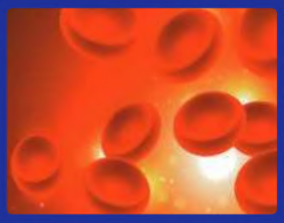
CHAPTER 6


Phlebotomy Technique

OBJECTIVES

After studying this chapter, you should be able to:

1. Explain the three skills used in collecting blood and how a phlebotomist needs to use each of these skills.
2. Explain the importance of correct patient identification, complete sample labeling, and proper accessioning. Discuss what happens when these rules are not followed.
3. List the components necessary for proper sample labeling. Discuss what can happen if a sample is not labeled properly.
4. List four common venipuncture sites and the advantages and disadvantages of each site.
5. List four techniques that can make veins easier to see.
6. Describe the step-by-step procedure for drawing blood with a syringe, an evacuated tube, and a butterfly system.
7. Understand the effect hemolysis will have on a blood sample and how the phlebotomist can prevent hemolysis from occurring.
8. Explain hemoconcentration, how it affects the blood sample, and how to prevent it.
9. Explain four precautions in blood collection and why the phlebotomist needs to be concerned.
10. Locate veins in the feet and ankles, and explain why they are not recommended for routine use.
11. Explain how to handle different patient reactions to venipuncture.
12. Name and explain the common causes of phlebotomy complications that result in a failed venipuncture.
13. Discuss the three blood collection alternatives when a patient has an IV running in one arm.
14. Describe the proper technique for drawing from an indwelling line.
15. Describe the equipment used and preparation of equipment for arterial puncture.
16. Describe the Allen test.

17. Locate the four arterial sites and explain the order of preference for arterial puncture.

18. Explain the proper procedure for handling arterial blood.

NAACLS Competencies Relevant to Chapter 6

Demonstrate understanding of the importance of sample collection and sample integrity in the delivery of patient care.

- Describe the legal and ethical importance of proper patient/sample identification.
- Describe the types of patient samples that are analyzed in the clinical laboratory.
- Define the phlebotomist's role in collecting and/or transporting these samples to the laboratory.
- List the general criteria for suitability of a sample for analysis and reasons for sample rejection or recollection.

Follow standard operating procedures to collect samples.

- Identify potential sites for venipuncture, capillary, and arterial punctures.
- Describe and demonstrate the steps in the preparation of a puncture site.
- List the effects of tourniquet, hand squeezing, and heating pads on capillary puncture and venipuncture.
- Recognize proper needle insertion and withdrawal techniques, including direction, angle, depth, and aspiration, for arterial puncture and venipuncture.
- Identify alternate collection sites for arterial puncture, capillary puncture, and venipuncture. Describe the limitations and precautions of each.
- Name and explain common causes of phlebotomy complications. Describe signs and symptoms of physical problems that may occur during blood collection.
- List the steps necessary to perform an arterial puncture, venipuncture, and capillary puncture in chronological order.
- Follow standard operating procedures to perform a competent and effective venipuncture on a patient.

Demonstrate understanding of requisitioning, sample transport, and sample processing.

- Describe the standard operating procedure for a physician requesting a laboratory analysis for a patient. Discuss laboratory responsibility in responding to physician requests.
- Instruct patients in the proper collection and preservation for various samples, including blood, sputum, and stool.
- Explain methods for transporting and processing samples for routine and special testing.
- Demonstrate ability to use computer information systems necessary to accomplish job functions.

KEY TERMS

Aliquot	Part of the whole sample that has been taken off for use or storage.
Arteriospasm	Reflex condition of the artery in response to pain or anxiety.
Cannula	Device used for access for dialyzing and for blood drawing in patients with a kidney disorder.
Edema	Abnormal accumulation of fluid in the tissues, resulting in swelling.
Fistula	Artificial shunt connection done by surgical procedure to fuse the vein and artery together. Used for dialysis only.
Hematoma	Leakage of blood out of the vein during or after venipuncture that causes a bruise.

Chapter 6 covers information about phlebotomy techniques. Techniques covered are venipuncture with syringe, venipuncture with an evacuated system, and arterial punctures. Appropriate steps to perform the procedures are discussed, and illustrations show the proper positioning of the needle. Interferences, common mistakes, and reasons for failure are discussed in this chapter.

STEPS IN BLOOD COLLECTION TECHNIQUE

Venipuncture is a detailed procedure requiring careful attention to each of the following steps:

1. Prepare accessioning order for the patient.
2. Grezet and identify the patient.
3. Verify diet/drug restrictions and allergies.
4. Wash hands, assemble supplies, and inspect equipment.
5. Reassure the patient.
6. Position the patient.
7. Verify paperwork and tubes.
8. Apply the tourniquet.
9. Cleanse the venipuncture site.
10. Put on gloves.
11. Perform the venipuncture.
12. Fill the tubes in the correct order of draw or fill the syringe.
13. Remove the tourniquet.
14. Dispose of sharps in the proper container.
15. If a syringe was used, fill the tubes using a transfer device in the correct order of draw.
16. Label the tubes.
17. Chill the sample or protect it from light (only for certain tests).
18. Remove gloves.
19. Check on the status of the patient for reactions to phlebotomy.
20. Eliminate diet restrictions.
21. Time-stamp or computer-verify paperwork.
22. Send the correctly labeled tubes to the proper laboratory departments.

Little attention is often given to these basic steps that are necessary for collecting a blood sample. Our state-of-the-art sophisticated laboratory technology is often riddled with errors because of misidentification and poor sample collection techniques. All the steps must be followed without deviation.

SKILLS USED IN APPROACHING THE PATIENT

The practice of collecting a blood sample does not rely on only the ability to pull blood from a patient. Three basic skills are used on a daily basis, helping the phlebotomist with each patient encounter.

Social Skills

Social skills are important. Always be polite and friendly with patients even if they are rude or inconsiderate. Patients are often angry about their condition or fearful of the procedure and take it out on the first person they see. For example, the phlebotomist could just be waking the patient up or could be entering the room right after the physician gave the patient bad news. Whatever a patient says, it is inappropriate to counter with unprofessional remarks. The easiest way to defuse an upset patient is to be as polite as possible and explain that the doctor's orders need to be carried out. This social skill is outlined in the discussion of professionalism in Chapter 1. Professionalism and customer service are discussed in more detail in Chapter 11.

As the laboratory representative, the reputation of the entire laboratory rests with the phlebotomist. The patient's response to how well the laboratory performed while the patient was in the hospital is not influenced by the sophisticated instrumentation used to test the specimens. The response to friends and neighbors could be, "The blood drawers were the best I have ever seen. They were polite, skilled, and very gentle." The finest social skill guarantees this response from each patient.

Helpful Hint

Always introduce yourself to the patient with your first name and then say you are going to collect a blood sample. That tells the patient who you are and what you intend to do.

Administrative /Clerical Skills

Administrative/clerical skills are used constantly and contribute to the most errors in the health care setting. Most administrative errors are the result of clerical errors in result reporting or patient and sample identification. For the phlebotomist, the administrative skill is as simple as drawing the correct patient's blood and labeling it with the correct name. Sounds simple, but numerous errors occur in this one area. This type of error can have devastating effects. The wrong patient could be drawn for a transfusion of blood. The blood would be labeled with the name of the patient you were supposed to draw, but the blood in the tube would not be from that patient. The preparation of the blood for transfusion (cross-match) would not be done on the correct blood. The patient could then receive units of blood that were not compatible. The side effects of such an error could be kidney failure or death.

Here is another example of an administrative error. The right patient was drawn for a blood glucose and the correct result was reported to the nursing unit. But the nurse misread the result and gave the wrong dosage of insulin. Administrative errors can occur at any step during the care of a patient. The phlebotomist does not want to be the cause of an error. The phlebotomist's errors are usually restricted to patient misidentification or mislabeling of a blood sample. A survey of U.S. laboratories found that the median labeling error rate is 1.31 per 1,000 labels. Errors in patient name, age, sex, and identification numbers are undetected despite many checking procedures. How to avoid these errors and develop an error-free patient and sample identification is discussed in the next section, Patient Identification.

SKILLS USED IN PHLEBOTOMY

- Social (interpersonal)
- Administrative/clerical
- Technical

Technical Skill

Technical skill means obtaining blood successfully with minimal pain. This consists of whatever method is used to complete the procedure: venipuncture, arterial sample, or microcollections through capillary puncture.

Social, administrative, and technical skills are used in each patient contact and are intertwined in each step of taking a blood sample. The approach to the patient often determines the success of the venipuncture. The muscles of a tense patient tighten over the blood veins, making them more difficult to access. A relaxed patient is more cooperative and easier to draw.

GREETING THE PATIENT

Before any attempt is made to collect a sample from the patient, you must gain the patient's trust. This is done through properly greeting the patient. Over the course of a day many people are in and out of the patient's room. A proper greeting will decrease the patient's anxiety and improve patient compliance. Always greet the patient in a positive manner. Establish eye contact with the patient. You will then introduce yourself to the patient, giving your name and your immediate role in his or her care. This is a way to create a personal connection with the patient. Explain how long this will take and explain what you are going to do. Listen closely to the patient with your eyes and ears. This way you can determine if the patient understands what you are going to do. During this process you should always be attentive to the patient's tone of voice and body language. The more relaxed you can make the patient, the easier the job of phlebotomy.

A common greeting may follow this script.

"Hi Ms. Robertson, may I come in? My name is Molly and I am here to draw some blood. It will take me about 10 minutes… is now a good time? Great! Let me look at your identification bracelet first and I will explain every step that I am going to take. Have you ever had your blood drawn before? You have… well, you are probably a pro at this. I have been drawing blood for five years so I think we will get along well."

After your positive greeting, you will start by verifying you have the correct patient. Do not trust that the patient is Ms. Robertson when she allowed you to come in when you said, "Hi, Ms. Robertson." Only verifying that the identification bracelet confirms the patient's full name is acceptable identification.

PATIENT IDENTIFICATION

It cannot be repeated often enough that proper patient identification is essential to accurate patient testing. It does not matter how expensive or sophisticated the equipment the sample is tested on; the results will be wrong if the sample is not identified accurately (Table 6.1). Hospital patients have a hospital identification bracelet that includes their first and last names, hospital numbers (often two sets of numbers), birth date, and physician. Proper greeting of the patient is essential in correct identification of the patient and putting the patient at ease. The patient will often have been asleep or not paying attention and will answer yes even if it is Mrs. Smith in the bed. Ask the conscious patient to state his or her full name and spell the last name. This helps patients realize that someone is in the room and it gets them thinking so they will be awake when their blood is collected. The phlebotomist still needs to check the identification bracelet with the orders or labels to verify that the correct patient is being drawn even after the patient has stated his or her name. In addition to checking the patient's name, check the patient's identification numbers. If the patient does not have an identification bracelet, do not draw the blood. Request the nurse to attach an identification bracelet to the patient before you do the collection. If this is impossible, the nurse needs to identify the patient and sign the requisition or tube label indicating that he or she positively identified the patient.

TABLE 6.1 Identification of Different Types of Patients According to Clinical Laboratory Standards Institute (CLSI) Standards

Type of Patient	Steps of Identification
Conscious patient	1. Ask outpatients to give their full name, spell their last name, or give their address, identification number, and/or birth date. 2. Compare this information with the information on the request form. 3. Ask inpatients for their full name, the spelling of their last name, and their birth date and compare this information to the patient's identification bracelet. The identification bracelet must be attached to the patient. 4. Report any discrepancy to the responsible person in the area. Correct the discrepancy before collecting the sample.
Semiconscious, comatose, or sleeping patient	1. Awaken a sleeping patient before attempting venipuncture. 2. Ask a caregiver or relative to identify the patient if the patient is semiconscious or comatose. Ask for the full name, a spelling of the last name, the identification number, and/or birth date. 3. Compare this information on the patient to the identification bracelet and to the request form. 4. Report any discrepancy to the responsible person in the area. Correct the discrepancy before collecting the sample. 5. Be prepared for the patient to move as a result of the venipuncture.
Patient who is unconscious, too young, mentally incompetent, or does not speak language of phlebotomist	1. Ask a caregiver or relative to identify the patient if the patient is semiconscious or comatose. Ask for the full name, a spelling of the last name, the identification number, and/or birth date. 2. Compare this information on the patient to the identification bracelet and to the request form. 3. Report any discrepancy to the responsible person in the area. Correct the discrepancy before collecting the sample.
Unidentified emergency patient	1. The patient must be positively identified when the blood sample is collected. 2. Upon admission, a temporary master identification number will be assigned to the patient according to institutional policy. This is assigned before the phlebotomist arrives to draw the patient. 3. Use this master identification number on all request forms. 4. Label samples by hand using the master identification number. 5. When a permanent number is assigned, cross-reference the temporary number with the permanent number.

Helpful Hint

An identification bracelet attached to the bed rail or on the bedside table is not proper identification. The bracelet must be attached to the patient.

There are times when a patient whose identity is unknown comes into an emergency department. The patient is not identified as "Jane or John Doe"; instead he or she is given a temporary identification number and an identification bracelet with that number. The patient will often be given a name such as "unidentified male" or "unidentified female." All samples taken from that patient and all patient identification refer to the number on the identification bracelet. Once the patient is identified a permanent identification number is assigned and the temporary number is cross-referenced to the permanent number.

Traditionally the phlebotomist would print bar code labels in the laboratory and take them to the nursing units. The phlebotomist would take the label to the patient's room, identify the patient, and match it to the patient's armband information. The sample would then be collected and labeled with the bar code label. Systems have now been developed whereby the phlebotomist has a handheld device. Orders are wirelessly transmitted to the handheld device and the phlebotomist can determine the next patient who needs blood drawn. Late orders are not be missed because orders added since the time the phlebotomist left the laboratory show on the handheld device. When the phlebotomist enters the room, the armband is scanned with the handheld device and labels are printed for tubes needing collection on that patient. Verbal identification of the patient is also completed before blood is collected. Once the blood is collected, the samples are sent to the laboratory by the pneumatic tube system. The phlebotomist does not have to return to the laboratory to receive orders for more patients. The handheld device is checked and any new orders will be displayed on it.

TEST REQUEST FORM

A test request form is sometimes used instead of labels only. A test request form lists the information needed for the phlebotomist to complete the task and collect the correct samples. The following information should be included on the form:

- The patient's complete name and age or date of birth
- A patient identification number
- The date and time the sample is to be obtained
- The type of test to be collected
- An accessioning number
- The physician's name
- The department or location where the work is to be done (printed on computer requests)
- Other information that is necessary to accurately collect the sample, such as a specific time of collection, whether the patient should be fasting, and so on
- ICD10 diagnosis codes for outpatients

The identification numbers on the patient's identification bracelet are compared to the name and numbers on the request form used in the health care institution. These order forms can be a manual requisition that is usually a multipart carbon form (Figure 6.1) that lists many of the tests available. The tests needed are checked on the form. An alternate form is a manual requisition that is imprinted from an imprinting plate that prints the patient's name, identification numbers, physician, and room number (Figure 6.2). The tests are either typed on the form or written by hand.

These manual requisitions can be used in an outpatient setting or with a hospital inpatient. The manual requisition patient information and tests requested are handwritten on the requisition by the physician or nurse. The requisition is then given to the phlebotomist for the hospital patient or given to the patient if he or she is an outpatient. This patient then takes the requisition to an outpatient laboratory service center. Billing information is obtained from the patient, and the requisition, along with the sample, is sent to the testing laboratory for entry into the computer system. Legibility errors of a prescription pad and handwritten orders can be eliminated through the use of computerized test requisitions or requisitions with tests checkmarked by the physician as shown in Figure 6.1.

MID AMERICA CLINICAL LABORATORIES

STAT ☐

BILL TO: ☐ DOCTOR'S OFFICE ☐ INSURANCE ☐ PATIENT

IF YOUR PATIENT IS GOING TO A MACL DRAW SITE, PLEASE FILL OUT THE GRAY-SHADED BOXES AND INDICATE THE TESTS DESIRED.

PATIENT NAME (LAST) PATIENT INFORMATION - PLEASE PRINT

(FIRST)

BIRTH DATE (MM/DD/YYYY) SEX PATIENT SOCIAL SECURITY #

OFFICE/PATIENT ID# PATIENT PHONE # ( )

PRINT NAME OF INSURED/RESPONSIBLE PARTY (LAST, FIRST, MIDDLE) - IF OTHER THAN PATIENT

PATIENT ADDRESS (OR INSURED/RESPONSIBLE PARTY) APT. #

CITY STATE ZIP

REFERRED BY

DATE COLLECTED TIME AM PM TOTAL VOL/HRS. ____ ML ____ HR ☐ Fasting

REQUIRED - COPY OF BOTH FRONT AND BACK OF INSURANCE CARD. IF NOT AVAILABLE COMPLETE BELOW SECTION

RELATIONSHIP TO INSURED: ☐ SELF ☐ SPOUSE ☐ DEPENDENT

U.P.I.N. REFERRING PHYSICIAN AND FULL NAME

INSURED / PRIMARY INSURANCE

INSURANCE CO. NAME

MEMBER / INSURED ID# GROUP REQUIRED

INSURANCE ADDRESS

CITY STATE ZIP

INSURED EMPLOYER NAME REQUIRED

INSURED SOCIAL SECURITY # (if not patient) INSURED BIRTH DATE (MM/DD/YYYY)

ICD9 DIAGNOSIS CODE(S) FOR TESTS ORDERED (MUST BE PROVIDED

☐ Call Results to: ( ) ☐ Fax Results to: ( )

Send Duplicate Report to:

MACL Client # OR NAME: _____

ADDRESS: _____

CITY: _____ STATE: ____ ZIP: _____

Medicare Limited Coverage Tests

@ = May not be covered for the reported diagnosis.
F = Has prescribed frequency rules for coverage.
& = A test or service performed with research/experimental kit.
B = Has both diagnosis and frequency-related coverage limitations

PANELS

34392 ☐	ELECTROLYTE PANEL: (Na, K, Cl, CO2)	S
10165 ☐	BASIC METABOLIC PANEL: (Na, K, Cl, CO2, Glu, BUN, Creat, Ca)	S
10256 ☐	HEPATIC FUNCTION PANEL: (Alb, DBil,TBil, AlkP, AST, ALT, TP)	1-S
10306 ☐ @	ACUTE HEPATITIS PANEL: (Hep. B Core AB IgM, Hep. B Surface AG*, Hep. C AB*, Hep. A AB IgM)	S
20210 ☐	OBSTETRIC PANEL: (CBC with Dif, Hep. B Surface AG, RPR*, Rubella IgG, ABO & Rh, Antibody Screen*)	P,R,L,S
7573 ☐ @	IRON STUDIES: (Iron, TIBC, UIBC, %Sat.)	S
7600 ☐ B	LIPID PANEL: (TChol, Trig, HDL, calc LDL)	S
10231 ☐	COMP METABOLIC PANEL: (Na, K, Cl, CO2, Glu, BUN, Creat, Ca, TP, Alb, TBil, AlkP, AST, ALT)	S
10314 ☐	RENAL PANEL: (Alb, Ca, CO2, Cl, Creat, Glu, Phos, K, Na, BUN)	S

INDIVIDUAL TESTS

7788 ☐	ABO GROUP & RH TYPE	P
223 ☐	ALBUMIN	S
234 ☐	ALKALINE PHOSPHATASE	S
823 ☐	ALT (SGPT)	S
243 ☐	AMYLASE	S
795 ☐	ANTIBODY SCN* REFLEX	P
249 ☐	ANTINUCLEAR AB (ANA)*	S
265 ☐	ASO, QUANT	S
822 ☐	AST, (SGOT)	S
285 ☐	BILIRUBIN, DIRECT	1-S
287 ☐	BILIBUBIN, TOTAL	1-S
4420 ☐	C-REACTIVE PROTEIN	S
29256 ☐ @	CA125	S
303 ☐	CALCIUM	S
310 ☐	CARBON DIOXIDE (CO2)	S
1759 ☐ @	CBC w/Plt & Indices	L
6399 ☐ @	CBC w/Plt, Indices and Diff	L
978 ☐ B	CEA	S
330 ☐	CHLORIDE (CL)	S
334 ☐ B	CHOLESTEROL, TOTAL	S
374 ☐ @	CK, TOTAL	S
375 ☐	CREATININE	S
418 ☐ @	DIGOXIN	R
457 ☐ @	FERRITIN	S
466 ☐	FOLIC ACID	S
470 ☐	FSH	S
483 ☐ B	GLUCOSE, FASTING	S
484 ☐ B	GLUCOSE, GESTATION SCREEN	S
8477 ☐	H PYLORI IgG AB QL	S
29407 ☐ @	HCG, QUAL SERUM	S
8435 ☐	HCG, QUANT SERUM	S
8396 ☐ B	HDL	S
608 ☐ B	HEMATOCRIT	L
509 ☐ @	HEMOGLOBIN	L
510 ☐ @	HEMOGLOBIN AND HEMATOCRIT	L
7998 ☐ @	HEMOGLOBIN A1C	L
496 ☐ B	HEP A AB IgM	S
512 ☐	HEP B Core AB IgM	S
4848 ☐	HEP B SURFACE AG* REFLEX	S
498 ☐	HEP C AB* REFLEX	S
8472 ☐	HIV SCREEN * REFLEX	S
6449 ☐ B	CONSENT ON FILE	
☐	IRON	S
@ 571 ☐	LDH	S
593 ☐	LEAD (BLOOD)	1
599 ☐	LH	S
615 ☐	MAGNESIUM	S
@ 622 ☐	MONO SCREEN	S
654 ☐	PHOSPHORUS	S
718 ☐	PLATELET COUNT	L
723 ☐ @	POTASSIUM (K)	S
733 ☐	PROTEIN, TOTAL	S
754 ☐	PSA DIAGNOSTIC	S
5363 ☐ B	PSA MEDICARE SCREEN	S
F 10157 ☐	PT WITH INR	1-B
8847 ☐ B	PTT, ACTIVATED	1-B
763 ☐ @	RHEUMATOID FACTOR	S
4418 ☐	RPR* REFLEX	S
36126 ☐	RUBELLA IgG	S
802 ☐	RUBELLA, IgG PRE-MARITAL	S
5780 ☐	SODIUM (Na)	S
836 ☐	SED RATE	L
809 ☐	T-4, (THYROXINE)	S
867 ☐ B	T-4, FREE	S
866 ☐ B	TESTOSTERONE	S
873 ☐	TRIGLYCERIDES	S
896 ☐ B	TSH	S
899 ☐ B	UREA NITROGEN (BUN)	S
294 ☐	URIC ACID	S
905 ☐	URINALYSIS, *REFLEX	X
7909 ☐	URINALYSIS, COMPLETE	X
5463 ☐	URINALYSIS, Dipstick Only	X
6448 ☐	URINALYSIS, Microscopic	X
8563 ☐	VITAMIN B12	S
927 ☐	WBC	S
937 ☐ @		

MICROBIOLOGY

ADDITIONAL CHARGE FOR ID AND SUSCEPTIBILITIES

SOURCE:

389 ☐	Culture, Blood	
4550 ☐	Culture, Aerobic	
4469 ☐	Culture, Anaerobic Reflex	
4446 ☐	Culture, Aerobic/Anaerobic (includes gram stain	
4558 ☐	Culture, Genital (Bacterial)	
4485 ☐	Culture, Gp. A Strep (Throat)	
5617 ☐	Culture, Gp. B Strep (Vag/Rect)	
59250 ☐	Culture, Fungus	
2692 ☐	Culture, Herpes Rapid	
395 ☐ @	Culture, Routine Urine	
6649 ☐	Culture, Stool	
8756 ☐	C difficile Toxin A Screen	
8502 ☐	DNA Probe, Chlamydia	
8501 ☐	DNA Probe, GC	
6919 ☐	Chlamydia & GC DNA probe	
497 ☐	Gram Stain	
681 ☐	Parasite Exam (O&P)	

(*) indicates additional reflex testing will be performed if indicated

COLLECTION COMMENTS

R = Red Top Tube
L = Lavender Top
B = Lt. Blue Top
P = Pink Tube
S = Serum Separator Tube
1 = Consult Service Manual
CY = Ur. Preservative Tube

STANDING ORDERS

Begin Date: _____ End Date: _____
FREQUENCY: _____
☐ ORIGINATING ORDER ☐ RECURRENT ORDER

CODE	ADDITIONAL TESTS	CODE	ADDITIONAL TESTS	TOTAL TESTS ORDERED

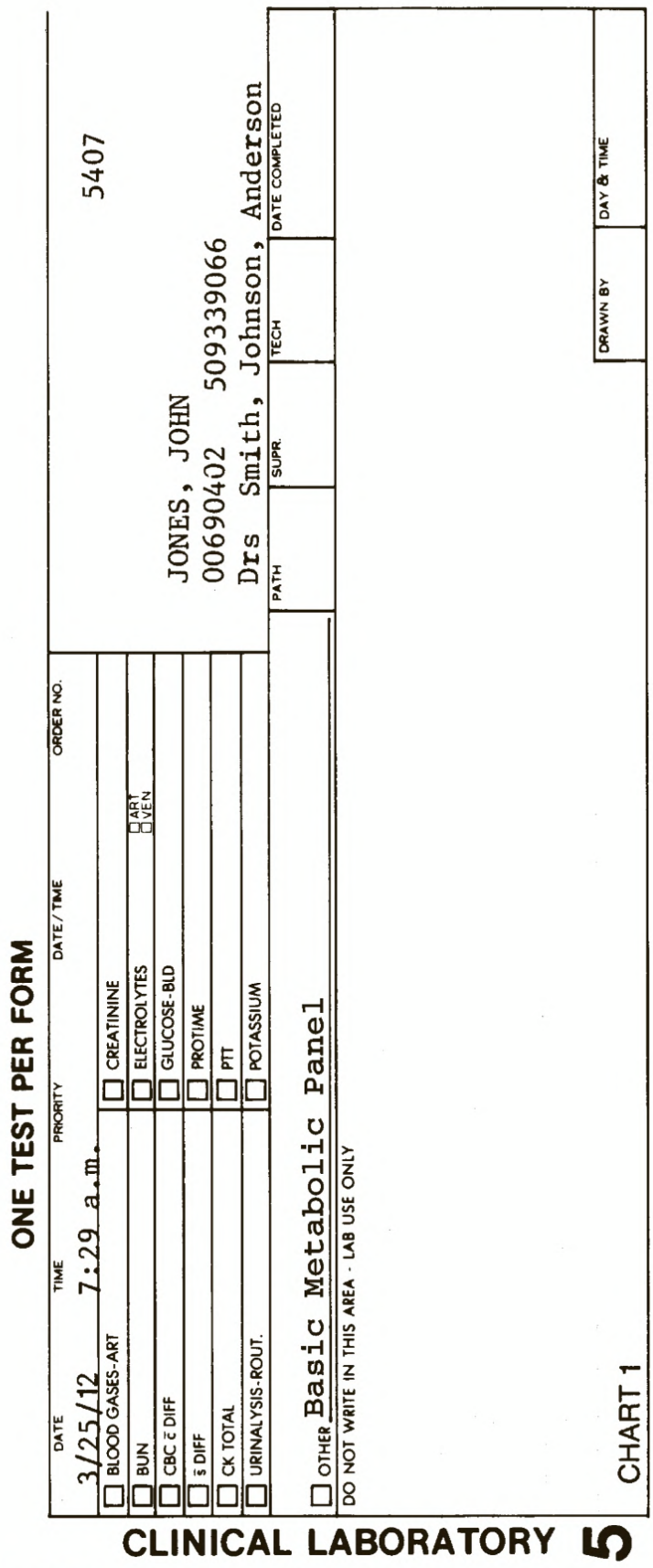
COMMENTS, CLINICAL INFORMATION:

Physician Signature

For any patient of any payor (including Medicare and Medicaid) that has a medical necessity requirement, you should only order those tests which are medically necessary for the diagnosis and treatment of the patient.

▲ **FIGURE 6.1** Manual requisition.

Source: Courtesy Mid America Clinical Laboratories



▲ FIGURE 6.2 Manual requisition.

SAMPLE LABELING AND IDENTIFICATION

Identification of the sample is as important as identification of the patient. If the blood was collected from the correct patient but the sample was misidentified, the patient could receive erroneous results. All samples should be labeled after the blood is drawn and before the phlebotomist leaves the patient. When hand labeling an inpatient sample, use the patient's armband to get the correct information. Use the requisition information for an outpatient after verifying with the patient that the information is correct.

When computer labels are not available, such as when a manual requisition is used, the tubes or containers must be hand labeled. Following is the minimum information needed:

- The patient's first and last names
- An identification number such as date of birth
- The collection date
- The time the sample was collected
- The initials or name of the person collecting the sample

When using a computer label, most of this information is on the printed label. The phlebotomist will need to add the following:

- The collection date
- The time the sample was collected
- The initials or name of the person collecting the sample

Computer systems are replacing many of the manual requisitions. Hospitals have used computer systems consistently and go to manual only when the computer system is down. Outpatient laboratory service centers also use computers to hold patient information for patients who return to the center and to print labels. This helps the laboratory and the patient by having addresses and billing information readily available. Some of the laboratory computer systems are linked to the physician's office so that the physician can order tests in the office and then have the patient go to the outpatient center to provide the sample. When the patient arrives, the laboratory is able to bring up the orders, collect the sample, and send the sample to the testing laboratory. When the testing is completed, the computer automatically sends the results to the physician's computer, fax, or a printer in the physician's office. The physician determines how results are to be received.

The computer label has several additional advantages. It lists the specific test that was ordered and the specific sample requirements. The bar code on the label contains information that can be used when running the test on the laboratory instruments. The bar code will tell the instrument what test to run, what patient the test is on, and other information that might be pertinent. The results of the test automatically enter into the patient's record without anyone entering results by hand onto a chart or into a computer. This is a computer interface of the instrument and the recordkeeping computer. The purposes of the interface and use of bar codes are to speed computer entry of results and eliminate clerical errors.

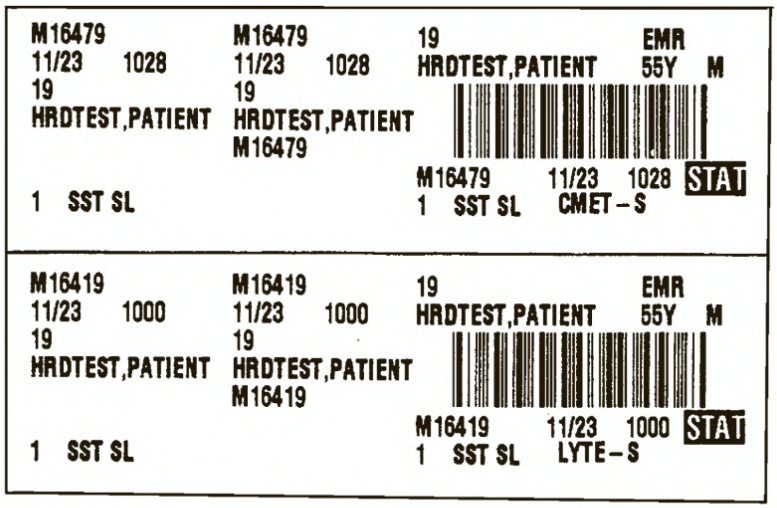
Helpful Hint

When labeling a tube, position the label so the bands on the bar code are horizontal when the tube is upright in a rack. This will allow the testing instruments to read the bar code.

A relatively new addition to sample identification is to incorporate into the bar code label a radio frequency identification chip. This chip emits a radio frequency so the sample can be tracked at each step in the process. Therefore, there is no line of sight required to read the label. This will help to identify where samples are located if they are needed for emergency testing or to locate stored samples when additional testing is needed. The samples can be located by scanning entire racks of samples rather than searching through individual tubes. The labels still need to have the printed patient identification information so they can be manually read without a scanning device.

Labels used for sample identification are usually adhesive so they can be attached directly to the tube. Smaller labels can also be printed at the same time for smaller **aliquot** samples. The computer has multiple other advantages in timing the printing of orders, sorting lists of orders for one patient at one time, and speeding entry of draw times and

test results. Most hospitals use some type of computer system for test ordering and result reporting. The computer labels print off in a roll where one label follows the other. Having two labels attached, as in Figure 6.3, requires special attention. One label must be carefully compared to the other to ensure that each label is for the same person, date, and time. Identifying patients by the computer labels and ensuring that each label used is for that patient requires using Procedure 6-1.



▲ FIGURE 6.3 Computer labels.

PROCEDURE 6-1

PATIENT IDENTIFICATION

Principle:

To verify patient identification prior to sample collection.

Procedure:

1. Patient requisitions: All requests for laboratory testing must have a requisition or computer labels. The requisition must include the patient's first and last names, tests requested, diagnosis, and name of the ordering physician.
2. When collecting a sample from a patient, the patient shall be identified by at least two verifiers (name, identification number, or birthdate) to ensure correct patient identification.
   A. Ask the patient to state his or her full name.
   B. Before drawing the sample, ask the patient to spell his or her last name and state the date of birth; use the requisition as verification. Patients whose blood is to be drawn for any blood bank procedure must be identified by an additional means besides the above procedure if they are outpatients. The preferred sources for outpatients are the following:
      a. A driver's license with a current address
      b. If the address is not current, then a driver's license and a personal check with the current address
      c. Another form of identification with a current address

continues

continued

PROCEDURE 6-1 PATIENT IDENTIFICATION

C. If the patient is unable to verbally provide the information, a parent/guardian, nurse, or current picture identification may be used.

D. Verify computer-generated labels with the requisition for the correct name before collecting the sample.

3. After ensuring that you have the correct patient, perform the venipuncture.
4. Follow procedures to ensure proper labeling.

A. Label the tubes when you obtain the sample. The following must be included on the label:

a. Patient's name (no nicknames)
b. Medical record number, if available
c. Patient's birth date (blood bank testing)
d. Date and time collected
e. Source of the sample (if other than blood)
f. Your initials

B. Aliquots or dilutions must be labeled with the following:

a. Patient's name (no nicknames)
b. Collection date and time
c. Type of sample (plasma, serum, etc.)

C. Timed collections must also be labeled with the time of collection and the type of collection (predose, postdose, fasting, 1-hour, 2-hour, etc.).

5. Read each label as it is attached to the tube before leaving the patient. Compare one label to another to ensure that all labels are for this patient.
6. If computer labels are unavailable, labeling of the tubes may be done by (a) imprinted labels or (b) handwriting the patient's complete first and last names, identification number, room number, date, time of draw as required by the test, and phlebotomist's initials.
7. If the patient does not have an identification band on his or her wrist or ankle, or if the identification band is not correct, notify the nurse or nursing unit secretary. *Do not draw blood unless the patient is wearing a correct identification band.*

EXERCISE 1 Short Answer

Directions: Write in the correct term or phrase for the nine items.

List the information that must be on a test request form.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

The blood is drawn and processed by institutional policy. Do not label the tubes before the blood sample is drawn. All samples must be labeled after the sample is drawn and before the phlebotomist leaves the patient. If tubes are labeled before the blood is in the tube, the phlebotomist could possibly label the tube and not use it. If this labeled tube is put back into the phlebotomist's tray, it might get used on another patient, and therefore the tube would be mislabeled. After the patient samples are collected, each tube and label must be checked to ensure that proper identification is completed and all information matches.

The American Association of Blood Banks (2014) sets the standards for labeling of blood bank samples. As quoted in its technical manual:

> The intended recipient and the blood sample shall be positively identified at the time of collection. Blood samples shall be obtained in stoppered tubes identified with a firmly attached label bearing at least the recipient's first and last names, identification number, and the date. The completed label shall be attached to the tube before leaving the side of the recipient, and there must be a mechanism to identify the person who drew the blood.

The phlebotomist initials the label attached to the tube to identify himself or herself as the person who drew the blood. With computerized systems the phlebotomist also verifies in the computer who drew the sample.

EXERCISE 2 Fill in the Blank: Patient Identification Procedure Competency Assessment (Procedure 6-1)

Directions: Fill in the blanks in the procedure steps.

Procedure Step	Reason/Explanation for the Step
All requests for laboratory tests must have a _____ or _____ _____.	The requisition must include the patient's _____ and _____ names, test(s) requested, _____ and name of _____ physician.
Before collecting the samples the phlebotomist must check _____ verifiers.	One way to verify the patient information is to ask the patient to _____ his or her name and state his or her _____.
The venipuncture is performed.	A blood sample must have these five items of identification on the label. 1. _____ 2. _____ 3. _____ 4. _____ 5. _____
Label the sample before leaving the patient.	Compare the information on the label with _____.

ACCESSION ORDER

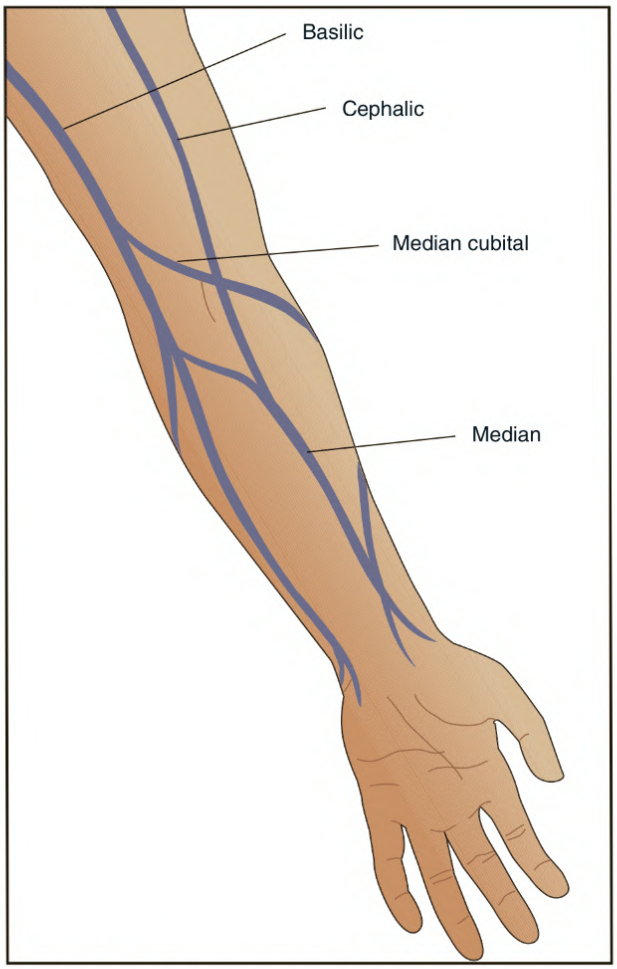
Each request for a blood sample may include an accession number—a number to identify all paperwork and supplies associated with each patient. This unique number can be used to trace back that sample and patient. It ensures accurate and prompt processing of various forms required when performing a venipuncture and analyzing the results. A computerized system generates the accession number when the sample request is ordered in the computer. This number or the letters and number are unique for that sample and will be used in tracking the sample, entering results of the tests on the sample, and checking or reporting of the patient results.

POSITIONING THE PATIENT

The position of the patient is critical for proper blood collection. Proper comfortable positioning of the patient helps him or her feel more at ease, and the phlebotomist is better able to perform the venipuncture. The patient must be in a seated or reclined position before any attempt is made to draw blood. Do not allow patients to sit on a tall stool or stand while you are drawing blood. There is always the possibility that patients will faint (syncope) and injure themselves. The sitting position requires a chair with adequate arm supports that are adjustable for the best venipuncture position. The reclined position is the ideal position from which to draw the patient. A pillow may be required to help support the patient's arm and keep it straight for easier venous access. Have patients lie down whenever they indicate that they are apprehensive or have fainted in the past while having their blood drawn.

SELECTING THE APPROPRIATE VENIPUNCTURE SITE

The appropriate venipuncture site can vary depending on the patient. The site to check first is the upper bend of the arm (antecubital area). The primary vein used in the upper arm is the median cubital vein, usually the prominent vein in the middle of the bend of the arm (Figure 6.4). The basilic, cephalic, or median veins can be used as a second alternative. After the median cubital vein, the cephalic vein is the next preferred site. The basilic vein is the least preferred because along this vein are the brachial artery and major nerves. When attempting a venipuncture in the area of the basilic vein you must be careful to not go too deep to avoid damage to the brachial artery or nerve. The next step is to go to the back of the hand to obtain venous access. The veins in the back of the hand have the tendency to roll more than the arm veins because they are not supported by as much tissue and are near the surface. To avoid this, hold (anchor) the vein in place below the puncture site with your thumb while you use a smaller-gauge needle or a butterfly. The hand veins are ideal for a butterfly (winged infusion set) with a 23-gauge needle. The butterfly can have a syringe attached to it or an evacuated tube holder attached. If the syringe is attached, careful slow pulling on the syringe will obtain the blood sample without collapsing the vein or hemolyzing the blood. With the evacuated tube holder, only small pediatric tubes should be used to avoid collapsing the vein. The wrist veins are also an alternative but generally are much more painful than the other sites. The appropriate wrist vein is the vein that is present when the hand is positioned so the thumb is facing up. Follow the line of the thumb to the wrist to find the prominent vein. When using this vein, a butterfly is usually needed because it has a tendency to roll. Do not use the veins that are present on the palm side of the wrist. These veins are unacceptable. This area is used for arterial punctures (discussed later in the chapter). The foot and ankle veins may also be used. Some hospitals have restrictions on the use of the foot or ankle veins, and the patient's physician must give permission to use them. These veins are often restricted because the physician is concerned about clots forming in the legs. The veins also may be used for heart bypass



▲ FIGURE 6.4 Superficial veins in the arm.

surgery and they cannot be damaged with needle punctures. The veins in the foot or ankle also have the tendency to roll.

The order for checking for the best available site is (1) upper arm, (2) hand, (3) wrist, and (4) ankle or foot. The patient's condition dictates the site to use. Sites that should be avoided are edematous arms; arms in casts; arms with intravenous lines (IVs), cannulas, fistulas, extensive scarring such as burns, or hematomas; and the arm on the side of a mastectomy. Arms with **edema** are swollen because of fluid in the tissue. The veins are not prominent, and the tourniquet will be ineffective due to the swelling. Placement of the tourniquet has the potential for tissue damage and leaves a temporary indentation in the arm. Optimally, a patient on IV therapy should have samples collected from the opposite arm. If this is impossible, other alternatives that are discussed later must be used. Blood should never be collected above a running IV. Cannulas and fistulas are devices that have been placed in the arm. Venipunctures should be performed on the opposite arm. Areas of scarring are also to be avoided because of possible injury to the patient or excessive pain. Samples collected from a hematoma area may cause erroneous test results. If another vein site is not available, the sample is collected distal from the hematoma. Because of the potential for harm to the patient due to lymphostasis, the arm on the side of a mastectomy should be avoided. If the patient has had a double mastectomy, a physician should be consulted prior to drawing the blood. Usually the draw will be performed on the side opposite the newest mastectomy.

Often the site you draw from is determined by whatever site you feel is best to obtain the amount of blood you need. First look at both arms. If you find nothing that feels like a good vein, then check the back of the hand, followed by the wrist. The next alternative is to have a more experienced phlebotomist check or, if possible, draw the sample from a fingerstick. If all these alternatives fail to obtain a blood sample, consider obtaining permission to draw from the foot.

APPROPRIATE VENIPUNCTURE SITES

- Upper arm (antecubital area)
- Back of the hand
- Wrist (in line with the thumb)
- Ankle or foot

SITES TO AVOID

- Edematous arms
- Arms in casts
- Arms with IVs
- Cannulas
- Fistulas
- Areas of scarring
- Side of a mastectomy

EXERCISE 3 Short Answer

Directions: Short answer.

1. What are the three skills used in phlebotomy when approaching a patient?
   a. _____
   b. _____
   c. _____
2. Why is a patient's sample given an accession order?
3. The most commonly used vein in the antecubital area of a patient's arm is the _____ vein.
4. List the sites to check on a patient for an acceptable vein (in order of preference).
   a. _____
   b. _____
   c. _____
   d. _____
5. Why is the basilic vein used with caution?
6. What is the protocol for drawing blood from a patient who has had a mastectomy?

PERFORMING A SAFE VENIPUNCTURE

Locating a Vein

The first step in collecting a venous blood sample is to find the site that will give the best blood return. A tourniquet, as explained in Chapter 5, constricts the flow of blood and helps fill the veins with blood. The tourniquet should be placed 3 to 4 inches (8 to 10 centimeters) above the proposed site. The phlebotomist then looks for a vein. The term *look* is often misused in selecting a vein. Actually a vein is being felt for. The vein must be felt for with the tip of the index or middle fingers. Palpate and trace the path of the vein several times. Avoid using the thumb because it has a pulse and is not as sensitive as the rest of the fingers. The vein will feel soft and bouncy to the touch. Determine the roundness, direction, and depth of the vein. All veins do not go straight up and down the arm. They each follow different angles or cross the arm going side to side. If no veins become prominent, retie the tourniquet slightly tighter but not so tight as to stop the flow of arterial blood into the arm. An alternative is to use a blood pressure cuff instead of a tourniquet. The blood pressure cuff should be inflated to between the systolic and diastolic pressure of the patient. This will provide a wider band of constriction on the arm to make the veins prominent. The difficulty is releasing the blood pressure cuff rapidly enough at the completion of the venipuncture to prevent bruising.

Helpful Hint

Sometimes looking away from the patient's arm as you feel for the vein will enhance your sense of touch. Your mind will focus on the feel of the vein and not on what you are looking for.

If the "vein" you feel pulsates, it is an artery in the patient's arm and should not be punctured. Tendons may also be deceptive and appear as a vein. But they do not have the soft bouncy feel and are hard to the touch. Puncturing a tendon gives no blood return and is painful to the patient. There are also nerves that run the length of the arm. They cannot be seen or felt, but by avoiding deep, probing venipunctures, the chance of touching a nerve is diminished. If the patient complains about the venipuncture hurting excessively, it is best to immediately stop and try another site.

Patient Restrictions

A safe and accurate venipuncture often depends on patient restrictions. Some tests require that the patient fast or eliminate certain foods before any blood samples can be taken. Time and diet restrictions vary according to the test. The patient may also be on certain drug restrictions. Collection is specifically timed so that enough time has passed since the last medication dose was given. (See the section Timed Samples in Chapter 9.)

Assemble Supplies

Before a venipuncture can be performed, all supplies and equipment must be assembled. It is best to prepare everything before greeting the patient. Locate exactly what tubes you need and any special equipment that might be necessary. The patient must be confident in the phlebotomist's abilities. It creates insecurity if the phlebotomist has to leave the patient to check on what tube needs to be drawn or to go back and get something else. It is best to go over the list of tests to draw and even write down what tube is needed for what test. Ask questions before entering the room to avoid interruptions in obtaining the blood sample.

Keep all supplies within your peripheral vision. As the sample is drawn, be sure you can reach the tubes you need without crossing over the patient or stretching and possibly moving the needle after it is in the patient. The worst case is to not have everything within reach, causing the patient to be restuck to finish all the blood work needed. Remember that occasionally a tube will not fill all the way. It is best to keep a few spare tubes or have the phlebotomy tray within reach.

Greet the Patient

Now it is time to greet the patient. The patient must be reassured that the procedure is going to be simple and only a slight inconvenience. Be friendly and outgoing, and talk to the patient, explaining the procedure. Do not tell the patient, "This is not going to hurt." A needle is being placed in the patient's body. The amount of pain varies with the patient. Warn the patient that he or she will feel a "little" stick. Usually the patient will not say a word during the puncture. The anticipation of having blood drawn is worse to many patients than the actual draw. Even if the patient is not responsive, it is best to continue to explain as if the patient were alert. Comatose patients can often hear; they just are unable

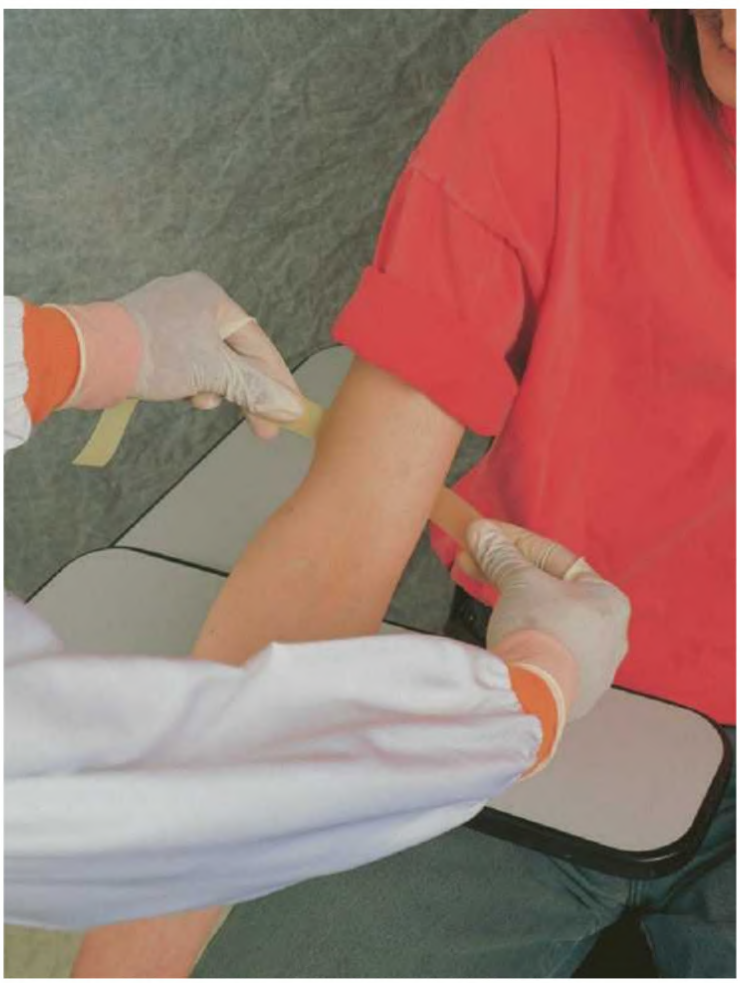
to communicate that they understand. Explaining what is being done often prevents the nonresponsive patient from moving when the blood is drawn. Conversation with all patients gives them the feeling someone cares about them. Friendly associates who are polite to patients are reassuring and caring. This concern for the patient brings more patients back to that health care institution than any other care anyone can offer.

Once the patient has been reassured and confidence gained, it is easy to get cooperation. While talking to the patient, verify the paperwork and tubes to be certain everything is correct. All types of clever comments can be made to check the patient's identification bracelet and labels. Ask the patient to state his or her full name and then ask the patient to spell his or her last name. Next ask to check the identification bracelet. When the identification bracelet matches, tell the patient that he or she is the right person and wins the prize of a blood draw. The phlebotomist can be creative and come up with clever comments to gain the cooperation of the patient, making it easier to concentrate on the task of drawing blood.

SYRINGE VERSUS EVACUATED TUBE SAMPLE COLLECTION

Locating a Vein

Now we come to the job of drawing blood from a patient. The patient has been identified, paperwork and tubes verified, and equipment assembled, and the patient is comfortable. The next step is to tie the tourniquet (Figures 6.5–6.8). After tying the tourniquet, have the patient close his or her hand. Then select a vein. Do not ask the patient to pump his or her fist. This will raise the potassium level of the blood and cause erroneous results. Place the patient's arm in a downward position if possible. After location of an acceptable



▲ FIGURE 6.5 Wrap the tourniquet around the arm 3 to 4 inches above the venipuncture site.

▲ FIGURE 6.6 Stretch the tourniquet tight, and cross the ends.

vein, mentally map the location. Set mental crosshairs (landmarks) on it by visualizing the puncture site. For example, it might be referenced slightly over from this freckle and a little down from that wrinkle. The phlebotomist is often tempted to take a pen and mark an "x" at the intended puncture site, but this is an unacceptable practice. Set those mental crosshairs for an accurate puncture. Now clean the site with a gauze pad soaked with 70 percent isopropyl alcohol solution. A commercially prepared alcohol pad or a pad with chlorhexidine, 0.5 percent, may also be used. Cleanse the skin in a circular motion from the center to the outside. Allow the area to air dry to prevent hemolysis of the sample and to prevent the patient from feeling a burning sensation during phlebotomy.

While the alcohol is drying, put on gloves if you have not already done so. Some authorities suggest donning gloves first and then feeling for the vein. This is required procedure for patients in isolation. For nonisolation patients, gloves are not needed until there is a chance of coming in contact with blood and body fluid. The biggest deterrent to a phlebotomist wearing gloves is the inability to "feel" the vein. The time it takes for the alcohol to air dry on the arm is just enough time to put on gloves.

The phlebotomist must wear gloves that fit properly (snugly). This helps the phlebotomist feel for the vein and gives him or her more dexterity in manipulating tubes and bandaging the patient after the venipuncture. Do not tear one finger off a glove or wear only one glove so you can feel the vein. Before the venipuncture is attempted, both gloves must be intact.

▲ FIGURE 6.7 While holding the ends tight, tuck one portion of the tourniquet under the other.

To avoid forgetting where the collection site is, palpate the vein 1 to 2 inches (2 to 5 centimeters) above and below the intended puncture site. This helps you feel that the vein is located in a straight line. These points can be used to reset the mental crosshairs without contaminating the venipuncture site. Never palpate the vein directly on the puncture site without cleansing the skin again. If you have to cleanse the site again, then there will probably be a problem with prolonged tourniquet time and hemoconcentration. You must release the tourniquet and start again if the tourniquet has been on longer than 1 minute. For the beginning phlebotomist it is difficult to do all this within 1 minute. It may be necessary to tie the tourniquet, find the vein, and then release the tourniquet while the arm is cleansed and gloves are put on. After everything is set up the tourniquet is retied and the venipuncture performed.

The syringe technique and the evacuated tube technique are the first two methods learned by the phlebotomist trainee. The syringe technique is not as common as the evacuated system. The techniques developed in the syringe method are building blocks for the evacuated tube technique and all other techniques.

Hand Position for a Syringe

Hold the syringe and needle system in your dominant hand, and cradle it on the four fingers. Place the thumb on top of the syringe. A right-handed person holds the syringe in the right hand, leaving the left hand to pull on the plunger. A left-handed person does the opposite. With the syringe held in this position, turn it slightly so the bevel of the needle is

▲ FIGURE 6.8 Check that the tourniquet will not come loose. The ends of the tourniquet should be pointed upward. Feel for a vein.

facing up (Figure 6.9). Puncturing a patient with the bevel down is painful to the patient. Grasp the patient's arm with the nondominant hand, using the thumb to draw the skin tight over the vein. The thumb should be 1 to 2 inches (2 to 5 centimeters) below the venipuncture site.

Collecting the Blood

Line up the needle and syringe with the vein to be drawn. Rest the hand with the syringe gently on the patient's arm. Hold the hand in a position so that, by tilting the point of the needle down slightly, the needle will enter the skin at a 15- to 30-degree angle and about 0.5 cm below the point of the vein (Figure 6.10). Do not enter the vein at the exact point you felt the vein. The point where you felt the vein is the point where the bevel of the needle must be under the skin (Figure 6.11). Push the needle into the skin. A sensation of resistance will be followed by easy penetration as the vein is entered. This is known as feeling the "pop." Once this point is reached, stop and do not move.

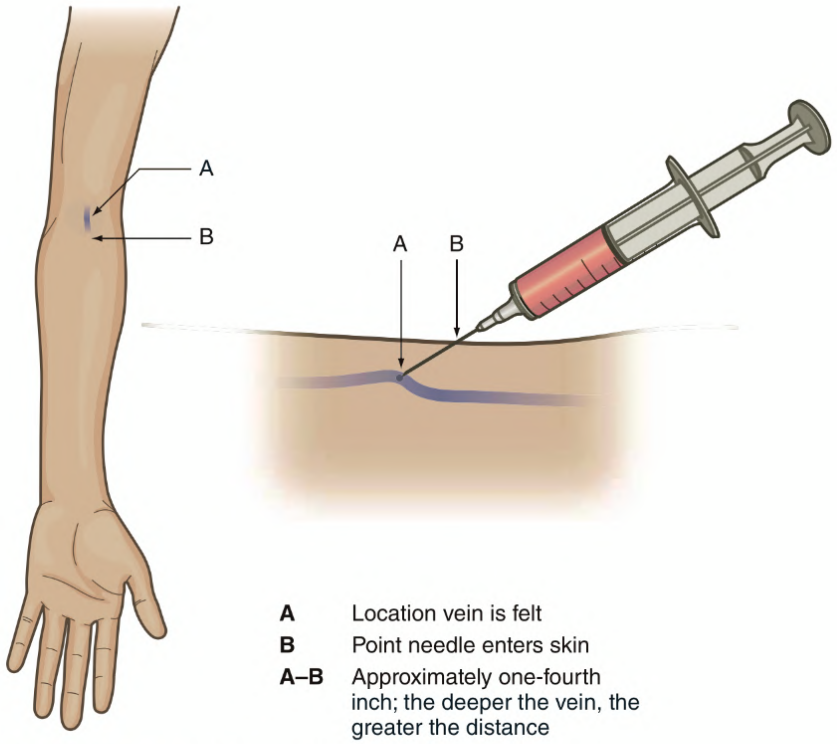
Then take the nondominant hand and pull on the plunger of the syringe. Pull gently and only as fast as the syringe will fill with blood. Pulling too hard or fast will collapse the vein. If the vein does collapse, stop pulling on the plunger and let the vein refill with blood. If more blood is needed than one syringe can hold, the initial venipuncture must be completed with a butterfly needle and syringe attached. The butterfly needle and tubing give the phlebotomist the ability to detach the syringe from the butterfly and reattach a new syringe without moving the needle in the patient. Place a

▲ FIGURE 6.9 Proper hand position to hold a syringe. Needle is attached to the syringe. Hold syringe and needle system in the dominant hand. Cradle the syringe with your four fingers. Place thumb on top of the syringe. Adjust the syringe so the bevel of the needle is facing up.

▲ FIGURE 6.10 Proper position of needle entering vein.

clean gauze square under the needle to catch any blood while you make the change. Changing syringes creates an exposure hazard to blood-borne pathogens and must be avoided if at all possible.

Ideally you should remove the tourniquet as soon as blood flow is established. This is not practical for the beginning phlebotomist. For a beginning phlebotomist, the



▲ FIGURE 6.11 Position at which to enter the skin.

act of removing the tourniquet may move the needle or vein just enough so no more blood can be obtained and the patient has to be restuck. If the tourniquet is left on, the tourniquet must never be left on longer than 1 minute. The entire process should take less than 1 minute to complete. Always remove the tourniquet before removing the needle from the arm. Not removing the tourniquet before the needle is removed causes blood to be forced out of the needle hole and into the surrounding skin, resulting in a hematoma.

Transfer of Blood

After collection of blood with a syringe, the blood must be transferred into evacuated tubes. There are two methods of performing this task safely. The preferred method of placing the blood into the evacuated tube is to use a transfer device. This device is similar to an evacuated tube holder with the exception that a syringe can lock into the end of the holder and an evacuated tube can be slid into the holder to accept the blood. The blood is collected with a syringe. The needle's safety mechanism is then activated. Remove the blood-filled syringe from the activated safety needle. Once the needle is removed, the transfer device can be attached to the syringe of blood (Figure 6.12). The transfer device is often used for dispensing blood after a syringe draw from a vascular line. With draws from a vascular line, a needleless system is used, and therefore the syringe can be attached to the transfer device without removing the needle.

An alternate method is not as safe and does not meet safety standards. It should be used only when there is no transfer device immediately available and the sample will clot before a transfer device can be located. Collect the blood with a syringe and after collection activate the safety shield on the needle. This needle is then removed and a new needle attached once the phlebotomist is at the location where the blood is to be transferred to the evacuated tube. Place the selected tubes to be filled into a test tube rack. Puncture the stopper of the selected tubes with the syringe needle and allow the blood to enter the tube as a result of the tube vacuum (Figure 6.13). Do not hold the tube to support it.

▲ FIGURE 6.12 Using a transfer device.

▲ FIGURE 6.13 Proper method of dispensing blood into an evacuated tube. Use this method only when a transfer device is not available.

Helpful Hint

Check to be certain that your equipment contains transfer devices. The alternate method of transferring blood is a safety issue and does not meet safety standards.

Allow the test tube rack to support the tube. If the tube is held with your hand, your hand is in harm's way if the needle slips off the tube top when puncturing it with the syringe. Do not force the blood into the tube. This technique maintains the proper ratio of blood to anticoagulant.

Do not hold the tube in your hand as you puncture the stopper. There is a potential for missing the stopper or slipping off the stopper and puncturing yourself. Do not remove the rubber stopper of the tubes. Running blood down the side of the tube after removing the stopper is not recommended because of aerosols that can be released and splattering of blood that can occur.

Order of Draw

There is a specific order to filling the evacuated tubes from a syringe or directly into an evacuated system. This order has been developed to avoid cross-contamination from one tube to the next. A small amount of blood from the previous tube is transferred to the next tube as the needle punctures the rubber stopper. If there is an additive or an anticoagulant in the first tube, this first tube could contaminate the next tube and cause a result error.

Glass red-stoppered tubes do not have an additive. Plastic red-stoppered tubes have a clot activator in the tube. With the increased use of plastic red-stoppered tubes, all red-stoppered tubes and gel separator tubes are treated as if they have an additive.

The recommended order of draw is as follows (Figure 6.14):

1. Blood culture bottles or yellow-stoppered blood culture tubes (sterile procedure)
2. Coagulation tubes (e.g., light-blue stopper)
3. Serum tubes with or without clot activator or gel serum separator (e.g., red stopper, red/black stopper, plastic or glass)
4. Heparin tubes with or without gel plasma separator (e.g., green stopper)
5. Ethylenediaminetetraacetic acid (EDTA) tubes (e.g., lavender stopper)
6. Oxalate/fluoride, glycolytic inhibitor tubes (e.g., gray stopper)

The practice of collecting a discard tube (clear tube) before any light-blue top coagulation tube is obtained is no longer standard practice. The theory was that a discard tube

▲ FIGURE 6.14 Tubes in the correct order of draw.

would clear any thromboplastin contamination from the site before the coagulation tube was drawn. This was found to be not necessary for collecting a prothrombin time (PT) or partial thromboplastin time (PTT) coagulation test. The discard tube is still necessary for other coagulation testing (factor assays) when drawing with the evacuated system.

A winged collection set (butterfly) contains air in the tubing. There is approximately 0.5 milliliter (mL) of air in a 12-inch butterfly tubing. Any samples collected without removing the air will result in 0.5 mL less sample than needed. When a coagulation tube is the first tube drawn with a butterfly (winged infusion set), the light-blue–stoppered tube does not fill completely due to the air in the tubing. This lack of fill is critical for the coagulation tests. This results in altered test results due to an incorrect anticoagulant-to-blood ratio. A discard tube must be drawn first to remove the airspace (dead space) from the butterfly (winged collection set) tubing. This discard tube must be a nonadditive tube (glass red stopper) or a coagulation tube to avoid contamination. Other types of tubes do not have this critical fill requirement and if the first tube is slightly short there will not be altered results.

The reasoning for the order of draw is that blood culture tubes are filled first to prevent bacterial contamination of the blood culture sample. The coagulation tube is collected next to avoid any additive such as clot activators or anticoagulants from other tubes getting into the tube. The heparin tube is collected before the EDTA tube because the EDTA would alter the chemistry tests run on the heparin tube. The heparin does not affect the EDTA. The oxalate/fluoride tube is collected last because the EDTA has no effect on the testing from the oxalate/fluoride tube.

Procedure 6-2 details a venipuncture with syringe.

Evacuated Tube System

The evacuated tube system is an improvement over the syringe method but maintains many similarities. With the syringe method, as the syringe plunger is pulled, a vacuum is created. The evacuated method has the vacuum already in the tube. Another advantage of the evacuated tube system is that with multiple blood samples, syringes do not need to be changed, just the tubes.

The similarity of the evacuated tube system is that the holder and needle are held in the same manner as a syringe (Figure 6.15). A syringe is held in a manner to leave access to pull on the plunger. Access must be left in the evacuated system for one tube to be pulled out and another inserted. The hand that pulled on the plunger of the syringe is the hand that changes tubes with the evacuated system.

The procedure for venipuncture with the evacuated tube system follows the same steps as the syringe method with only slight variation (Procedure 6-3).

▲ FIGURE 6.15 Proper hand position to hold an evacuated tube system holder.

PROCEDURE 6-2

VENIPUNCTURE BY SYRINGE

Principle:

To obtain venous blood acceptable for laboratory testing as required by a physician.

Sample:

Venous blood collected to be aliquoted into evacuated tubes or special collection containers.

Materials:

Syringe, varies in size

Disposable needle for syringe, 21 or 22 gauge

Evacuated tube(s) or special collection tube(s)

Tourniquet

70 percent isopropyl alcohol swab

Gauze or cotton balls

Adhesive bandage or tape

Sharps container

Disposable gloves

Biohazard sharps container

Safety glasses and mask if potential for spatter

Transfer device

Procedure:

1. Identify the patient. *Inpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify the identification bracelet name and hospital number with the computer label or requisition information. *Outpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify with the computer label or requisition information.
2. If a fasting sample is required, ask the patient when he or she last ate. Explain the procedure to the patient.
3. Perform hand hygiene before starting the procedure. Open the sterile needle and syringe packages, attaching the needle if necessary.
4. Prevent the plunger from sticking by pulling it halfway out and pushing it all the way in one time.
5. Select the proper tube(s) to transfer the blood to after collection. Place in the proper order for filling.
6. Apply the tourniquet.
7. Ask the patient to close his or her hand. The patient must not be allowed to pump the hand. Place the patient's arm in a downward position if possible.
8. Select a vein, noting the location and direction of the vein (Figure 6.16A).
9. Clean the venipuncture with 70 percent isopropyl alcohol swab (Figure 6.16B).
10. Put on gloves while the alcohol is drying. Do not touch the venipuncture site.
11. Draw the patient's skin taut with your nondominant thumb. The thumb should be 1 to 2 inches (2 to 5 centimeters) below the puncture site (Figure 6.16C).

continues

continued

PROCEDURE 6-2 VENIPUNCTURE BY SYRINGE

12. With the bevel up, align the needle with the vein and perform the venipuncture. While securely grasping the syringe with one hand, use the other hand to slowly pull the plunger back until the desired amount of blood has been obtained (Figure 6.16D).
13. Replace the syringe with another syringe if additional blood is needed. The needle should remain in the vein. Place clean gauze under the needle during this procedure to catch blood while making the change.
14. Ask the patient to open the hand.
15. Release the tourniquet.
16. Lightly place a gauze square or cotton ball immediately above the venipuncture site.
17. Remove the needle from the arm.
18. Activate the safety shield over the needle.
19. Apply pressure to the site with the gauze square or cotton ball for 3 to 5 minutes. The patient may assist if able.
20. Aliquot blood into appropriate tubes. Remove the needle from the syringe, and discard the needle into the sharps container. Attach the transfer device. Fill the tubes via the transfer device following the correct order of draw. Allow blood to enter the tube until flow stops.

▲ FIGURE 6.16A Feel for a vein.

▲ FIGURE 6.16B Clean the site with isopropyl alcohol.

▲ FIGURE 6.16C Draw the skin taut to anchor the vein.

▲ FIGURE 6.16D Perform the venipuncture. Secure the syringe with one hand and pull on the syringe plunger with the other hand.

continued

PROCEDURE 6-2 VENIPUNCTURE BY SYRINGE

Mix if any anticoagulant or additive is present. Gently inverting the tube five to eight times provides adequate mixing without causing hemolysis.

21. Dispose of the syringe and transfer device into the sharps container. Do not disconnect the syringe from the transfer device or needle before disposal. Dispose of devices intact.
22. Recheck the identification bracelet with the labels or requisitions.
23. Label all tubes.
24. Check the puncture site. Apply adhesive bandage. If the patient is an infant, the use of the bandage should be eliminated.
25. Remove gloves and perform hand hygiene.
26. Thank the patient and transport the sample(s) to the laboratory.

The recommended order of draw for direct collection into an evacuated system is the same as a syringe:

1. Blood culture bottles or yellow-stoppered blood culture tubes (sterile procedure)
2. Coagulation tubes (e.g., light-blue stopper)
3. Serum tube with or without clot activator or gel serum separator (e.g., red stopper, red/black stopper, plastic or glass)
4. Heparin tube with or without gel plasma separator (e.g., green stopper)
5. EDTA tube (e.g., lavender stopper)
6. Oxalate/fluoride, glycolytic inhibitor tubes (e.g., gray stopper)

If not all the tubes in the order of draw are to be collected, the order is started with the first tube needing collection. For example, if all that is needed are a green-stoppered tube and a lavender-stoppered tube, the green-stoppered tube is collected first, followed by the lavender-stoppered tube.

If orders include routine coagulation testing—PT and activated partial thromboplastin time (aPTT)—then the first tube collected can still be the light-blue–stoppered tube.

The exception to this is with special coagulation testing. For special coagulation testing (factor assays), a plain glass red-stoppered tube (no clot activator) or a light-blue–stoppered tube may need to be drawn as a discard tube first.

PROCEDURE 6-3

VENIPUNCTURE BY EVACUATED TUBE METHOD

Principle:

To obtain venous blood acceptable for laboratory testing as required by a physician.

Sample:

Venous blood collected by evacuated tubes; volume of blood dependent on size of tube and test requirements.

Materials:

Evacuated tube holder

Disposable needle for evacuated system, 20, 21, or 22 gauge

continues

continued

PROCEDURE 6-3 VENIPUNCTURE BY EVACUATED TUBE METHOD

Evacuated tube(s) or special collection tube(s)

Tourniquet

70 percent isopropyl alcohol swab

Gauze or cotton balls

Adhesive bandage or tape

Disposable gloves

Biohazard sharps container

Safety glasses and mask if potential for spatter

Procedure:

1. Identify the patient. *Inpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify the identification bracelet name and hospital number with the computer label or requisition information. *Outpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify with the computer label or requisition information.
2. If a fasting sample is required, ask the patient when he or she last ate. Explain the procedure to the patient.
3. Perform hand hygiene before patient contact. Collect equipment.
4. Break the needle seal. Thread the appropriate needle into the holder using the needle sheath as a wrench.
5. Before using, tap all tubes that contain additives to ensure that all the additive is dislodged from the stopper and wall of the tube.
6. Insert the tube into the holder until the needle slightly enters the stopper. Avoid pushing the needle beyond the recessed guideline, because a loss of vacuum may result. If the tube retracts slightly, leave it in the retracted position.
7. Apply the tourniquet.
8. Ask the patient to close the hand. The patient must not be allowed to pump the hand. Place the patient's arm in a downward position to prevent reflux or "backflow" of the blood from the tube into the venous system.
9. Feel for a vein, noting the location and direction of the vein (Figure 6.17).
10. Clean the venipuncture with 70 percent isopropyl alcohol swab.
11. Put on gloves while alcohol is drying. Do not touch the venipuncture site.
12. Draw the patient's skin taut with your nondominant thumb. The thumb should be 1 to 2 inches (2 to 5 centimeters) below the puncture site.
13. With the bevel up, align the needle with the vein while holding the skin taut. Perform the venipuncture (Figure 6.18). Remove your hand from drawing the skin taut (Figure 6.19). Grasp the flange of the evacuated tube holder, and push the tube forward until the butt end of the needle punctures the stopper (Figure 6.20). You should not change hands while performing the venipuncture. The hand you perform the venipuncture with is the hand that holds the evacuated tube holder. The opposite hand manipulates the tubes.
14. Fill the tubes in the correct order of draw until the vacuum is exhausted and blood flow into the tube ceases, ensuring the proper blood-to-anticoagulant ratio (Figure 6.21).

continued

PROCEDURE 6-3 VENIPUNCTURE BY EVACUATED TUBE METHOD

15. When the blood flow ceases, remove the tube from the holder. While securely grasping the evacuated tube holder with one hand, use the flange on the tube holder to give leverage to change the tubes. The sleeve re-covers the point, stopping the flow of blood until the next tube of blood is inserted.

▲ FIGURE 6.17 Feel for vein direction and location.

▲ FIGURE 6.18 Insert the needle while holding the skin taut.

▲ FIGURE 6.19 Remove the hand from holding the skin taut.

▲ FIGURE 6.20 Insert the tubes into the holder in the correct order of draw.

▲ FIGURE 6.21 Fill the tube until the vacuum is exhausted.

continues

continued

PROCEDURE 6-3 VENIPUNCTURE BY EVACUATED TUBE METHOD

16. Mix immediately after drawing each tube that contains an additive. Gently inverting the tube five to eight times provides adequate mixing without causing hemolysis.
17. To obtain additional samples, insert the next tube into the holder and repeat the procedure, starting with step 14.
18. Ask the patient to open the hand.
19. Release the tourniquet.
20. Remove the last tube to draw from the holder.
21. Lightly place a gauze square or cotton ball above the venipuncture site.
22. Remove the needle from the arm. Be certain that the last tube drawn has been removed from the holder before removing the needle. This will prevent blood from dripping out of the tip of the needle as it is withdrawn from the arm. *Note:* Remember the two "Ts" (tourniquet and tube) before removing the needle from the arm.
23. Activate the safety shield over the needle.
24. Apply pressure to the site with the gauze square or cotton ball for 3 to 5 minutes. The patient may assist if able.
25. Dispose of the needle in the sharps container.
26. Recheck the identification bracelet with the labels or requisitions.
27. Label all tubes.
28. Check the puncture site. Apply adhesive bandage. If the patient is an infant, the use of the bandage should be eliminated.
29. Remove gloves and perform hand hygiene.
30. Thank the patient and transport the sample(s) to the laboratory.

Helpful Hint

Mark your discard tube with an "x" or the word *discard* so you do not use it as a patient sample.

Check with your health care facility if a discard tube is necessary; this requirement will vary by facility. This discard tube eliminates possible thromboplastin contamination from the venipuncture site. Thromboplastin is a substance produced by the patient and released into the bloodstream as a reaction to the venipuncture. In most testing, it has no effect. With special coagulation testing, there is possible effect. The discard tube clears the thromboplastin from the bloodstream.

BUTTERFLY (WINGED INFUSION SET) COLLECTION

The butterfly collection system can use either a syringe or an evacuated tube for collection. The most commonly used is a butterfly needle with a Luer adapter that can receive an evacuated tube. The butterfly needle will enter the skin at a lower angle than with the evacuated system. The butterfly system needle should be inserted at a 5- to 10-degree angle for the best draw of blood. The butterfly system is usually used for small veins in the antecubital area (Procedure 6.4) or to access veins in the back of the hand (Procedure 6.5).

The procedure for venipuncture with a butterfly system follows steps similar to those of the evacuated tube system.

PATIENT REACTIONS

Patients can display a variety of reactions to having their blood drawn. The phlebotomist must anticipate these reactions and respond quickly and appropriately. These reactions can range from inconveniences to serious problems. Whatever the reaction, the phlebotomist

must be able to access the situation and react appropriately. Having first aid training and training in cardiopulmonary resuscitation will help the phlebotomist handle the range of reactions. Doing a venipuncture from the basilic vein is one of the main causes of pain and nerve damage for the patient. The basilic vein is more difficult to feel and has a tendency to roll. Venipuncture from this vein should be approached with caution. Underlying this vein are the brachial artery and median cutaneous nerve. Without careful venipuncture either of these can be easily damaged, causing serious problems for the patient.

PROCEDURE 6-4

ANTECUBITAL VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING EVACUATED TUBES

Principle:

To obtain venous blood acceptable for laboratory testing as required by a physician.

Sample:

Venous blood collected by evacuated tubes; volume of blood dependent on size of tube and test requirements.

Materials:

Evacuated tube holder

Disposable butterfly needle with safety shield, 21 or 23 gauge

Evacuated tube(s) or special collection tube(s)

Tourniquet

70 percent isopropyl alcohol swab

Gauze or cotton balls

Adhesive bandage or tape

Disposable gloves

Biohazard sharps container

Safety glasses and mask if potential for spatter

Procedure:

1. Identify the patient. *Inpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify the identification bracelet name and hospital number with the computer label or requisition information. *Outpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify with the computer label or requisition information.
2. If a fasting sample is required, ask the patient when he or she last ate. Explain the procedure to the patient.
3. Perform hand hygiene before patient contact. Collect equipment.
4. Open the butterfly needle system package. Connect the needle system to the evacuated tube holder.

continues

continued

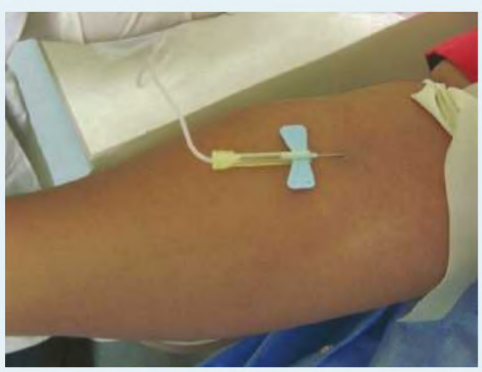
PROCEDURE 6-4 ANTECUBITAL VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING EVACUATED TUBES

5. Before using, tap all tubes that contain additives to ensure that all the additive is dislodged from the stopper and wall of the tube.
6. Insert the tube into the holder until the needle slightly enters the stopper. Avoid pushing the needle beyond the recessed guideline, because a lack of vacuum may result. If the tube retracts slightly, leave it in the retracted position.
7. Apply the tourniquet.
8. Ask the patient to close the hand. The patient must not be allowed to pump the hand. Place the patient's arm in a slightly downward position to prevent reflux or "backflow" of the blood from the tube into the venous system.
9. Feel for a vein, noting the location and direction of the vein (Figure 6.22).
10. Clean the venipuncture with 70 percent isopropyl alcohol swab (Figure 6.23).
11. Put on gloves while alcohol is drying. Do not touch the venipuncture site.
12. Draw the patient's skin taut with your nondominant thumb. The thumb should be 1 to 2 inches (2 to 5 centimeters) below the puncture site.
13. With the bevel up, line up the needle with the vein while holding the skin taut. Perform the venipuncture (Figure 6.24). When the needle enters the vein, you should see a "flash" of blood (Figure 6.25). Remove your hand from drawing the skin taut. Grasp the flange of the

▲ FIGURE 6.22 Feel for a vein.

▲ FIGURE 6.23 Clean the venipuncture site with isopropyl alcohol.

▲ FIGURE 6.24 Perform the venipuncture.



▲ FIGURE 6.25 When the needle enters the vein you should see a "flash" of blood.

continued

PROCEDURE 6-4 ANTECUBITAL VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING EVACUATED TUBES

evacuated tube holder, and push the tube forward until the butt end of the needle punctures the stopper (Figure 6.26). You may need to hold the butterfly needle in place. For multiple draws that require both hands to manipulate the tubes, the butterfly needle may be temporarily taped down or left in place.

14. Fill the tubes in the correct order of draw until the vacuum is exhausted and blood flow into the tube ceases, ensuring the proper blood-to-anticoagulant ratio. *Note:* Remember, if a coagulation tube is collected first, you must use a discard tube to remove the air from the tubing to ensure that the proper amount of blood is in the light-blue–top tube and that a 1:9 anticoagulant-to-blood ratio is maintained.
15. When the blood flow ceases, remove the tube from the holder. While securely grasping the evacuated tube holder with one hand, pull the tube from the holder. The sleeve re-covers the point, stopping the flow of blood until the next tube of blood is inserted.
16. Mix immediately after drawing each tube that contains an additive. Gently inverting the tube five to eight times provides adequate mixing without causing hemolysis.
17. To obtain additional samples, insert the next tube into the holder and repeat the procedure, starting with step 14.
18. Ask the patient to open the hand.
19. Release the tourniquet (Figure 6.27).
20. Remove the last tube to draw from the holder (Figure 6.28).
21. Lightly place a gauze square or cotton ball above the venipuncture site.
22. Remove the needle from the arm (Figure 6.29). Be certain that the last tube drawn has been removed from the holder before removing the needle. This will prevent blood from dripping out of the tip of the needle as it is withdrawn from the arm. *Note:* Remember the two "Ts" (tourniquet and tube) before removing the needle from the arm.
23. Activate the safety shield over the needle (Figure 6.30).
24. Apply pressure to the site for 3 to 5 minutes. The patient may assist if able.
25. Dispose of the butterfly device in the sharps container. When disposing, insert the needle end of the device in first and allow the tubing and holder to drop into the container.
26. Recheck the identification bracelet with the labels or requisitions.

▲ FIGURE 6.26 Insert the evacuated tube into the holder.

▲ FIGURE 6.27 Release the tourniquet.

continues

continued

PROCEDURE 6-4 ANTECUBITAL VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING EVACUATED TUBES

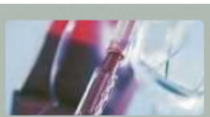
27. Label all tubes.
28. Check the puncture site. Apply adhesive bandage. If the patient is an infant, the use of the bandage should be eliminated.
29. Remove gloves and perform hand hygiene.
30. Thank the patient and transport the sample(s) to the laboratory.

▲ FIGURE 6.28 Remove the last tube from the holder.

▲ FIGURE 6.29 Remove the butterfly needle from the arm.

▲ FIGURE 6.30 Activate the safety shield.

PROCEDURE 6-5



HAND VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING A SYRINGE

Principle:

To obtain venous blood acceptable for laboratory testing as required by a physician.

Sample:

Venous blood collected by evacuated tubes; volume of blood dependent on size of tube and test requirements.

continued

PROCEDURE 6-5 HAND VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING A SYRINGE

Materials:

Evacuated tube holder

Disposable butterfly needle with safety shield, 21 or 23 gauge

10- to 15-mL syringe

Transfer device

Tourniquet

70 percent isopropyl alcohol swab

Gauze or cotton balls

Adhesive bandage or tape

Disposable gloves

Biohazard sharps container

Safety glasses and mask if potential for splatter

Procedure:

1. Identify the patient. *Inpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify the identification bracelet name and hospital number with the computer label or requisition information. *Outpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify with the computer label or requisition information.
2. If a fasting sample is required, ask the patient when he or she last ate. Explain the procedure to the patient.
3. Perform hand hygiene before patient contact. Collect equipment. Put on gloves.
4. Open the package containing the butterfly needle system. Connect the syringe to the butterfly needle system (Figure 6.31).
5. Apply the tourniquet.
6. Ask the patient to close the hand. The patient must not be allowed to pump the hand. Place the patient's arm in a downward position to prevent reflux or "backflow" of the blood from the tube into the venous system (Figure 6.32).
7. Feel for a vein, noting the location and direction of the vein.
8. Clean the venipuncture with 70 percent isopropyl alcohol swab (Figure 6.33).
9. Put on gloves while the alcohol is drying if you did not do so in step 3. Do not touch the venipuncture site.
10. Draw the patient's skin taut with your nondominant thumb. The thumb should be slightly below the puncture site and a little to the side for maximum access to the vein.
11. With the bevel up, line up the needle with the vein while holding the skin taut. Perform the venipuncture at a 5- to 10-degree angle (Figure 6.34). When the needle enters the vein, you should see a "flash" of blood.
12. Continue holding the needle in position. Gently pull on the syringe with the other hand, allowing the syringe to fill (Figure 6.35).
13. When the syringe is filled to the desired amount, have the patient open the hand. Release the tourniquet. Place a cotton ball or gauze above the venipuncture site and remove the needle (Figure 6.36).

continues

continued

PROCEDURE 6-5 HAND VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING A SYRINGE

▲ FIGURE 6.31 Connect the syringe to the butterfly needle system.

▲ FIGURE 6.32 Apply the tourniquet. Ask the patient to close the hand.

▲ FIGURE 6.33 Clean the venipuncture site.

▲ FIGURE 6.34 Perform the venipuncture at a 5- to 10-degree angle.

14. Activate the safety shield over the needle (Figure 6.37).
15. Apply pressure to the site, and ask the patient if he or she can continue to hold pressure (Figure 6.38).
16. Disconnect the syringe from the butterfly device.
17. Dispose of the butterfly device in the sharps container (Figure 6.39).
18. Fill the evacuated tubes in the correct order of draw from the syringe using a transfer device. Fill each tube until the vacuum is exhausted and blood flow into the tube ceases, ensuring the proper blood-to-anticoagulant ratio.
19. Mix each tube that contains an additive immediately after filling. Gently inverting the tube five to eight times provides adequate mixing without causing hemolysis.
20. Recheck the identification bracelet with the labels or requisitions.
21. Label all tubes.

continued

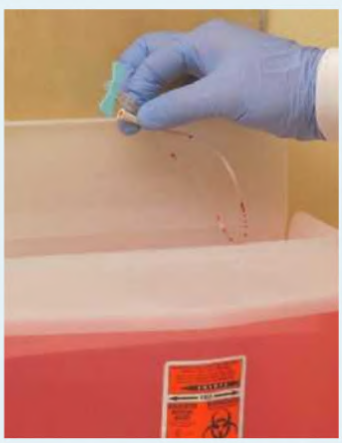
PROCEDURE 6-5 HAND VEIN VENIPUNCTURE BY BUTTERFLY (WINGED INFUSION SET) COLLECTION SYSTEM USING A SYRINGE

▲ FIGURE 6.35 Gently pull on the syringe with the other hand, allowing the syringe to fill.

▲ FIGURE 6.36 When the syringe is filled to the desired amount, have the patient open the hand. Release the tourniquet. Place a cotton ball or gauze above the venipuncture site and remove the needle.

▲ FIGURE 6.37 Activate the safety shield over the needle.

▲ FIGURE 6.38 Apply pressure to the site, and ask the patient if he or she can continue to hold pressure.



▲ FIGURE 6.39 Dispose of the butterfly device in the sharps container.

22. Check the puncture site. Apply adhesive bandage. If the patient is an infant, the use of the bandage should be eliminated.
23. Remove gloves and perform hand hygiene.
24. Thank the patient and transport the sample(s) to the laboratory.

Pain

The most common patient reaction to venipuncture is pain. The patient may indicate that the venipuncture is painful. Try repositioning the needle slightly and releasing the tourniquet. Releasing the tourniquet often helps because the tourniquet may be pinching the arm and causing pain rather than the needle. Avoid deep, probing venipunctures, especially in the area of the basilic vein, because this vein is close to a major nerve. Immediately discontinue the venipuncture if the patient indicates sharp, piercing pain.

Nerve Damage

Helpful Hint

Try to avoid venipuncture from the basilic vein or entering the vein at greater than a 30-degree angle. These are the most common reasons for nerve damage.

Deep, probing venipunctures can result in nerve damage. This damage will be first felt by the patient as a tingling or numbing of the arm or hand on which the venipuncture was performed. The resulting sensation usually goes away in a few hours to days if the nerve was only touched and not damaged. If the nerve was damaged, this numbness could be permanent. Nerve damage by a phlebotomist has resulted in legal issues for health care facilities. Only a physician can determine if damage occurred.

The best method to avoid nerve damage is to avoid probing venipunctures and attempt to puncture only veins that can be felt. Deep punctures can not only cause nerve damage but can also result in puncture of an artery.

Syncope

Syncope (fainting) is preceded by the patient turning pale, perspiring, and starting to breathe shallowly. This is followed by drooping eyelids; weak, rapid pulse; and finally unconsciousness. If a patient does faint, immediately remove the needle and stop the patient from getting hurt. The patient in a chair must be held there to keep from sliding out onto the floor. Lower the head and arms. Wipe the patient's forehead and back of the neck with a cold compress if necessary. If the patient still does not respond, a physician must be notified. It is best to ask the patient prior to drawing the blood if he or she has had any reactions to having blood drawn. If the patient states that he or she has fainted in the past, have the patient lie down before drawing the blood, which usually prevents the problem. Never draw blood with a patient standing or sitting on a stool or on a chair with wheels.

Nausea

Having their blood drawn is so upsetting to some patients that they become nauseated and vomit. The patient may indicate that he or she feels sick. Make the patient as comfortable as possible, and instruct him or her to breathe deeply and slowly. Apply cold compresses to the patient's forehead. Give the patient an emesis basin, wastebasket, or container, and have facial tissues ready if the nausea does not diminish. Give the patient water to rinse out his or her mouth if vomiting does occur.

Diabetic Shock

Patients can go into diabetic shock or experience hypoglycemia because they have fasted. Patients with diabetes need to regulate their diet and eat at specific times of the day. If a test needs to be drawn while fasting, the patient breaks from his or her normal routine and does not eat breakfast before coming in to have blood drawn. The patient is 1 to 2 hours late eating breakfast and can go into diabetic shock from low blood sugar. This is usually the result of too much insulin in their blood stream. The first signs are a cold sweat and a pale face similar to the signs of syncope. The patient becomes weak and shaky, followed by sudden mental confusion that appears as an instant personality change. At this point the patient may indicate what is happening or lapse into unconsciousness. If the patient is conscious enough to swallow, a glass of orange juice or cola will help temporarily. Call a physician if the patient remains unconscious.

Convulsions

A patient who goes into convulsions becomes unconscious and exhibits violent or mild convulsive motions. Do not try to restrain the patient, but move objects or furniture out of the way to prevent injury. Call the physician or nurse to help with the situation. The patient will usually recover within a few minutes and will be able to leave after a few minutes of rest.

Cardiac Arrest

Many individuals who come in to have their blood drawn have a health problem. A person with heart problems could go into cardiac arrest. The patient falls into unconsciousness and has no pulse or respiration, dilated eyes, and a blue or gray skin tone. Immediate cardiopulmonary resuscitation (CPR) is necessary to avoid patient death. Only persons certified to do CPR can perform this procedure. Most health care institutions call this occurrence a code or code blue. Each institution has a certain protocol to announce the code and call the code team that will take over in caring for the patient.

Continued Bleeding

Upon completion of a venipuncture, a gauze square or cotton ball is placed on the puncture site to help stop the bleeding. Normally the bleeding will stop in approximately 2 minutes, the time it takes to label and initial the tubes that were drawn. Some patients have continuous bleeding at the venipuncture site for longer than 5 minutes. Continue to apply pressure to the site by wrapping an elastic gauze bandage around the arm over a pad. Tell the patient to leave the bandage on for at least 15 minutes, but as long as necessary to stop the bleeding.

Hematoma

A patient can react by leaking blood under the skin at the site of the venipuncture during or after the venipuncture. A **hematoma** (bruise) will result. At the first sign of a hematoma the phlebotomist should discontinue the venipuncture and apply heavy pressure to the site. The phlebotomist should use the major superficial veins for venipuncture. Only the uppermost wall of the vein should be punctured to prevent a hematoma. The puncture should not be so deep that the top and bottom walls of the vein are punctured. The puncture should be deep enough to fully penetrate the uppermost wall of the vein (partial penetration allows blood to leak around the puncture site). After any venipuncture, a small amount of pressure should be applied to the area. Place adequate cotton or gauze under the bandage to prevent bleeding.

Petechiae, small red dots that are indications of small amounts of bleeding under the skin surface, may be present on the skin of some patients. These are often the result of low platelet counts or other coagulation problems. The patient may bleed excessively after the venipuncture.

Skin Allergies

Some patients are allergic to tape or iodine. This is usually the result of the patient having a latex sensitivity. The patient will stop you as you try to put tape on the arm if he or she is allergic. Before you leave this patient, check that all bleeding has stopped and tell the patient to hold a cotton ball or gauze square on the puncture site. The gauze or cotton can be held in place with hypoallergenic tape or nonlatex elastic wrap. Blood cultures require iodine for cleansing the collection site. Before the phlebotomist uses iodine on a patient, the patient should be asked if he or she has any allergies.

Anemia

Patient anemia is caused by four factors:

- Decrease in erythrocytes
- Decrease in hemoglobin
- Deficiency of hemoglobin
- Abnormal hemoglobin

As a result of anemia, the patient has lack of energy, pale skin, fatigue, and shortness of breath. There are many types of genetic or disease-related anemias.

- Sickle cell anemia—A hereditary disease in which the erythrocytes have an abnormal sickle shape with abnormal hemoglobin
- Iron-deficiency anemia—A condition resulting in excessive iron loss caused by nutritional deficiencies that create lower-than-normal erythrocyte production
- Hemolytic anemia—A hereditary condition in which erythrocytes are destroyed faster than normal
- Thalassemia—A hereditary disease in which hemoglobin production is suppressed
- Iatrogenic anemia—Anemia caused by drawing excessive quantities of blood from a patient during the care of the patient; this is usually of most concern with premature infants

POSSIBLE PATIENT REACTIONS

- Pain
- Nerve damage
- Syncope (fainting)
- Nausea
- Diabetic shock
- Convulsions
- Cardiac arrest
- Continued bleeding
- Hematoma
- Skin allergies
- Anemia

Hemolysis

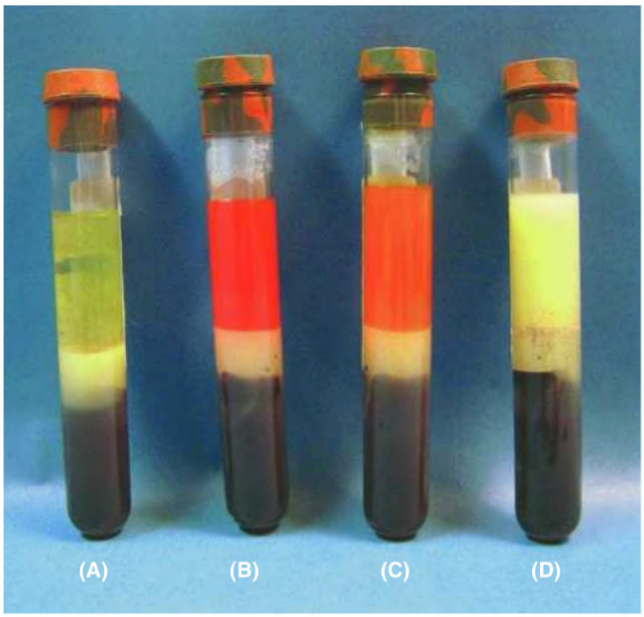
Three characteristics of patients' blood can result in altered test results (Figure 6.40). The most commonly seen characteristic is hemolysis of the red blood cells. Hemolysis is a breaking or rupturing of the membrane of the red blood cells. The contents of the red blood cells then contaminate the serum or the plasma being tested. The serum or plasma appears red. The darker the red, the more cells that have been hemolyzed. The causes of hemolysis are:

- Drawing from a hematoma
- Rupturing of the red blood cells by using a needle that is too small
- Alcohol on the site of the venipuncture that enters the blood sample
- Leakage of air and frothing of the blood through a needle not attached to the syringe tightly enough
- Pulling back the plunger of the syringe too forcibly
- Temperature extremes

Blood left in a car could get too hot in the summer or freeze in the winter. In either case, the red blood cells would rupture.

Jaundice

A patient's serum or plasma that contains a large amount of bilirubin because of jaundice has a yellow to orange color. The patient's skin and the sclera of the eyes may also be yellow to orange. Serum or plasma with this coloration is called icteric. It is not caused by the phlebotomist's error, but results from the patient's condition.



▲ FIGURE 6.40 (A) Normal, (B) hemolyzed, (C) icteric, and (D) lipemic blood.

Lipemia

A large amount of fats and lipids in a patient's blood gives the serum and plasma a white, milky color. This type of serum or plasma is known as lipemic. It, too, is the result of the patient's condition and not a phlebotomist's error. The lipemic appearance also may be due to the patient not having fasted.

THE FAILED VENIPUNCTURE

When you cannot obtain a blood sample, it may be necessary to change the position of the needle. Rotate the needle half a turn. The bevel of the needle may be against the wall of the vein. If the needle has not penetrated the vein far enough, advance it farther into the vein. Only advance slightly. A small change can make the difference between a failed and a successful venipuncture. If the needle has penetrated too far into the vein, pull back a little. Always pull out slowly when the venipuncture has been unsuccessful. The blood will often start coming just as it seems the needle is ready to come out of the skin.

There are several reasons for venipuncture failure. The tube may have pulled back out of the holder. The tubes often will not stay pushed all the way into the holder while the blood is being collected. The tube slides back out, and then it stops filling with blood. A slight pressure holding the tube into the holder will reseat the tube and remedy this problem. The tube being used may not have sufficient vacuum. Try another tube before withdrawing. The tourniquet could have been on too tight, stopping the flow of blood. Reapply the tourniquet loosely. An alternative to a tourniquet is a blood pressure cuff inflated to between the patient's systolic and diastolic pressure. The cuff provides a larger surface area to apply pressure, and the pressure can be regulated. This often brings veins to the surface when other methods have failed.

TECHNIQUES TO ENHANCE THE VEIN AND RECOVER A FAILED VENIPUNCTURE

1. Retie the tourniquet.
2. Use a blood pressure cuff in place of the tourniquet.
3. Massage the arm. Do not slap the arm.

continued

4. Lower the patient's arm.
5. Warm the venipuncture location.
6. Reseat the tube in the holder.
7. Use a different tube.
8. Place your finger below the venipuncture site and stretch the vein slightly.
9. Rotate the needle one-quarter to one-half a turn.
10. Pull back or advance the needle slightly.

Blood flow can also be stimulated by massaging the arm in an upward motion below the venipuncture site. Position the arm lower than the patient. Hang the patient's arm over the side of the bed, for example, causing the blood to pool more in the arm and making the veins more prominent. If these techniques do not work, infant heel warmers or warm towels applied to the site can be helpful to increase blood flow.

Probing of the site is not recommended, because it is painful to the patient and may cause a hematoma. Use a vein in the opposite arm, or puncture a site below the first site. Never attempt a venipuncture more than twice. If a blood sample cannot be obtained in two tries, do a capillary collection if possible, or have another person attempt the draw. Notify the patient's physician if two phlebotomists have been unsuccessful and a capillary collection is not possible.

INTRAVENOUS AND INDWELLING LINES

IV lines supply needed fluids and medicines to the patient. When an IV solution is being administered into one arm, blood should not be drawn from that arm. The IV solution that is in the arm has the potential to contaminate the blood sample. These fluids and medicines can cause erroneous results in a blood sample. IV lines are inserted into a vein. The site can be anywhere from the back of the hand to farther up the arm. The IV sites are generally not placed in the upper area of the arm but in any site below the upper arm. That makes the upper arm area very tempting to draw blood from because you can feel veins in the upper arm and the IV is in the lower part of the arm. Venous blood flow is flowing up the arm from the hand to the shoulder. The IV solution is flowing in that direction. Any blood drawn in a site above the IV will contain the IV solution. The IV solution will be in a high concentration because it has not had a chance to circulate through the body and distribute through the circulatory system. Therefore, the laboratory test results will be higher or lower depending on the contents of the IV solution.

If glucose is being tested in a patient who has a saline solution running in the IV, the value for the blood glucose will be less than actual due to the dilution. If a glucose solution is running in the IV, the value for the blood glucose will be increased due to the concentration of glucose solution. These test results are therefore erroneous and misleading to the physician. Such erroneous results will cause the physician to treat the patient incorrectly.

To avoid this kind of error, look for a blood-drawing site in the opposite arm. Occasionally, an IV will be running in both arms and no site can be found except in the area of the IV. Satisfactory samples can be drawn below the IV (never above) by following several precautions. Ask the nurse to shut off the IV for at least 3 minutes before venipuncture. Apply the tourniquet below the IV site. Select a vein other than the one with the IV. Perform the

venipuncture. Draw 5 mL of blood, and discard this blood to clear any IV solutions from the arm before test samples are collected.

If the IV cannot be shut off, there are three options. The first choice is to do a fingerstick if the tests ordered can be done by capillary collection. Second, obtain permission from the physician to draw from the ankle or foot. The third option is to wait until the IV is taken out and then draw the blood sample. It is best to wait until at least 30 to 60 minutes after the IV has been removed to allow the blood to circulate in the arm without IV contamination.

COLLECTION OF A BLOOD SAMPLE FROM AN ARM WITH AN IV LINE

1. Try to avoid the arm if at all possible (use other arm, fingerstick, or foot).
2. If unable to avoid the arm with the IV, ask the nurse to shut off the IV for 3 minutes. The patient's nurse must shut off the IV. A phlebotomist is not authorized to and does not have the knowledge of a patient's conditions to perform this function.
3. Apply the tourniquet below the IV. This will avoid disruption to the IV.
4. Select a vein other than the vein the IV is in and perform the venipuncture.
5. Discard 5 mL of blood to clear any backed-up IV fluid.
6. Collect the required blood sample(s).
7. Bandage the venipuncture site.
8. Ask the nurse to restart the IV. The nurse must restart the IV. This is not within the authority of the phlebotomist.
9. Label the tube with a notation that blood was collected from the same arm as the IV and what was running in the IV.

To eliminate some of these problems, a new cooperation between the laboratory and nursing departments has begun in many health care areas. Nurses are starting to draw more of the blood samples. To save the patient the discomfort of being punctured to start the IV and then punctured again to obtain the blood sample, the nurse inserts the IV needle and, before starting any IV fluids, pulls a blood sample. This saves the patient a needle puncture and speeds the blood samples to the laboratory without the delay of waiting for the phlebotomist. No longer is the phlebotomist the only health care associate drawing blood from patients. The negative to this practice is that collecting blood through an IV needle often results in increased hemolysis of the blood and requests for re-collection of the blood. The health care facility must determine if this practice is acceptable.

Drawing from Vascular Access Devices

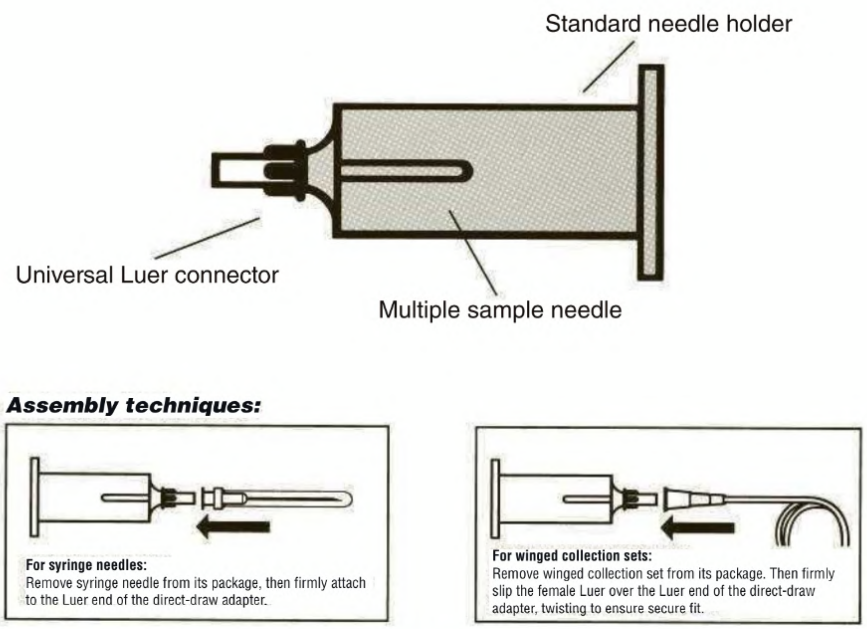
Many patients have inserted indwelling lines or vascular access devices (VAD) such as arterial lines, venous catheters, percutaneous indwelling central catheters (PICC), or heparin/saline locks (Figure 6.41). These devices consist of small plastic tubing that is placed in the patient for access to give fluids and medication or to draw blood.

To keep blood from clotting in the line, heparin or saline is used to flush the line. After blood is pulled from the line, heparin or saline is injected into the line until all the blood is pushed back into the patient. This keeps the line clear until the next blood sample needs to be taken. Any samples first taken from the line contain a mixture of blood and heparin or saline. The capacity of the line must be discarded at least twice to clear any fluid from the line. For coagulation tests, the capacity must be discarded at least five to six times. If the

line contained heparin and a coagulation tube needs to be collected, it is best to flush the line with saline to remove any heparin that coats the walls of the line. A discard sample is then collected before blood for the tube is drawn. At least 7 mL of blood is usually sufficient as a discard to clear all the heparin/saline. After the discard, the blood can be drawn as if you were drawing from a vein. Not discarding 7 mL of blood could cause erroneous results.

The method of drawing can be with a syringe or with an evacuated system. To draw from a line with the evacuated system, a *Luer adapter* (Figure 6.42) is used. A Luer adapter looks like an evacuated needle without the needle. The part that screws into the holder has the same needle and rubber sleeve. The needle that would normally be used on the patient is replaced with a port. The port can be fit into the line, and multiple tubes can be drawn. Once drawing is completed, the heparin/saline must be replaced in the line. In some states, the injection of heparin into the line by a phlebotomist is not permitted.

▲ FIGURE 6.41 Heparin lock with tubing added for access.



▲ FIGURE 6.42 Luer adapter (direct-draw adapter).

Helpful Hint

Only specially trained individuals may draw from a VAD. This is not within the normal authority of the phlebotomist.

Phlebotomists in some situations are drawing blood from lines, but usually nurses do this type of collection. The same limitations hold for accessing a **cannula,** a type of tubing connector used on patients with kidney transplant or on dialysis.

Some patients on dialysis have fistulas. A **fistula** is an artificial shunt connection done by a surgical procedure to fuse together a vein and an artery. When encountering a patient with a fistula, samples should be drawn from the opposite arm.

EXERCISE 4 **Short Answer**

Directions: List techniques to enhance the vein and recover a failed venipuncture.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

PRIORITIZING SAMPLE COLLECTION

The phlebotomist is faced with the decision of which patient to draw first and which patients to draw later. Some hospitals allow tests to be ordered with different priorities. The *stat* test indicates that the sample collection is critical to the immediate treatment of the patient. These stat samples must be collected before other samples. The *as soon as possible (ASAP)* order priority is sometimes used to indicate that the sample needs to be collected generally within an hour of the order time. Lesser priorities would be *this AM/PM* or *today.*

Samples that have a specific time to be drawn dictate the proper collection time and sequence. Stat samples should always be collected first. After a stat sample is collected, it must not be carried on the phlebotomist's tray while other lower-priority samples are collected. The stat should be taken immediately to the appropriate laboratory.

Certain types of tests determine when the phlebotomist collects the sample. In the blood test for ammonia, the sample must be placed on ice and then delivered to the laboratory within 20 minutes of collection. If a phlebotomist has several patients to draw and one of those patients has an ammonia test ordered, the ammonia test must be drawn last and then delivered immediately to the laboratory. Each laboratory determines the priority for sample collection. This is covered in more detail in Chapter 9.

ARTERIAL PUNCTURES

Arterial punctures are not for the beginning phlebotomist. Extensive observation and training in the technique should be completed before an arterial puncture is attempted. The patient could be seriously injured if the arterial sample is not collected correctly. Arterial punctures are used to obtain a sample for blood gas analysis. The blood gas determines the effectiveness of a patient's ability to use oxygen and carbon dioxide. All living cells in the body must absorb oxygen and expel carbon dioxide. The dissolved oxygen in the blood is the PO_2. The dissolved carbon dioxide is the PCO_2. The pH of the blood is a measure of the acid–base balance of the blood. The body carefully regulates blood pH, maintaining it within a narrow range of 7.35 to 7.45, not too acidic (*acidosis*) or too alkaline/basic (*alkalosis*). A pH of 7.40 is a perfect balance. The blood transports these dissolved gases to and from the cells. The arterial blood that has just left the heart and lungs has the highest

concentration of oxygen. The arterial blood has a uniform composition of gases in all parts of the body. The venous blood gas varies depending on cell location. The muscular and metabolic activity of the cells varies the amount of gas the blood contains at different locations in the body. Due to the uniformity of the arterial blood gas, the arterial blood is the sample of choice for blood gas analysis.

A patient's anxiety or excitement can alter his or her breathing pattern and change the composition of the blood gas. Blood gas analysis is best done during a period of *steady state*, when the patient is resting comfortably and has had no recent physical activity or treatments. A period of 20 to 30 minutes is needed for a patient to reach steady state after a physical activity or treatment. A patient who fears needles and the pain associated with arterial blood collection will change rapidly from this steady state. Some health care institutions use an anesthetic solution such as 1 percent lidocaine to numb the skin overlying the site before puncture. If this is done, a 1-mL syringe with a 25-gauge needle is necessary for the injection. Numbing of the skin lessens the pain and prevents hyperventilation, breath holding, and anxiety. A stabilized breathing pattern gives more reliable results.

Hazards

There are two hazards of arterial blood collection. Because of the higher pressure of arterial blood compared with venous blood, a hematoma is more likely. The arteries contain elastic tissue and provide better closure of the puncture site for young to middle-aged adults. For these adults, a hematoma is less likely. The older adult has a decrease in elastic tissue and therefore an increase in the possibility of hematoma. A patient on anticoagulant therapy has an even greater chance of a hematoma.

The second hazard is the possibility of **arteriospasm**, a reflex condition of the artery in response to pain or anxiety. It goes away rapidly but may make it impossible to obtain blood.

Arterial Sites

There are several sites from which an accurate arterial sample can be obtained. A newborn infant during the first 24 to 48 hours of life has large umbilical arteries. A sick infant's respiratory system must be monitored frequently by the measurement of arterial blood gases. This measurement is completed by catheterization of the umbilical arteries. Without catheterization the umbilical arteries constrict rapidly after birth and access by needle is impossible. Shortly after birth the umbilical arteries are catheterized if the infant is premature or ill. Sampling from the catheterized artery is a duty of the infant's physician or specially trained nurse.

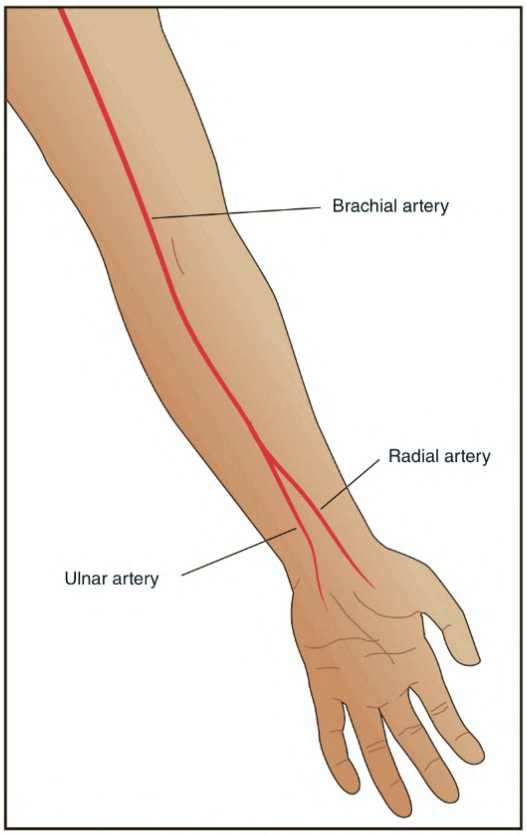
The preferred puncture site in adults is the radial artery, located on the thumb side of the wrist (Figure 6.43). It is easy to palpate, and the patient is less hesitant about a puncture there. The arm and wrist of the apprehensive patient can be held more firmly to prevent movement during sample collection. The artery is also easier to compress due to the underlying bone structure making hematoma formation less likely after arterial puncture. Collateral circulation by the ulnar artery must be checked by use of the Allen test before puncture is made in the radial artery.

Allen Test

The Allen test checks the patient for collateral arterial circulation. This is done so that when accessing the radial artery for blood gas analysis, an alternate artery is functional and supplying arterial blood to the hand. The procedure follows several simple steps.

The brachial artery can be used for arterial punctures but has several disadvantages. Its location deep within the muscles and connective tissues makes palpating and puncture difficult. Major nerves run in the location of the brachial artery, resulting in debilitating nerve damage if they are punctured. Once puncture is completed, it is difficult to compress and stop the bleeding. Therefore, hematoma formation is likely.

The femoral artery is one of the largest arteries in the body. It is located in the groin and can be palpated and punctured easily due to its size. Pubic hair makes cleansing difficult and can lead to infection. The femoral artery is commonly used for cardiac catheterization



▲ FIGURE 6.43 Arteries in the arm.

and is often reserved only for catheterization-type procedures. Patients are often hesitant about arterial samples drawn from the femoral area because of the need to partially disrobe for the procedure. In newborn infants the femoral vein and nerve lie very close to the femoral artery, making puncture of the femoral artery nearly impossible without also injuring the other structures. Due to the many disadvantages of the femoral artery puncture, it is one of the last choices for arterial blood gases. Puncture of the femoral artery is generally reserved for physicians.

ALLEN TEST

1. The patient rests his or her hand on the bed or bedside table with the wrist up.
2. The patient then clenches the fist (Figure 6.44).
3. Using the middle and index fingers of each hand, press on the radial and ulnar arteries (Figure 6.45).
4. While continuing to hold pressure, have the patient unclench the fist (Figure 6.46).
5. The obstructed flow causes a blanching of the palm. Release pressure on the ulnar artery (little-finger side of the wrist).
6. The palm and fingers should show pink about 15 seconds after releasing pressure only on the ulnar artery (Figure 6.47).
7. This pink coloration indicates that the ulnar artery is providing circulation to the hand and is refilling the capillary bed.

continued

8. In a negative test, the hand remains blanched, indicating restricted blood flow of the ulnar artery.
9. With a negative test, the radial artery should not be used and the opposite wrist should be checked for a positive Allen test.
10. If both tests are negative, a Doppler ultrasonic flow indicator test will need to be performed to determine the best arterial puncture site.

▲ FIGURE 6.44 Rest the patient's arm with the wrist up. Have the patient clench the fist.

▲ FIGURE 6.45 Apply pressure to the radial and ulnar arteries simultaneously.

▲ FIGURE 6.46 Have the patient unclench the fist.

▲ FIGURE 6.47 Release pressure on the ulnar artery. The patient's hand should turn pink.

Arterial punctures must be done with special arterial blood sampling kits. The basic equipment consists of the following:

1. An antiseptic solution such as povidone-iodine (Betadine)
2. Gauze squares
3. A preloaded arterial blood gas syringe with a heparin solution of 1,000 international units/mL
4. Various hypodermic needles, generally 22 gauge and ⅝ inch to 1½ inches in length; length depends on location of puncture site
5. Syringes can be 1 to 5 mL in volume
6. Ice water solution or bag of crushed ice

Many types of arterial syringes in sterile prepackaged kits are available. Glass has traditionally been the preferred type of syringe because of the limited exchange of gas through the glass and the ease with which the arterial pressure fills the syringe. Plastic is now the material of choice due to safety concerns of broken glass. The plastic syringes have now become more effective with prefilled heparin and ease of filling without manual aspiration. The exchange of gas through the plastic has become less of a factor. Evacuated tubes should not be used for arterial blood sampling. The tubes alter the partial pressure of the gas in the blood sample.

Arterial Blood Gas Procedure

Patients who are to have arterial blood gases drawn are either on room air or are on an enriched oxygen mixture. The patient can be breathing spontaneously or breathing through artificial ventilation. The amount of oxygen the patient is receiving and expiring must be recorded before the blood gases are drawn. This is recorded as a fraction of inspired oxygen (FiO_2) in percent or prescribed flow rate in liters per minute (L/M). The requirements of what to record vary depending on the health care center. Procedure 6-6 details the process of drawing arterial blood gases from the radial artery.

The site for the draw of the radial artery is located by feeling with the middle or index finger for a pulsing action. Do not use the thumb for palpating. The Allen test is performed. Clean the skin surface with an alcohol prep. Allow the alcohol to air dry. Clean again with povidone-iodine (Betadine). Before using iodine, make sure that the patient does not have any allergies to iodine or shellfish. Paint the skin with the solution. Work from the puncture site to the outside in concentric circles, and then let it air dry. The povidone-iodine (Betadine) is not fully effective until it has dried. The skin is infiltrated on top of the puncture site to produce a small blister with a few drops of 1 percent epinephrine-free lidocaine anesthetic solution using a 25-gauge needle and 1-mL syringe. If the patient is unconscious or an adult patient who is not apprehensive about the arterial puncture, the anesthetic solution may be omitted.

PROCEDURE 6-6

RADIAL ARTERIAL BLOOD GAS PROCEDURE

Principle:

To obtain arterial blood acceptable for laboratory testing as required by a physician.

Sample:

Arterial blood collected by arterial blood collection kit.

Materials:

Sterile prepackaged arterial blood gas kit containing preheparinized syringe, safety needle, and caps

One 1-mL syringe and 22-gauge safety needle

1 percent epinephrine-free lidocaine

70 percent isopropyl alcohol swab

Povidone-iodine (Betadine)

Gauze or cotton balls

Adhesive bandage or tape

Disposable gloves

Biohazard sharps container

Mixture of crushed ice and water

Procedure:

1. Identify the patient. *Inpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify the identification bracelet name and hospital number with the computer label or requisition information. *Outpatient:* Ask the patient his or her name, ask the patient to spell his or her last name, and verify with the computer label or requisition information.
2. Record the amount of oxygen the patient is receiving and expiring.
3. Perform hand hygiene before patient contact. Collect equipment.

continues

continued

PROCEDURE 6-6 RADIAL ARTERIAL BLOOD GAS PROCEDURE

4. Locate the arterial site.
5. Perform the Allen test for collateral circulation.
6. Cleanse the site with alcohol and iodine solution.
7. Put on gloves.
8. Numb the area with 1 percent epinephrine-free lidocaine.
9. Wait 1 to 2 minutes.
10. Clean the venipuncture with 70 percent isopropyl alcohol swab.
11. Position the patient's wrist.
12. Relocate the artery by placing the index or middle finger over the artery to palpate for its size, depth, and direction. Reposition the fingers on both sides of the artery.
13. Puncture the skin about 5 to 10 mL down the length of the artery (toward the palm) from the point the finger is feeling the pulsating artery. The needle of the syringe enters the skin at a 45-degree angle. The bevel of the needle should face the direction of the blood flow (toward the elbow).
14. The phlebotomist will not need to pull on the plunger. The syringe will fill on its own due to the arterial pressure.
15. After collection of the proper amount of arterial blood, the syringe and needle are gently pulled from the puncture site. Activate the safety device on the syringe and needle.
16. Immediately apply pressure to the site for 5 minutes.
17. The needle must be removed from the syringe and placed into a sharps container. All needles must be removed from syringes before they are transported to the laboratory.
18. The removal of the needle will create an opening for air to infiltrate the sample. The opening must be sealed with a special rubber stopper before the sample is sent to the lab.
19. Label the sample.
20. Immerse the sample in an ice/water solution if it cannot be immediately delivered to the laboratory.
21. Recheck the identification bracelet with the labels or requisitions.
22. Label the sample.
23. Check the puncture site. Apply adhesive bandage.
24. Remove gloves and perform hand hygiene.
25. Thank the patient and transport the sample(s) to the laboratory.

The patient's arm should rest on a table or pillow with the palm facing up and the wrist extended to stretch the arteries and tissues. The artery is then relocated by placing the index or middle finger over the artery to palpate for its size, depth, and direction. No tourniquet is used to help locate the artery. The area of the artery that you are going to puncture can no longer be touched except with sterile gloves or fingers that have also been cleaned with the povidone-iodine (Betadine).

Remove the needle cap from the syringe, and hold it as you would a dart. The blood gas syringe from a kit will have the proper amount of heparin in the arterial syringe. Adding heparin to the syringe is not necessary. Place your finger over the location in the artery where you want the tip of the needle to be after it has entered the artery. Puncture the skin about 5 to 10 millimeters down the length of the artery (toward the palm) from the point the finger is feeling the pulsating artery. The needle of the syringe enters the skin at a

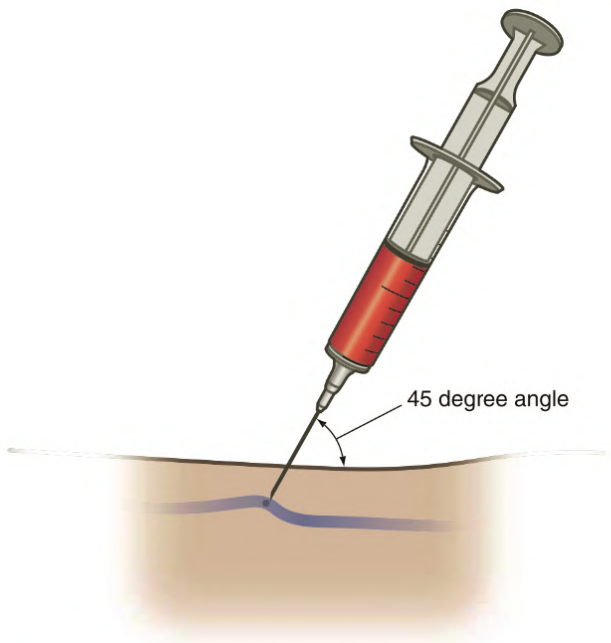
45-degree angle. The bevel of the needle should face the direction of the blood flow (toward the elbow). This procedure places the bevel of the needle in the center of the artery exactly under the finger that is feeling the pulsating artery (Figure 6.48). When the artery is punctured, the blood will flow into the syringe. The syringe will fill on its own due to the arterial pressure. The phlebotomist will not need to pull on the plunger. Once the syringe is filled, the needle is removed from the puncture site and the needle safety device is activated. Pressure must be immediately applied to the site with a gauze pad for 5 minutes. The needle must be removed and the syringe opening sealed with a special rubber stopper. All needles must be removed from samples before they are transported to the laboratory.

An alternate method to draw the arterial sample is to use a butterfly needle to puncture the artery. The needle of the butterfly is inserted into the artery using the same method as the syringe technique. Once the butterfly needle is in the artery, the tubing attached to the needle starts filling with blood with a pulsating action. After all the air is forced out of the tubing, a prepared heparin syringe is attached and the arterial blood obtained. The needle is removed from the patient, and the butterfly tubing is detached from the syringe and replaced with a special rubber stopper. Air must not be allowed to enter the syringe. Any air bubbles that enter the syringe must be expelled before the syringe is stoppered.

Immediately after you remove the needle from the patient's arm, place a dry gauze square over the puncture site and apply pressure for a minimum of 5 to 10 minutes. Patients on anticoagulant blood thinners require a longer time to stop bleeding. Before you leave the patient, check that the artery has not started bleeding again.

Handling of the blood gas sample after collection is critical for accurate results. Properly identify and label the sample at the patient's bedside. Indicate either on the label or on the test requisition the amount of oxygen the patient is on. If the sample is to be analyzed within 20 minutes, the use of a plastic syringe is recommended and the sample should be transported to the laboratory at room temperature.

Samples that will not be tested within 20 minutes are best collected in glass syringes. The sample should be immersed in coolant immediately after collection, labeling, and sealing of the sample. The coolant is a mixture of crushed ice and water large enough to



▲ FIGURE 6.48 Proper position of the needle entering the artery.

immerse the entire barrel of the syringe in the solution. This will maintain the sample at 1° to 5° Celsius. This maintains the accuracy of the sample for approximately 2 hours. Make sure that the marking pen used to label the sample does not rinse off in the coolant solution.

An alternative to the percutaneous collection of arterial blood gases is to collect them by capillary collection through capillary puncture. The patient's finger or infant's foot is warmed before the puncture to obtain the maximum arterial blood flow. The capillary bed of the circulatory system is predominantly arterial blood. Blood from the capillary collection must be collected in heparinized glass capillary tubes and must not contain air bubbles. Blood is collected directly into the end of the capillary tube without letting it run down the finger or foot. Exposure of the blood to air for as little as 10 to 30 seconds can significantly alter the results of the blood gases. After collection, one tip of the tube is sealed with clay or a rubber plug, a magnetic mixing bar is placed into the opposite end of the tube, and that end is then sealed with clay or a rubber plug. The capillary tubes must then be placed on ice immediately. Due to the small size, the capillary tubes are more sensitive to temperature variation. The capillary puncture blood gases are not as ideal as a percutaneous blood gas sample. Capillary puncture is necessary when removing large volumes of blood is threatening to the patient or the arteries are inaccessible. Chapter 7 covers more details of capillary puncture collection.

EXERCISE 5 Radial Arterial Blood Gas Procedure competency assessment (procedure 6-6).

Directions: Fill in the blanks in the procedure steps.

Procedure step	Reason/explanation for the step
Identify the patient by following procedure 6-1	One way to verify the patient information is to ask the patient to _____ his or her name and state their _____.
Record the amount of oxygen the patient is using.	This is recorded as _____ per _____.
Perform the Allen test.	Both the _____ and _____ arteries are occluded.
Clean the site.	For an arterial procedure the site must be cleaned with _____ and _____.
The special blood gas syringe is used to collect the sample.	The needle enters the artery at a _____ degree angle.
The syringe will fill on its own.	Once the syringe is filled, the syringe is placed in _____ if it cannot be delivered to the laboratory immediately.
Complete the procedure by rechecking the patient identification.	Apply an adhesive bandage to the site. To prevent _____.

EXERCISE 6 Requisition Exercise

A phlebotomist goes to a patient's room with the following requisition.

Hometown Hospital USA
125 Goodcare Avenue
Small Town, USA

Laboratory Requisition

Clinic or room number: 2345
Physician Name: Samuel Caregiver
Diagnosis code: 743.89

Sample Collection
Date: xx/xx/xxxx
Time: 1430
Initials: _____

Patient Name: Amanda Allsick
MRN: 1234567
DOB: 8/12/1988
Sex: F

Special Instructions:

Chemistry

X Basic Metabolic Panel
_____ Electrolyte Panel
_____ Hepatic Function Panel
_____ Comprehensive Panel
_____ Ethanol
_____ Acetaminophen
_____ Salicylate
_____ Glucose, Fasting
_____ Glucose Tol. _____ hr
X Hgb A1C

Other Tests

Hematology

_____ CBC without diff
_____ CBC with diff
_____ Reticulocyte count
_____ Sedimentation rate, ESR
_____ Sickle cell screen
X Protime, PT
_____ APTT

Urine

_____ Urinalysis
_____ Urine protein
_____ UUN, urea nitrogen
_____ urine electrolytes
_____ Creat. Clearance (24 hr.)
_____ Urine TOX screen

Microbiology

_____ Culture, urine
_____ Culture, throat
_____ Culture, stool
_____ Ova and Parasite, stool

Serology

_____ Syphilis RPR screen
_____ Mononucleosis screen
_____ ANA screen
_____ Rheumatoid factor screen

Blood Bank

_____ ABO
_____ Rh
_____ Antibody Screen
_____ Type and Crossmatch

Upon examining the patient the phlebotomist realizes that she will need to collect the samples with a butterfly from the hand. What special precautions must the phlebotomist take in collecting the samples? What tubes will the phlebotomist collect and how many of each?

_____

_____

_____

REVIEW QUESTIONS

Multiple Choice

Choose the one best answer.

1. The following items are essential information for sample labeling:
   a. the patient's complete name, identification number, date and time the sample was obtained, and name of the physician.
   b. the patient's complete name, identification number, date and time the sample was obtained, and collector's initials.
   c. the patient's complete name and identification number.
   d. the patient's complete name and the date and time the sample was obtained.
2. A conscious patient does not have an identification bracelet. The name and room number on the door agree with the information on the request. What should the phlebotomist do?
   a. Ask the patient for verbal verification of his or her name
   b. Draw the patient's sample and take it to the laboratory
   c. Do not draw the sample until an identification bracelet has been applied
   d. Draw the sample and then ask the nurse to identify the patient
3. A phlebotomist is requested to go to a patient's hospital room and draw a sample from an unconscious patient. The room number and the name on the door agree with the request form and the patient identification bracelet. What else should be done to ensure patient identification?
   a. Refuse to draw the patient until he or she is conscious
   b. Attempt to find the patient's name on some other item in the room
   c. Nothing else is necessary
   d. Verify the patient's identity from a relative or a nurse
4. An unconscious, unidentified man is admitted to an emergency trauma center. What would be the system of choice to ensure patient identification?
   a. Assign a name to the patient, such as John Doe, and use that name for identification
   b. Assign a number to the patient until the patient can be identified
   c. Wait to process any samples until the patient can be identified
   d. Use a three-part identification system that uses a temporary identification bracelet and labels for samples and blood to be transfused
5. When drawing multiple samples in evacuated tubes, it is important to fill which of the following color-stoppered tubes first?
   a. light-blue
   b. green
   c. lavender
   d. red
6. The doctor orders tests requiring a light-blue–stoppered tube for coagulation studies, a lavender-stoppered tube, a red-stoppered tube, and a set of blood cultures. What is the correct order of draw?
   a. red, light-blue, blood cultures, lavender
   b. blood cultures, light-blue, red, lavender
   c. blood cultures, red, light-blue, lavender
   d. blood cultures, lavender, light-blue, red
7. As a general rule, you should not stick a patient more than _____ in an attempt to obtain blood.
   a. once
   b. twice
   c. three times
   d. four times
8. When you cannot perform a venipuncture successfully after two attempts, you should
   a. try at least two more times.
   b. notify the patient's physician.
   c. ask another phlebotomist to try.
   d. request the test for the next day.

9. Why is the first tube discarded when you are drawing from an indwelling arterial line?
   a. to remove tissue fluid
   b. to wipe away any bacterial contamination
   c. to remove heparin/saline contamination
   d. to make the blood flow faster
10. Which two arteries are occluded when performing the Allen test?
   a. femoral and radial
   b. radial and ulnar
   c. brachial and ulnar
   d. radial and brachial
11. The artery that lies on the thumb side of the wrist is the
   a. popliteal artery.
   b. radial artery.
   c. temporal artery.
   d. ulnar artery.
12. Pressure must be applied to the site of an arterial puncture and maintained for at least
   a. 3 minutes.
   b. 5 minutes.
   c. 10 minutes.
   d. 15 minutes.
13. In performing an arterial puncture, the artery should be punctured using a
   a. 15-degree angle of insertion with the bevel facing the hand.
   b. 15-degree angle of insertion with the bevel facing the elbow.
   c. 45-degree angle of insertion with the bevel facing the hand.
   d. 45-degree angle of insertion with the bevel facing the elbow.
14. An arterial puncture site is more likely to bleed than a venipuncture site because of
   a. higher blood pressure in the arteries.
   b. lack of specific coagulation factors in the arteries.
   c. lack of elastic tissue in the artery wall.
   d. the presence of anticoagulant in the arterial syringe.

CRITICAL THINKING

1. Using your best interpersonal skills, how would you respond to a patient who says she does not want her blood drawn because all phlebotomists hurt her?
2. You have been given an order to draw patient Jane Smith in room 2232. When you go into that room, the patient identifies herself as Jane Smith but the identification bracelet indicates the patient is Jane Smiley. What do you do next?
3. The physician is in the room when you go in to draw blood, and the patient has an IV in the right forearm. The left arm is inaccessible. You need to draw a blood glucose. The physician says that you can go ahead and draw the blood in the median cubital vein of the right arm because all that is running in the IV is saline. What do you do?
4. You come back to the laboratory with a tube of blood and notice that the tube does not have a label. You have one extra label for a patient from whom you were to collect. Do you use this label to label the extra tube?