ACD) - yellow

The following is a more simply stated order of the draw. Keep in mind that other, less frequently used tubes will be placed in the order below based on the additive present.

1. blood cultures
2. light blue
3. red
4. green
5. lavender (purple)
6. gray
7. other

When drawing blood for a blood profile or panel (many different types of laboratory tests are ordered) the phlebotomist fills several vacuum collection tubes, each with a different color stopper appropriate for each test ordered. This is called a multiple draw, or multi-draw. This is necessary to avoid contaminating the blood in one tube with traces of chemicals from a previous tube that might alter the test results.

The order of the draw is CRITICAL due to the potential for carryover of additive in one tube to the next tube which will adversely affect the results of laboratory testing. The order of the draw was developed to avoid errors in patient results. Examples of erroneous lab result from not following the order of the draw:

- EDTA binds calcium, so if the EDTA tube is collected before the heparin tube the EDTA will cause falsely decreased calcium levels, as well as interfering or altering a number of other tests.
- If a lavender stopper tube, which contains K$_2$EDTA, is drawn before a tube for a patient’s potassium (K) level, the potassium level will be falsely elevated.
- The plastic red stoppered tubes have a clot activator; if these are drawn before the light blue coagulation tubes erroneous coagulation results will be obtained.

Tubes containing additives must be gently mixed when removed from the blood collection needle so the substance can mix with the blood and function properly. If the additive is an anticoagulant and the tube is not adequately mixed, clots will form in the sample and it will need to be recollected.

When drawing tubes for multiple tests one tube of the appropriate color may be used to perform multiple tests. For example, a reticulocyte count and complete blood count are ordered. Both require a lavender stoppered tube. You would NOT draw one lavender tube for each test, instead you would draw ONE lavender tube for both tests. Always check with your facility to determine how many tubes to draw. There are times when some tests are performed on site and some tests are sent out. In this situation you may need to draw more than one tube of the same stopper color so each department/facility will have a sample.
Types of Blood Specimens

Blood as it flows through the body is made up of plasma and cellular elements. Plasma is composed of water and dissolved substance, such as proteins, nutrients, carbohydrates, lipids, minerals, gases, vitamins, hormones, antibodies, fibrinogen, as well as waste products. There are lab tests for all of these types of dissolved substances, as well as test for the cellular elements, and each lab test requires a specific type of specimen.

Blood is mixed with different additives in order to obtain different types of specimens. The most common additive is an anticoagulant, which will keep the blood from clotting by binding or inactivating one of the elements necessary for clotting to occur. The most common anticoagulants used in blood collection tubes include sodium citrate, heparin, EDTA, and potassium oxalate. All anticoagulated specimens will contain plasma and cellular elements. Other additives serve other purposes. Many tubes that produce serum contain clot activator, which helps the clotting process start and go to completion. The additive sodium fluoride is a glycolytic inhibitor. This prevents the use of glucose by the blood cell which is called glycolysis. Some tubes may also contain a polymer gel which will create a physical barrier between the liquid portion of the sample and the cellular elements during centrifugation. There are both serum and plasma tubes with polymer gel.

Serum is the clear liquid portion of a specimen that has clotted. If a test requires serum, the sample must be drawn into a tube that will allow the sample to form a clot, and the tube must sit upright for at least 30 minutes while the clotting process occurs. Once clotting is complete, the sample is spun down and the liquid portion, which is serum, is used for testing. Serum does not contain any clotting factors, as they are all used in the clotting process. Many chemistry and serology test are performed on serum samples.

Plasma is the clear liquid portion of an anticoagulated specimen. For tests that require plasma, the anticoagulated specimen is spun down, and only the plasma portion is used for testing. Plasma contains fibrinogen. Test that require plasma include Coagulation test such as Fibrinogen, Prothrombin time (PT), and the Activated Partial Thromboplastin Time (PTT). One advantage of using plasma is that the specimen can be spun down right away, without having to wait for the clotting process to occur. For this reason, many stat chemistry tests are performed on plasma, as it allows for a quicker turnaround time.

Whole blood is an anticoagulated specimen where the cellular elements must stay mixed with the plasma for testing purposes. Test that require a whole blood sample include most hematology test, such as the Complete Blood Count (CBC) and the Erythrocyte Sedimentation Rate (ESR), as well as Blood Cultures for microbiology.

Patient Identification and Preparation

It is vitally important that the phlebotomist correctly identifies the patient. Do not offer the patient a name to respond to, since many patients are hard of hearing and will respond affirmatively to any name you give.

All hospitalized patients have an identification arm band with their name, hospital identification number and other pertinent information. Always compare the laboratory test request slip name and ID number with the name and ID number on the patient's hospital arm band. If there is any discrepancy, do not draw the patient's blood. Report the discrepancy immediately to the nurse in charge of the unit. If there is a genuine error on the patient's arm band and the nurse asks you to go ahead and draw the blood before a corrected arm band is available for the patient, let the nurse take the responsibility of the patient identification by initialing the blood tube and the request slip.

For an out-patient, verify the patient's identity by having the patient give you additional identifying information such as the spelling of their last name, date of birth or address. Follow the protocol used at the site as it may differ from one institution to another.
Before beginning a venipuncture, the phlebotomist must wash or sanitize their hands and follow any special infection control policies. Always wear gloves when performing phlebotomy procedures.

Explain the procedure to the patient as necessary. Most patients have had their blood drawn by the time they are in their late teens or early twenties. Depending on the patient’s age, an appropriate question to ask is, "Have you ever had your blood drawn before?" or “Have you ever had any problems while having your blood drawn?"

If the patient has never had blood drawn before, the phlebotomist should help prevent anxiety by explaining the procedure to the patient including being honest about the amount of discomfort that will be felt. Describe that it is like a little pinch. This procedure is known as “informed consent”. The patient has the right to know what is involved in the medical procedure being performed on them. If the patient asks what the test is for tell them that their physician has ordered some laboratory tests to monitor their condition, the results will be available to the physician later and the patient can check with them later about the results. You must never tell the patient what tests are ordered or share results of testing.

Choose the appropriate vacuum tubes for the tests requested and, after collection of the samples, label the tubes appropriately. Each laboratory will have a Standard Operating Procedure manual (SOP) which lists the requirements, including stopper color of tubes needed, for all tests ordered.

Position the patient so he or she is comfortable and safe in case the patient becomes faint and falls. Hospitalized patients should always be drawn when they are reclining in bed. Out-patients should be seated in a phlebotomy chair which has a locking arm in front for support of the arm and body.

**Site Selection and Preparation** (refer to pages 11-15 of this lab)

The selection of the best site to perform a venipuncture is aided by the use of a tourniquet. The most common type of tourniquet used is a thin, flexible strap which is applied above the elbow to constrict blood flow and make the veins more prominent. The tourniquet is tied in such a way that it can be removed with one hand. Do not apply the tourniquet so tight as to prevent flow of blood in the arteries but just tight enough to decrease the flow of blood in the veins. The tourniquet must not be left in place for more than 1 minute as this can alter the composition of the blood which will affect many laboratory test results. Take the tourniquet home and practice on family members. The more you practice applying the tourniquet with your gloves on, the easier it becomes.

The tourniquet is inappropriately applied
- If the skin appears blanched above and below the tourniquet - it is too tight.
- If your finger can be inserted between the tourniquet and the patient's skin - it is too loose.

After applying the tourniquet to the arm, choose the puncture site. The arm has many veins from which to choose from. For venipuncture use the large veins of the forearm which are the median cubital, cephalic or basilic veins. The basilic vein veers toward the anterior surface of the forearm and is joined to the cephalic vein by the median cubital vein. These veins are ideal for venipuncture due to their fairly large size and the fact that most are well anchored in tissue and will not "roll".

The correct order of vein selection is:
1. median cubital
2. cephalic
3. basilic

The basilic vein lies close to the brachial nerve and artery, and for this reason should be used only if necessary. The blue superficial veins of the forearm are not adequate for a venipuncture.
To determine if the vein is adequate use the tip of the *index finger* to palpate the veins to determine their direction, depth and size. Choose the veins that are large and accessible. Large veins that are not well anchored in tissue frequently roll, so if you choose one, be sure to secure it (anchor) with the thumb of your non-dominant hand when you penetrate it with the needle. Do not choose veins that feel hard (sclerosed). Blood is not easily collected from veins that are scarred or sclerosed from repeated use, as they are difficult to enter, and if obstructed or occluded will not permit blood to flow through them. Study the diagram on page 13 for the veins of the arm and memorize them.

After selecting a vein, clean the puncture site with 70% isopropyl alcohol usually available as prepackaged swabs. Rub the alcohol swab in a *circular motion moving outward from the site* (page 14). Use enough pressure to remove all perspiration and dirt from the puncture site. Discreetly look at the swab when finished, if it appears excessively dirty repeat the cleansing process with a fresh alcohol swab. After cleansing *do not touch the site*, if the vein must be re-palpated the area must be cleansed again.

Grasp the holder and attached needle with the bevel of the needle facing up in your dominant hand. Your thumb should be on the top of the holder, with two fingers supporting the holder from below. Keep the holder at a right angle to your thumb and index finger. Carefully uncap the needle with your non-dominant hand. Examine the tip of the needle for defects and verify that the bevel is facing up. Place the thumb of the non-dominant hand below the puncture site and pull the skin taut to anchor the vein. The thumb should be 1 to 2 inches below the puncture site so that the needle entering the vein should not touch the phlebotomist’s thumb. Use the rest of your fingers of your non-dominant hand to gently hold the patient’s arm to steady it. Position the needle in the same direction as the vein at a 15 to 20 degree angle with the skin surface, enter the skin and penetrate the vein in one swift, smooth motion to decrease the patient's discomfort. Slow insertion of the needle is more painful to most patients. If the needle is inserted too slowly blood will leak out at the puncture site creating a biological hazard as well as obstructing the view of the puncture site. The bevel of the needle should enter and remain in the center of the vein. The following diagrams illustrate proper and improper needle positioning.

![Diagram of correct insertion technique](image1)

![Diagram of improper needle positioning](image2)

**Figure 10-6** Proper and improper needle positioning. 
A. Proper needle position. B. Needle bevel against the upper wall of a vein. C. Needle bevel against or embedded in opposite wall of vein. D. Needle inserted all the way through a vein. E. Needle partially inserted into vein. F. Needle in collapsed vein.
When using the vacuum blood collection method for multi-drawing, prevent movement of the holder, or the needle may accidentally be pulled from the vein especially while switching tubes. Be sure that the needle is a multi-draw needle, or blood will leak into the holder when the initial tube is removed, creating a biological hazard. It is recommended in the literature that the tourniquet should be released as soon as the blood begins to flow into the tube or when the tourniquet has been on for 1 minute. Releasing the tourniquet too soon may result in the vein collapsing due to the vacuum in the tube.

When all tubes of blood have been collected and the tourniquet has been removed, remove the last tube from the holder, place a Biowipe or gauze pad above the site and withdraw the needle in a smooth and cautious manner so as not to bruise the vein. Do not apply pressure before the needle is removed, as this can cause pain to the patient.

After fully withdrawing the needle from the vein, apply pressure to the puncture site with a biowipe or gauze pad while IMMEDIATELY activating the needle safety device. Discard the entire assembly into a biohazard container. This will prevent you from attempting to activate the device with two hands. Once this is discarded, and if the patient is able, ask them to hold pressure on the site for 3 to 5 minutes until the bleeding stops. If the patient is asleep, unconscious or uncooperative, hold pressure for them. The puncture site must have pressure applied for 3 to 5 minutes to prevent the formation of a hematoma. A hematoma is caused by blood leaking from the vein into the tissues resulting in the formation of a bruise.

Gently invert all tubes containing an additive following the manufactures directions, usually 3-10 times depending on the additive. This may be done while observing the patient for any signs of fainting and must be done prior to labeling.

Specimen Labeling

Each blood sample must be labeled immediately following collection in the presence of the patient. The minimum amount of information required is:

- Patient's full name (last name first, first name second)
- Identification number (may be the patient’s Date of Birth or other unique number)
- Date and time of collection. Many laboratories require the use of military time.
- Phlebotomist’s initials

Many laboratories utilize computer generated labels to put on the blood specimen. These labels generally contain the patient's name and identification number and the name of the test ordered. When computer labels are used the appropriate label is placed on the tube of blood and the phlebotomist writes the date, time and their initials on the label. Other information may be required on the tube by the particular lab protocol.

NEVER LABEL TUBES BEFORE COLLECTING THE SAMPLE, as this may result in a mix up of blood patient specimens should the first venipuncture be unsuccessful and empty, labeled tubes are left on the tray. This may result in wrong lab results ending up in a patient’s medical record which may affect diagnosis and treatment. Label the tubes at the patient bedside or drawing chair, never take the tubes to another location to label them; this breaks the chain of identity of the blood specimens with the patient.
Problems Encountered During the Venipuncture

**Fainting** Feeling faint is a fairly common problem for patients when having blood drawn, particularly in outpatient settings. Be prepared to catch or break the fall of any patient who might faint.

Be familiar with the following steps in providing aid if the patient appears pale, complains of feeling faint or actually faints:

- Immediately release tourniquet.
- Remove the needle from the patient’s arm.
- Have the patient breathe slowly and deeply.
- Have the patient lower his or her head below the knees or, if possible, have the patient lay flat.

While providing aid to the patient you should immediately call for assistance from your mentor. You may need to apply a cold compress to the patient’s forehead and back of the neck. Remain with the patient until he or she is fully recovered. Document the incident according to facility protocol.

The use of ammonia capsules are no longer recommended as they have been associated with adverse affects. (CAP Today, November 2010)

**Redirecting Needle** In the event that you have been unable to puncture the vein immediately, use your free index finger to locate the vein by gently palpating the arm above the inserted needle. It may be that the needle has not gone in deeply enough or may be too deep. Carefully re-anchor the vein and gently insert the needle a bit farther or with draw the needle a bit to see if you can get the blood to begin to flow. If you feel you are in the vein but no blood is flowing, try changing tubes, as the vacuum on the tube may be the issue. As a beginning phlebotomist, you should only try to advance or withdraw the needle slightly.

*Never go "digging" for veins.* This is painful to the patient and may cause tissue or nerve damage. During clinical you may see experienced phlebotomist re-direct the needle if the needle is slightly to the left or right of the vein. This is done by carefully withdrawing the needle until the point is almost to the surface of the skin, redirecting the needle in the direction of the vein and advancing the needle. This procedure should only be attempted by experienced phlebotomist if the needle is close to the vein, and care should be taken that the patient is not caused too much discomfort.

**IMPORTANT:** If the needle is completely withdrawn from the site the procedure must be discontinued.

**Number of Attempts** When a venipuncture is unsuccessful it may be necessary to perform a second venipuncture on the opposite arm. If the second attempt is unsuccessful it is best to have a different phlebotomist perform the venipuncture. According to a recent survey by “Phlebotomy Today”, most facilities limit the number of attempts by a single phlebotomist to two. After two unsuccessful attempts in a row both you and the patient have lost confidence which will probably lead to a third unsuccessful attempt. As a student your clinical site will inform you of the maximum number of attempts. At some sites you may be allowed one attempt, at others two.

**Hematoma** If the area surrounding the puncture site begins to swell during the venipuncture, this usually indicates that the needle has gone through the vein or that the bevel of the needle is partially inserted into the vein causing leakage of blood into the tissues which may result in the formation of a hematoma which will ultimately result in the formation of a bruise at the venipuncture site. The tourniquet should be released and the needle withdrawn immediately if swelling is observed at the phlebotomy site, with pressure applied to the site after needle removal.
Drawing in an Arm with an Intravenous (IV) Line  If a patient is receiving intravenous infusions in both arms it is acceptable to puncture the vein 3 and 4 inches below the site of the IV device. Never place a tourniquet on an arm above the IV site, because you may dislodge the IV needle placement, resulting in infiltration of tissues with the IV fluid.

Never draw blood from above an IV site because the blood will be contaminated with the IV fluids which will cause inaccurate laboratory test results. This may lead to misdiagnosis or treatment of the patient. IV fluids present in the sample will dilute the sample or may cause hemolysis of the sample.

If the blood must be drawn above an IV site, these steps must be followed:
1. Have the nurse turn the IV off.
2. Wait 5 minutes.
3. Perform the venipuncture discarding the first tube of blood drawn (usually 5 – 10 ml)
4. After collection of the samples have the nurse turn the IV back on. Document that the sample was drawn using this method

Failure to Locate Vein in Antecubital Fossa In some instances it is almost impossible to locate a vein in the arm. In such a case, the veins of the lower arm, hand or foot can be used. NEVER use veins located on the underside of the wrist as these may be close to arteries and nerves. The student should gain a reasonable amount of skill and confidence and should have observed this type of procedure before attempting a venipuncture in these areas. Special written permission from the physician may be required prior to drawing blood from the foot. Check your laboratory’s policy before proceeding.

Mastectomy During the patient interview if the patient states they have had a mastectomy you CAN NOT draw blood from the same side as the mastectomy. If the patient has had a double mastectomy, check with the patient’s physician.

Respectful Treatment Always treat the patient with respect, even when they are not respectful of you. Patients are usually in the hospital because of a severe illness or injury and do not feel good. It seems like people are constantly coming in to poke or prod them preventing them from getting the rest they need. They may be extremely irritable and decide that you are a good target to vent their frustration out on. In this type of situation it is extremely important to act in a tactful, professional manner.

Patient Refuses Blood Draw If the patient refuses to have his or her blood drawn, speak to them calmly and indicate that the blood tests are important in monitoring their condition. If they still refuse do not attempt to perform the venipuncture. When patients are uncooperative there is a very real chance that a needle stick injury will occur. Notify the patient’s nurse or the charge nurse that the patient refuses to be stuck so that the doctor can be notified.

Sources of Error:
1. Failure to insert the needle completely into the vein. The phlebotomist should feel resistance initially following insertion of the needle. The resistance is almost immediately followed by a sensation of free or easier movement as the needle enters the vein. When the phlebotomist no longer senses that the needle has been inserted into the vein, the evacuated tube should be pushed onto the needle - NOT before.
2. Puncturing the stopper before entering the vein. If the phlebotomist partially pushes the evacuated tube onto the needle before inserting the needle into the vein, they risk puncturing the stopper and releasing the vacuum. If you hear a hissing sound prior to inserting the needle this indicates the vacuum in the tube is gone.
3. Retouching the site just before inserting the needle. If you are going to re-palpate, you must either cleanse your index finger before re-palpating (this technique is debatable) or, preferably, re-cleans the site before puncture.

4. Not anchoring the vein before inserting the needle. The vein must be held in place for successful needle penetration. Failure to anchor vein may result in the vein rolling to the side of the needle.

5. "Bouncing" the needle on the skin before guiding it into the vein. During venipuncture, the needle can only be used once. If the needle becomes contaminated it must be discarded.

6. Not keeping the holder stationary, causing the needle to dislodge from the vein when tubes are changed.

Rejection of Samples

The quality of laboratory results are directly affected by the quality of the blood sample obtained from the patient. Samples may need to be rejected as unacceptable for the following reasons:

1. Hemolysis - this is usually caused by a procedural error such as using too small of a needle, or pulling back too hard on the plunger of a syringe used for collecting the sample.

2. Clotted - failure to mix or inadequate mixing of samples collected into an additive tube.

3. Insufficient sample (QNS) - certain additive tubes must be filled completely. When many tests are ordered on the same tube, be sure to know the amount of sample needed for each test.

4. Wrong tube collected for test ordered.

5. Improper storage - certain tests must be collected on ice, protected from light, or be kept warm after collection.

6. Improperly labeled

First Aid Following Accidental Needle stick

Regardless of the disease the patient has, be careful not to stick yourself with a used needle. If an accidental stick does happen, immediately

1. Go to the sink, turn on the water, and bleed the site well by alternating squeezing and releasing the area around the site.

2. Do this for approximately 3 to 5 minutes.

3. Afterwards scrub the site with an alcohol swab.

4. Follow with a thorough hand washing.

5. Report it to your supervisor immediately.
Tying the Tourniquet

Releasing the Tourniquet
Selecting the Vein

Palpating the Vein
Cleansing the Site

Performing the Venipuncture
Completing the Venipuncture - Always release tourniquet and remove the tube from the back of the needle FIRST, then place gauze or a bio wipe above the puncture site, then remove the needle. Apply pressure to the puncture site while activating the needle safety device.
Procedure: Venipuncture

Introduction:

Quality test results depend heavily on proper patient identification and preparation. The student phlebotomist should "interview" the artificial arm to determine both the patient's identity and the patient's adherence to preparation guidelines. Not all laboratory tests have special patient preparation guidelines. In fact, most do not. However, the phlebotomist must remember to screen the patient regarding these guidelines whenever appropriate. You will practice on the artificial arms and must perform 3 successful multi-draws (two to three tubes of blood drawn).

Materials:

1. Artificial arm
2. Holder
3. 21 or 22 gauge multi-sample needles
4. Tourniquet
5. Alcohol pads
6. Gauze or bio wipes
7. Vacuum tubes
8. Gloves
9. Sharps container
10. Test tube rack
11. Sharpie marker
12. Trash can

Instructions:

NEVER ATTEMPT A LIVE DRAW WITHOUT THE INSTRUCTOR BEING PRESENT. Each venipuncture must be witnessed by your lab instructor and evaluated by your lab partner or instructor, using the checklists. Your partner must fill out the checklist for your third successful artificial arm draw AND the “live” draw.

Remember the purpose of this exercise is to allow you to learn and develop good venipuncture technique. Don't be shy about tactfully calling your lab partner's attention to mistakes which are made, or asking an instructor for input on technique.

Under the “COMMENTS” section of the check off sheet write appropriate feedback such as, “Good job. Continue to work on holding the needle stationary while changing tubes.”
Procedure Overview:
NOTE: This is an overview of the steps of the procedure. You will be using the evaluation sheets in this lab to evaluate each other on the draws.

1. Approach the patient, identify yourself as a student, the department you represent, and state the procedure you are about to perform. Ask for verbal permission to proceed. (Observer records time.)
2. Properly identify the patient. Ask the patient to state their name, spell it, and state their date of birth.
3. Role Play: Wash or sanitize hands.
4. Put on gloves.
5. Ask about blood drawing history and explain the procedure if necessary.
7. Apply the tourniquet properly 3 to 4 finger widths above the elbow of the selected arm. The ends of the tourniquet are above the tourniquet and are not in the area to be used for venipuncture.
8. Ask patient to clench fist. (You may hand the patient a couple of plastic tubes to hold in their fist.)
9. Palpate for suitable veins using your index finger. Note the size, direction and depth of the veins.
10. Select an appropriate vein based on selection criteria: 1) median cubital, 2) cephalic, 3) basilic.
11. Release the tourniquet within 1 minute of application.
12. Cleanse the chosen site with a 70% alcohol swab. Begin at the puncture site selected and move the alcohol pad outward, in small concentric circles. Allow the site to air dry while assembling needle.
13. Select and prepare appropriate needle based on chosen vein. Attach the needle to the hub and position the correct first tube in the holder. Verifies all supplies are present, and can be easily reached.
14. Reapply the tourniquet, making sure that the ends do not touch the prepared site.
15. Ask patient to clench fist.
16. Position tube in holder and with holder in your drawing hand, uncap the needle with your other hand and briefly inspect for manufacturer's defects.
17. Grasp the holder between your thumb and index finger of your drawing hand. The holder should be at a right angle to your index finger. Do not “cradle” the holder in your hand.
18. Anchor the vein selected by placing your thumb below the intended puncture site and pulling the skin down to make it taunt. Stabilize the patient’s arm by gently grasping it with the rest of your fingers. Do not re-palpate the site.
19. Position the needle in the same direction as the vein selected. Insert the needle, bevel up, at a 15-degree angle. The needle should be inserted in one quick, smooth motion.
20. Release the anchor of the vein and use that hand to push the evacuated tube onto the back of the needle applying counter pressure to the holder. Keep your eye on the needle to verify that you are keeping the holder stationary. You can apply gentle but firm pressure to the patient’s arm with the back of your fingers that are stabilizing the holder. Once the tube has been pushed onto the needle, take your hand off of the tube. If the stopper of the tube has been punctured by the back of the needle, and blood is not entering the tube, pushing on the tube will not cause blood to enter it.
21. Fill all tubes following the correct order of the draw.
22. Allow the tubes to fill to the correct volume. When the vacuum has been exhausted, blood will no longer enter the tube.
23. Keeping the holder absolutely still, pull the filled evacuated tube off the back of the needle using counter pressure on the holder and replace it with the next tube.
24. Gently invert the first tube while waiting for the second tube to fill; repeat with additional tubes.
25. Release the tourniquet once blood begins to enter the last tube and within one minute of application.
26. Pull the last evacuated tube off of the needle. Invert the tube at least once.
27. Place a Biowipe or gauze over or just above the puncture site. Do not apply pressure to the puncture site while the needle is still in the patient’s arm.
28. Remove the needle from the patient's arm. **Immediately activate the needle safety device with one hand according to manufacturer's directions** while applying pressure to the site. Do not remove your other hand from the puncture site until the safety device is activated!
29. **Immediately** discard the needle and holder in a sharps container carefully.
30. Ask patient to apply pressure to the puncture site.
31. Gently invert all additive tubes several times to mix the blood with the additive. Label the tubes collected IMMEDIATELY after drawing from the stopper down as follows:
   a. Patient's name (last name first, first name second)
   b. ID number (or date of birth)
   c. Today's date
   d. Time of collection (some labs require the use of military time)
   e. Your initials
32. Carefully show the correctly labeled tubes to the patient and ask them to verify their name and date of birth. Place all tubes in a test tube rack.
33. Inspect puncture site to verify that bleeding has stopped, apply bandage if needed. If bleeding has not stopped, continue to apply pressure. Recheck site at one minute intervals until bleeding has stopped.
34. Discard materials in appropriate waste receptacle (Sharps, biohazard, or regular trash).
35. Thank the patient. Allow patient to leave if they are an outpatient.
36. Disinfect work area.
37. Remove gloves, immediately wash or sanitize hands. (Observer records time.)
38. Partner completes evaluation and records total amount of time. The evaluator should give **constructive criticism** of the phlebotomist's technique. Let them know what you think they did well and tactfully suggest what and how you believe they could improve. Remember, the person practicing on the artificial arm will be your phlebotomist in a few moments. React as though the artificial arm were your own.
EXERCISE 2: VENIPUNCTURE
STUDY QUESTIONS – PART ONE

Name ___________________________ Date ___________________________ Points: ____/39

1. Label the 3 parts of the vacuum blood collection system. IMPORTANT: the line is pointing to the part which needs to be identified. (1.5 pts).

![Illustration of a syringe with parts labeled]

2. Define the following terms (0.5 point each – 3 pts total)
   A. needle gauge
   B. lumen
   C. bevel
   D. holder
   E. vacuum tube
   F. anticoagulant

3. State the ratio of blood to anticoagulant in the light blue stoppered tube. (0.5 point)
4. For each of the stopper colors listed below state the additive(s) in the tube, the type of blood specimen **AND one test** which is drawn into the tube. *Place a check mark in the “serum,” “plasma” or “whole blood” column as appropriate.* (Points as listed; 24 points total).

<table>
<thead>
<tr>
<th>Stopper Color</th>
<th>Additive(s) Present</th>
<th>Serum</th>
<th>Plasma</th>
<th>Whole Blood</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red – plastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red/black mottled or Gold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavender (Purple)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Royal blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Describe how a phlebotomist can help prevent anxiety in the patient who has never had their blood drawn before. (1 point).

6. Explain why blood collection tubes should never be pre-labeled (1 point).

7. Describe the action which should be taken whenever there is a discrepancy between the information on the patient's hospital armband and the information on the laboratory requisition slip (1 point).

8. Describe how an outpatient is properly identified prior to drawing a blood sample (1 point).

9. Define "tourniquet" and describe how the phlebotomist knows when it is inappropriately applied. (2 points).

10. List, IN THE CORRECT ORDER OF SELECTION (first, second, third choices), the 3 veins of choice for performing a routine venipuncture. (1.5 points).
    A.
    B.
    C.

11. State why the vein listed in “C” in the question above should be chosen only if A or B are not usable. (1 point)

12. List three sources of error which may be the cause of an unsuccessful real arm venipuncture attempt (1.5 points).
    A.
    B.
    C.
1. **DESCRIBE** each of the following needle positions & **CIRCLE** the figure which is CORRECT. (3 pts)

   A.   
   B.   
   C.   
   D.   
   E.   
   F.   

2. List the steps to be performed (in the correct order) when a patient appears about to faint (2 pts).
   A.  
   B.  
   C.  
   D.  

3. Define "hematoma" and how these are caused during venipuncture (1 pt).
   A.  
   B.  

4. State the maximum number of venipuncture which should be attempted **AND** why this policy is set (1 pt)?
   A.  
   B.  

5. State the reason why a phlebotomist must **never** place a tourniquet on an arm **above** an IV site (1 pt).

6. State how drawing blood **above** an IV site will impact results of laboratory testing performed on the sample (1 pt).
7. List the 4 steps which must be performed when a sample must be drawn above an IV site (2 pts).
   A. 
   B. 
   C. 
   D. 

8. List 3 alternate venipuncture sites in cases when it is impossible to locate a vein in the antecubital fossa area in both of the patient’s arms. (1.5 pts)
   A. 
   B. 
   C. 

9. Briefly describe the 5 steps to follow immediately after an accidental needle stick injury (2.5 pts).
   A. 
   B. 
   C. 
   D. 
   E. 

10. Describe the proper action to take when a patient refuses to have their blood drawn (1 pt).

11. List 4 reasons that a blood sample may be rejected by the laboratory (2 pts).
   A. 
   B. 
   C. 
   D. 

12. Define the following types of blood specimens and one stopper color used for each (3 pts)
    Serum:
    Stopper color:
    Plasma:
    Stopper color:
    Whole Blood:
    Stopper color:
13. List the color of stoppers in the correct order of the draw for blood collected in evacuated tubes in a multi-draw. NOTE: Use the simplified list. (3.5 pts)
   a.
   b.
   c.
   d.
   e.
   f.
   g.

14. State the reason the correct order of the draw must be followed. (1 pt)

15. Briefly summarize the steps for performing a routine venipuncture in your own words (6.5 pts).