EXERCISE 2: VENIPUNCTURE USING VACUUM COLLECTION SYSTEM

Skills 36 points

Objectives

1. List the three veins of the arm used for venipuncture, describe where they are positioned, order of selection and the reason for the selection order.
2. State three alternate sites for venipuncture.
3. Describe and demonstrate the steps in the selection of the venipuncture site, including 3 attributes which determine if a vein is adequate for venipuncture.
4. Apply appropriate safety and infection control techniques.
5. Briefly explain the venipuncture 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 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, and aspiration.
11. List the correct steps in chronological order to properly perform a venipuncture using the vacuum blood collection system.
12. State the correct order of the draw for venipuncture in terms of tube stopper colors and additives.
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 the minimum information which must be included on a properly labeled blood sample, and where and when it must be labeled.
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 be followed in the event of an accidental needle stick.
27. Define “hematoma” and state the cause.
28. State the amount of time the phlebotomist must observe the puncture site prior to bandaging.
29. Perform three venipunctures on an artificial arm and one live draw.

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 the vacuum collection system specifically designed for collecting venous blood. The goal of venipuncture is to obtain a blood sample from the correct patient into the correct tube with minimal trauma.
Vacuum Blood Collection System
The vacuum system consists of a double-pointed needle, a tube holder, and a series of vacuum tubes with rubber stoppers of various colors. OSHA’s Needle Stick Safety and Prevention Act requires blood collection equipment to have a safety device that can be activated with one hand to cover the needle immediately following use. The tube stopper color indicates the type of additive present. 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’s vein 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.

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), 21g (green top), and 22g (black 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 an individual sterile package and are always single use. Some needles have the safety device attached to the needle, others have the safety device attached to the holder (or hub).

Holder
The vacuum collection system holder (or hub) is a plastic sleeve into which the phlebotomist screws the double pointed blood collection needle. 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
An additive is any substance added to a tube by the manufacturer. Different additives serve different purposes. Additives 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 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 of blood.

An anticoagulant is the most common additive found in tubes. It keeps the blood from clotting by binding or inactivating one of the elements necessary for clotting to occur and produces a plasma specimen. The most common anticoagulants used include sodium citrate, heparin, EDTA, and potassium oxalate.

A clot activator is the additive found in most plastic tubes that produce serum. Clot activators help the clotting process start and go to completion.

A glycolytic inhibitor is an additive that prevents the use of glucose by blood cells, a process called glycolysis. The additive sodium fluoride found in gray stopper tubes is a glycolytic inhibitor.

The polymer gel additive found in some tubes creates a physical barrier between the liquid portion of the sample and the cellular elements during centrifugation. Both serum and plasma tubes are available with polymer gel.
The Clinical Laboratory Standards Institute (CLSI) provides national standards for clinical laboratories and has recommended a specific “Order of the Draw”. The order of the draw is based on the additive present in each tube and the test done on subsequent tubes, not just the color of the tube stopper.

Any blood collection where two or more tubes is collected from one venipuncture is called a Multi-draw. The Order of the Draw is CRITICAL in every multi-draw due to the potential for carryover of additive in one tube to the next tube which can adversely affect the results of laboratory testing.

The following table lists the stopper color, the additive in the vacuum tube, and some of the most common test for that tube. This table contains only the most commonly used tubes. The tubes are listed in the correct order of the draw except for the last three. For royal blue, yellow (ACD) or black, follow facility policy and manufacturer instructions.

MEMORIZE THIS TABLE  
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>Whole Blood for Blood Cultures</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Sodium Citrate</td>
<td>Plasma for Coagulation studies: PT, PTT and fibrinogen</td>
</tr>
<tr>
<td>Red</td>
<td>Clot activator</td>
<td>Serum for Chemistry and Serology tests</td>
</tr>
<tr>
<td>Gold SST Red/Black Speckled</td>
<td>Clot activator and a polymer gel for serum separation</td>
<td>Chemistries: Cholesterol, Glucose, BMP, CMP</td>
</tr>
<tr>
<td>Green</td>
<td>Sodium heparin OR Lithium heparin OR Ammonium heparin Heparin additive and polymer gel for plasma separation</td>
<td>Plasma for Chemistry tests Often used for STAT Chemistry tests</td>
</tr>
<tr>
<td>Green PST Green/Black Speckled</td>
<td>K₂ EDTA (ethylendiaminetetraacetic acid)</td>
<td>Whole Blood for Hematology studies: CBC, WBC count, H&amp;H, Platelet count, Reticulocyte count, ESR</td>
</tr>
<tr>
<td>Lavender (Purple)</td>
<td>K₃ EDTA</td>
<td>Plasma and Red blood cells for Blood Bank testing using gel system.</td>
</tr>
<tr>
<td>Pink</td>
<td></td>
<td></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. Examples: Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Magnesium, Manganese, Zinc</td>
</tr>
<tr>
<td>Black</td>
<td>Buffered Sodium Citrate</td>
<td>Whole Blood for Westergren Erythrocyte Sedimentation Rate (ESR)</td>
</tr>
<tr>
<td>Yellow</td>
<td>Acid Citrate Dextrose (ACD)</td>
<td>Whole Blood for Genetic and tissue test</td>
</tr>
</tbody>
</table>
The Order of the Draw was developed to avoid errors in patient results that could result from carryover. Examples of erroneous lab results from not following the order of the draw:

- The plastic red and gold stoppered tubes contain a clot activator; if these are drawn before the light blue coagulation tubes, erroneous coagulation results will be obtained.
- If a lavender or pink K-EDTA stopper tube is drawn before a red, gold or green tube for a patient’s potassium (K) level, the potassium level will be falsely elevated.
- EDTA binds calcium, so if the lavender EDTA tube is collected before the green heparin tube, the EDTA carryover will cause falsely decreased calcium levels.

The Order of the Draw does not eliminate carryover, it is designed so that test will not be affected by it.

Tubes containing additives must be gently inverted when removed from the blood collection needle, so the additive 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. If the additive is a clot activator and the tube is not adequately mixed, the sample may take longer to clot, which can delay testing.

Today, most blood vacuum collection tubes are made of plastic, but a few are still made of glass. Tubes are sealed with a partial vacuum inside by rubber stoppers. The air pressure inside the tube is less than the normal environment, which creates the vacuum in the tube. 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 volume of tubes varies from low volume tubes (2 ml or less) to normal volumes up to 10 ml. The volume of the tube is printed on the tube.

When drawing tubes for multiple tests, one tube of the appropriate color may be used to perform multiple tests. At other times, you will need to draw multiple tubes of the same color so that different departments or labs will each have their own sample. Always check with your facility to determine how many tubes to draw.

**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 these types of dissolved substances, as well as test for the cellular elements, and each lab test requires a specific type of specimen.

**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 a spun anticoagulated specimen. For tests that require plasma, the anticoagulated specimen is spun down, and only the plasma portion is used for testing. Plasma contains all the clotting factors except one; the one that is missing will depend upon the type of anticoagulant in the tube. Test that require plasma include Coagulation tests such as Fibrinogen, Prothrombin time (PT), and the Activated Partial Thromboplastin Time (PTT). An advantage of using plasma is that the specimen can be spun down right away, since the sample does not require time to clot. For this reason, many STAT Chemistry tests are performed on plasma from a green heparin tube, 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. Every patient must be identified with a minimum of 2 patient identifiers.

All hospitalized patients have an identification arm band with their name, hospital identification number and other pertinent information. *Always* compare the following 3 items, as they must match EXACTLY:

1. The name and date of birth the patient states
2. The name and date of birth on the laboratory test request slip and ID number listed there
3. The name and date of birth on the patient's hospital arm band and ID number listed there

If there is *any* discrepancy, *do not draw the patient's blood*. Report the discrepancy immediately to the nurse in charge of the unit. Follow facility policy to resolve the issue before collecting the sample.

For an out-patient, you must have a minimum of 2 patient identifiers. Verify the patient's identity by having the patient state their name and date of birth or address and give you additional identifying information such as the spelling of their name. All information stated by the patient must match the information stated on the lab requisition exactly. Follow the protocol used at the site as it may differ from one institution to another.

Before beginning a venipuncture, the phlebotomist must perform proper hand hygiene and follow any special infection control policies necessary for the patient. *Always* wear gloves when performing blood collection procedures. In addition to gloves, other Personal Protective Equipment (PPE) may be required by your facility (lab coat) or due to Transmission Based Precautions (mask, gown).

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 briefly 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 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 are most often drawn when they are reclining in bed. Out-patients should be seated in a phlebotomy chair which has a padded bar in front for support of the arm and body.

**Site Selection and Preparation** (refer to pages 13-17 of this lab)

The site preferred for venipuncture is the *antecubital fossa*, which is the portion of the arm in front of the elbow. This area of the arm usually has several large veins close to the surface of the skin. A *tourniquet* is used to aid in the selection of the precise puncture site, and is most commonly a thin, flexible strap. It is applied just above the elbow to constrict blood flow, making the veins more prominent. The tourniquet is tied in such a way that it can be removed with one hand. 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. 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 is inappropriately applied:
- If the skin appears blanched above and below the tourniquet - it is too tight.
- If your finger can be easily 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 several veins from which to choose from. For venipuncture use the large veins of the arm which are the median cubital, cephalic or basilic veins. The basilic vein veers toward the anterior surface of the arm 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 15 for the veins of the arm and memorize them.

After selecting a vein, remove the tourniquet while you clean the puncture site with 70% isopropyl alcohol usually available as prepackaged pad. In the past it was recommended that the site be cleaned by moving the alcohol pad in a circular motion moving outward from the site. NOTE: The current CLSI guidelines state that research has shown that a vigorous back and forth friction is superior to circular concentric cleansing. Use enough pressure to remove all perspiration and dirt from the puncture site. Discreetly look at the pad after cleansing; if it appears excessively dirty repeat the cleansing process with a fresh alcohol pad. Allow the site to air dry. This serves two purposes: 1) drying allows for optimal site decontamination and 2) the site will not burn when the needle is inserted. After cleansing, do not touch the site. If the vein must be re-palpated, the area must be cleansed again.

Re-apply the tourniquet, being careful not to let the ends of the tourniquet touch the cleansed site. 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. Adjust the safety device if necessary.

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 patients arm to steady it. Position the needle in the same direction as the vein at an angle with the skin surface of 30 degrees or less. 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 may leak out at the puncture site creating a biological hazard as well as obstructing your 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.

When performing a multi-draw, grip the holder FIRMLY and apply pressure to the patients arm with the back of the fingers holding the hub to prevent movement while changing tubes. Without a firm grip on the holder, the needle may accidentally be pulled from the vein when removing a tube or may go farther into the arm when inserting the next tube in the holder.

CLSI recommends releasing the tourniquet as soon as the blood begins to flow into the tube UNLESS doing so will cause the vein to collapse. If the tourniquet is released within the one-minute time frame, the tourniquet can stay in place until you have the last tube filling.

When all tubes of blood have been collected and the tourniquet has been released, remove the last tube from the holder, hold a gauze pad over the site and withdraw the needle in a smooth and cautious manner so as not to bruise the vein. Bring the needle straight back, do not scrape the patient’s skin with the tip of the needle. 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 gauze pad while IMMEDIATELY activating the needle safety device according to manufacturer’s direction. Discard the entire assembly into a biohazard sharps container. 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.

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

Always label tubes with the patient’s last name starting at the stopper end of the tube as shown below.

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 specific 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 used on another patient. This may result in wrong lab results ending up in a patient’s medical record which may affect diagnosis and treatment.

Never take the tubes to another location to label them; this breaks the chain of identity of the blood specimens with the patient. Label all tubes at the patient’s side immediately after collection.

Postvenipuncture Care and the two-step check

Immediately after the needle is withdrawn, a gauze pad must be placed over the venipuncture site and gentle, but firm pressure applied. This pressure must be maintained for at least 3-5 minutes (step 1) to prevent the formation of a hematoma. The patient may assist in maintaining the pressure, but the phlebotomist must supervise as they are ultimately responsible for the patient’s care.

After all tubes have been properly labeled, the phlebotomist must inspect the puncture site. CLSI recommends that the phlebotomist directly observes the puncture site for 5 to 10 seconds (step 2) before bandaging. The phlebotomist must look for both superficial bleeding and hematoma formation. If the site is still bleeding, the phlebotomist must apply pressure and recheck the site at one- minute intervals until bleeding stops.

Once bleeding has ceased, apply a bandage or gauze with self-adhering bandage around the arm. Instruct the patient to leave the bandage on for at least 15 minutes. Caution the patient about putting pressure on the site (from purse or tote straps, shopping bags, etc.) and to refrain from exerting the arm for several hours to avoid reopening the wound or causing a hematoma to form.

Thank the patient. For an out-patient facility, allow the patient to leave. If in a hospital setting, follow facility policy on the location of the bed siderails. Disinfect the work area as required by your facility. Remove your gloves and perform proper hand hygiene.
Problems Encountered During the Venipuncture

Fainting (Syncope): Feeling faint is a fairly common problem for patients when having blood drawn, particularly in out-patient 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 does actually faint:

- Immediately release tourniquet.
- Remove the needle from the patient's arm. Activate the safety device.
- 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.

NOTE: CLSI states that ammonia inhalants must not be used as they have been associated with adverse effects.

Redirecting Needle In the event that you have been unable to puncture the vein immediately, use your free index finger on your non-dominant hand 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 tube may have lost its vacuum. 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 arm 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 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 ACC policy allows a student to attempt only ONE venipuncture on any patient.

Hematoma is the collection of blood beneath the skin which results in the formation of a bruise. If the area surrounding the puncture site begins to swell or discolor 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. If swelling is observed at the phlebotomy site during the procedure, the tourniquet should be released, and the needle withdrawn immediately. Pressure should be applied to the site for a minimum of 3 minutes with the patient raising their arm above their head, if possible.
**Drawing in an Arm with an Intravenous (IV) Line** *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.

*The two blood samples shown above were both drawn from the same patient. The sample on the right was drawn above an IV. Note the low ratio of red cells to serum and the pale color of the serum. The correctly collected sample is shown on the left.*

*Never* place a tourniquet on an arm *above* the IV site, this may dislodge the IV needle placement, resulting in infiltration of tissues with the IV fluid.

According to CLSI, if blood must be drawn above an IV site, these steps *must* be followed:

1. Ask a responsible health care professional, usually a nurse, to turn off the IV. Ensure the IV flow has completely stopped.
2. Wait at least 2 minutes before applying the tourniquet.
3. Collect the samples. **NOTE:** Some facilities require discarding the first 5 ml of blood.
4. After collection, notify the appropriate health care professional that the IV may be restarted.
5. Document that the sample was drawn *above* an active IV site and the type of fluid being infused.

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.

**Alternate Sites When Veins Cannot Be Located in the Antecubital Fossa** In some instances it is almost impossible to locate a vein in the antecubital area of the arm. If veins in the antecubital area not available or acceptable, veins on the back of the hand or lower arm may be used for venipuncture. According to CLSI, **written permission from the physician is required prior to drawing blood from the lower extremities, such as the ankle or foot.** Follow facility policy on any draw out side of the antecubital area. The student should gain a reasonable amount of skill and confidence and should observe this type of procedure before attempting a venipuncture in these areas. **NEVER** use veins located on the underside of the wrist, as these are close to arteries and nerves.

**Mastectomy** During the patient interview if the patient states they have had a mastectomy you **CAN NOT** draw blood from the arm on the same side as the mastectomy. If the patient has had a double mastectomy, check with the patient’s physician. CLSI states that a **physician must provide written permission** before a venipuncture is performed on the arm on the side of a mastectomy.
Respectful Treatment Always treat the patient with respect, even when they are not respectful of you. Patients seeking medical care because of a severe illness or injury may not feel good. They may be extremely irritable and decide that you are a good target to vent their frustration. 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. If a patient has initially consented to be drawn but then changes their mind during the procedure, you must discontinue the procedure immediately.

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 has been lost.
3. **Not properly anchoring the vein before inserting the needle.** The vein must be held in place for successful needle penetration. Failure to anchor the vein may result in the vein rolling to the side of the needle.
4. **Not keeping the holder stationary OR not using counterpressure when changing tubes.** This will cause the needle to advance into the arm or dislodge from the vein during tube changes.
5. **Retouching the site just before inserting the needle.** CLSI states that if re-palpation is required you must clean the site again before puncture.
6. "**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.

Rejection of Samples

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

1. **Hemolysis** is the rupture of red blood cells causing the red hemoglobin to be released. During phlebotomy 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. Hemolysis affects the results of many lab test, samples with hemolysis must be recollected.
   In the picture below, the far-left sample is normal, the others have varying degrees of hemolysis.
2. Clotted - failure to mix or inadequate mixing of samples collected into a tube with anticoagulant. In this picture, the sample on the left was mixed correctly, the sample on the right is clotted.

3. Insufficient sample (Quantity Not Sufficient - QNS) Fill all tubes completely.
4. Wrong tube collected for test ordered.
5. Improper storage – After collection, tubes for certain tests must be chilled by placing in an ice slurry, protected from light, or be kept warm.
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 pad.
4. Follow with a thorough hand washing.
5. Report it to your instructor or supervisor immediately.
Components of the Vacuum Collection System, shown without a Needle Safety device

Tying the Tourniquet

Releasing the Tourniquet
Selecting the Vein – First Choice: median cubital – located in the center of the antecubital fossa
Second Choice: cephalic – located on the thumb side of the antecubital fossa
Third Choice: basilic – located on the little finger side of the antecubital fossa

Palpating the Vein – Use your index finger to note the direction, size and depth of the vein.
Cleansing the Site – Traditionally, the site was cleansed using an alcohol pad, starting at the intended puncture site in a circular motion moving outward in concentric circles. Current CLSI guidelines state that research has shown vigorous back and forth friction with an alcohol pad to be a superior cleansing method.

Performing the Venipuncture – Once the alcohol has dried, re-apply the tourniquet and briefly inspect the needle. Properly anchor the vein, swiftly and smoothly insert the needle, bevel up, in the same direction as the vein and at the correct angle. The bevel of the needle should be in the lumen of the vein.
Completing the Venipuncture:
A. Release the tourniquet
B. Remove the needle while holding gauze over the puncture site.
C. Apply pressure to the puncture site with the gauze while activating the needle safety device according to manufacturer’s directions.

BD Eclipse – Thumb activation
Portex Needle Pro – Hard surface activation
Procedure: Venipuncture

Introduction:

Quality test results depend heavily on proper patient identification and preparation. The student phlebotomist should "interview" their lab partner when practicing on 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.
For this lab, each student will perform three venipunctures on the artificial arm and one live draw.

Materials:

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

Instructions:

NEVER ATTEMPT A LIVE DRAW WITHOUT THE INSTRUCTOR BEING PRESENT.
Each live draw 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 all draws performed in this lab.

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: Use the Venipuncture Practice Skill Assessment Form to document each step.

1. **Introduce self as student and states mission.** Approach the patient, state your first name, identify yourself as an ACC student, and state that you have orders to draw lab work. Ask for verbal permission to proceed. (Lab partner records start time.)

2. **Properly identify the patient.** Ask the patient to state their name, spell it, and state their date of birth.

3. **Perform proper hand hygiene.** Wash or sanitize hands. While your hands are drying, you may verbally move to the next step. (Roll play hand hygiene during artificial arm practice.)

4. **Ask about blood drawing history and explain the procedure if necessary.** Depending on the patient’s age, ask if they have had the procedure done before, or if they had any problems, such as fainting.

5. **Put on gloves.** By the time you have the patient’s blood drawing history, your hands should be dry enough to easily put on your gloves.

6. **Apply the tourniquet properly.** About 3 to 4 finger widths above the elbow of the selected arm, wrap the tourniquet around the arm and tuck in one small section to secure. The ends of the tourniquet are above the tourniquet and are not in the area to be used for venipuncture.

7. **Ask patient to clench fist.** Make sure the patient does not “pump” their fist, as this can affect lab results. You may hand the patient a couple of plastic tubes to hold in their fist.

8. **Properly palpate and choose appropriate vein to be used for venipuncture.** Palpate for suitable veins using your index finger. Note the size, direction and depth of the veins. Select an appropriate vein based on selection criteria: 1) median cubital, 2) cephalic, 3) basilic.

9. **Release the tourniquet at the appropriate time and less than 1 minute of application.** If the tourniquet is on for more than 1 minute, you must release the tourniquet and wait at least 2 minutes before reapplying the tourniquet.

10. **Properly cleanse the site using appropriate technique.** Cleanse the chosen site with a 70% alcohol pad. Use a vigorous back and forth motion. Use a second alcohol pad as needed. Allow the site to air dry while assembling needle.

11. **Select equipment, tubes and needle assembly based on chosen vein.** Prepare appropriate needle by attaching the needle to the hub. Verify that correct tubes are at hand. Verify that all supplies (tubes, gauze, sharps container) are present, and can be easily reached.

12. **Applies tourniquet properly.** Reapply the tourniquet, making sure that the ends do not touch the prepared site.

13. **Ask patient to clench fist.** Patients are not to pump their fist.

14. **Uncap the needle and briefly inspects for defects.** Hold the hub with the dominate hand and uncap the needle with your other hand. Briefly inspect for manufacturer’s defects. If a problem is found, activate the safety device and discard the defective needle. Remove the tourniquet while you assemble a new needle. Repeat steps 12 – 14 as needed.

15. **Properly grasp holder between your thumb and finger of your drawing hand.** Place your thumb on top of the holder and 2 or 3 fingers below. The holder should be at a right angle to your index finger. Do not “cradle” the holder in your hand.

16. **Properly anchors vein using aseptic technique and without re-palpating intended puncture site.** Anchor the vein selected by placing your thumb below the intended puncture site and pulling the skin downward 1 to 2 inches to make it taunt. Pulling the skin taunt makes it less painful for the patient and keeps the vein from rolling. Stabilize the patient’s arm by gently grasping it with the rest of your fingers. Do not re-palpate the site.

17. **Inserts needle swiftly, bevel up, in the same direction of the vein and at the correct angle.** The needle should be lined up with the vein and inserted at an angle with the patient’s skin of 30 degrees of less. The needle should be inserted in one quick, smooth motion.
18. Stabilizes holder by applying gentle but firm pressure to patient arm with back of fingers while pushing evacuated tube onto needle in holder using counterpressure. Release the anchor of the vein and use that hand to push the evacuated tube onto the back of the needle by applying counter pressure to the tube and 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 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.

19. Fill evacuated tube(s) with the correct volume. Turn the tube so that the label is to the bottom. This makes it easier for you to see how full the tube is. Allow the tube to fill. You may have to adjust the angle of the tube slightly to get good blood flow.

20. Stabilizes tube holder during tube change to prevent movement of needle in the vein, using counterpressure to remove and replace tubes. Keep your eye on the needle during tube changes to make sure it does not move.

21. Fill evacuated tubes in the correct order. Always follow the CSLI order of the draw.

22. Tubes with additives are inverted; in multiple tube draws, tubes can be inverted as additional tubes are filled. Invert the first tube while waiting for the second tube to fill; repeat as needed.

23. Release tourniquet at the appropriate time. The tourniquet can be released once blood begins to enter the last tube or within one minute of application, whichever occurs first.

24. Removes last tube from holder. Invert the tube at least once.

25. Removes needle, then places gauze over puncture site. Hold 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. Remove needle by pulling straight out. Do not drag needle downward, as this can scratch the patient’s arm.

26. Immediately activate the needle safety device 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!

27. Discards needle in sharps container carefully and correctly. Never shove a needle and holder into an overfilled sharps container. The collection device should easily fall into the container.

28. Ask patient to apply pressure to the puncture site.

29. Inverts tubes several times. Pick up all tubes collected and invert slowly and completely to mix as needed.

30. IMMEDIATELY after drawing, labels tubes correctly. Label 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 and time of collection (Some labs require the use of military time)
   d. Your initials

After you have labeled the tubes, show the tubes to the patient and ask them to verify that the information is correct. Your instructor will also check your labeling.

31. Inspect puncture site to make sure bleeding has stopped, applies bandage as necessary. If bleeding has not stopped, continue to apply pressure. Recheck site at one-minute intervals until bleeding has stopped.

32. Thank patient; if outpatient, allow patient to leave.

33. Discard used materials in appropriate receptacle (sharps, biohazard, or regular trash). Any item with blood on it must go into biohazard trash.

34. Disinfect work area. Use the disinfectant spray and a paper towel to clean your area. Allow to dry.

35. Remove gloves, immediately performs proper hand hygiene. (Lab partner records End Time.)

36. Skill performed within allotted time. Partner records total amount of time and gives constructive criticism of the phlebotomist's technique. State 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: ____

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).

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. State four (4) types of additives found in blood collection tubes. (2 points)
   A)
   B)
   C)
   D)
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. (Points as listed; 21 points total).

*Place a check mark in the “serum,” “plasma” or “whole blood” column as appropriate.*

The top portion of this table is in the Order of the Draw as recommended by CLSI.

<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>Yellow or bottles</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>1.5 points</td>
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<td></td>
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<tr>
<td>Light Blue</td>
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<td></td>
<td>1.5 points</td>
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<tr>
<td>Red/Gold/Red-black speckled</td>
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<td></td>
<td>1.5 points</td>
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<td>Green</td>
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<td>3.5 points</td>
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<tr>
<td>Lavender (Purple)</td>
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<td></td>
<td>1.5 points</td>
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<td>Pink</td>
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<td>1.5 points</td>
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<tr>
<td>Gray</td>
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<tr>
<td></td>
<td>3.5 points</td>
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</table>

Follow facility policy for the Order of Draw for the Tubes listed below

<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>Black</td>
<td></td>
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<tr>
<td></td>
<td>1.5 points</td>
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<tr>
<td>Royal blue</td>
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<td></td>
<td>3.5 points</td>
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<tr>
<td>Yellow</td>
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<tr>
<td></td>
<td>1.5 points</td>
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</tr>
</tbody>
</table>
6. State the reason the correct order of the draw must be followed. (1 point)

7. Describe how a phlebotomist can help prevent anxiety in the patient who has never had their blood drawn before. (0.5 point)

8. State the minimum number of patient identifiers required for proper patient identification. (0.5 point)

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

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

11. List, IN THE CORRECT ORDER OF SELECTION the 3 antecubital veins used for routine venipuncture. (1.5 points).

    A.

    B.

    C.

12. Define "tourniquet" \textit{AND} describe how the phlebotomist knows when it is inappropriately applied. (1.5 points)
    A. Definition of tourniquet:

    B. Describe Inappropriate application:

        i. 

        ii. 

13. State when \textit{and} where blood tubes must be labeled. (1 point)

14. Explain why blood collection tubes should \textit{never} be labeled prior to collection. (0.5 points)
15. State the minimum information that must be listed on a blood specimen. (2.5 points)

16. What is the minimum amount of time that pressure must be applied to the venipuncture site immediately after blood collection to prevent hematoma formation? (0.5 points)

17. According to CLSI, how long must the phlebotomist directly observe the venipuncture site for superficial bleeding and hematoma formation before bandaging? (0.5 points)

18. Briefly summarize the steps for performing a routine venipuncture in your own words. (5 points).
1. **DESCRIBE** each of the following needle positions & **CIRCLE** the figure which is CORRECT. (3 points)

   ![Diagram A]
   ![Diagram B]
   ![Diagram C]
   ![Diagram D]
   ![Diagram E]
   ![Diagram F]

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

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

4. State the maximum number of venipunctures which should be attempted on any patient at one time **AND** why this policy is set. (1 point)
   
   A. 
   B. 

5. State why a phlebotomist must **never** place a tourniquet on an arm **above** an IV site. (1 point).
6. State how drawing blood above an IV site will impact results of laboratory testing performed on the sample. (1 point)

7. List the 5 steps which must be performed when a sample must be drawn above an IV site. (2.5 points)
   A. 
   B. 
   C. 
   D. 
   E. 

8. List 3 alternate venipuncture sites in cases when it is impossible to locate a suitable vein in the antecubital fossa area in either arm of the patient. (1.5 points)
   A. 
   B. 
   C. 

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

10. Describe the proper action to take when a patient refuses to have their blood drawn. (1 point)
11. List 4 reasons that a blood sample may be rejected by the laboratory. (2 points)

A.

B.

C.

D.

12. Define the following types of blood specimens and one stopper color used for each. (3 pts)

<table>
<thead>
<tr>
<th>Blood Specimen Type</th>
<th>Definition</th>
<th>A Tube Stopper Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasma</td>
<td></td>
<td></td>
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<tr>
<td>Whole Blood</td>
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</tbody>
</table>

13. List three (3) sources of error which may cause an unsuccessful live draw (not practice draw) venipuncture attempt. (1.5 points)

A.

B.

C.

14. Give 2 examples of erroneous lab results if the correct order of the draw is not followed. (2 points)

<table>
<thead>
<tr>
<th>If this tube… (list stopper color)</th>
<th>is drawn before this tube… (list stopper color)</th>
<th>this test result will be inaccurate….</th>
<th>because of this additive.</th>
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</table>