CHAPTER 14

Arterial Puncture Procedures

STUDY TIPS

- Locate the brachial artery on a partner or yourself, noting how close it is to the pulse of the brachial artery.
- Locate the radial and ulnar arteries on a partner, perform the modified Allen test, and describe both positive and negative results and what each mean.
- List the advantages of various arterial puncture sites on the front of a sheet of paper and disadvantages on the back. Quiz yourself over both.
- Study the ABG analytes in Table 14-1 and radial ABG Procedure 14-3 in the TEXTBOOK.
- The Cautions in Chapter 14 of the TEXTBOOK describe things that you should not do when collecting ABGs. Explain the reason for or the proper procedure to follow for each Caution box.
- Make a table of arterial puncture complications, sampling errors, and specimen rejection criteria. Include descriptions of how to prevent or identify and handle them.

OVERVIEW

Arterial blood composition is more consistent throughout the body than that of venous blood, which varies relative to the metabolic needs of the area it serves. However, arterial puncture is technically difficult and potentially more painful and hazardous than venipuncture. Consequently, arterial specimens are *not* normally used for routine blood tests. The primary reason for performing arterial puncture is to obtain arterial blood gas (ABG) specimens. To ensure accurate test results and the safety of the patient, those who collect arterial specimens must have thorough knowledge of all aspects of collection and special training in arterial puncture procedures. This chapter focuses on personnel who may be required to perform arterial puncture, arterial puncture sites, and site selection criteria, including advantages and disadvantages of using each site. Also covered are ABGs and the analytes measured; ABG specimen collection, including radial ABG procedure; and arterial puncture hazards, complications, sampling errors, and specimen rejection criteria.

REVIEW QUESTIONS

Choose the BEST answer.

1. Arteriospasm is defined as:
   a. artery contraction due to pain, irritation by a needle, or anxiety.
   b. fainting related to hypotension caused by a nervous response.
   c. pain that shoots up the side of the arm after needle penetration.
   d. tingling felt in the fingertips when the needle enters the artery.

2. Formation of a thrombus during arterial puncture can result from an:
   a. extremely tight tourniquet.
   b. impaired collateral artery.
   c. injury to the arterial wall.
   d. unaddressed arteriospasm.

3. Significantly inaccurate ABG values can result from:
   a. collection from a femoral artery.
   b. improperly applied antiseptic.
   c. microclots that are undetected.
   d. testing with a POCT instrument.

4. The integrity of a blood gas specimen can be affected by:
   a. increased vagus nerve activity.
   b. ratio of blood to anticoagulant.
   c. use of a syringe instead of ETS.
   d. use of the anticoagulant heparin.

5. The thumb should not be used to feel for an artery because it:
   a. has a pulse.
   b. is insensitive.
   c. is too large.
   d. is too strong.

6. A patient complication associated with arterial puncture is:
   a. hemolysis.
   b. numbness.
   c. phlebitis.
   d. venostasis.

7. The radial artery is located in the:
   a. antecubital fossa.
   b. crease of the groin.
   c. pinky side of the wrist.
   d. thumb side of the wrist.

8. Why is arterial blood better for blood gas determination than venous blood?
   a. Analytes in venous specimens are not very stable.
   b. Arterial puncture is technically easier to perform.
   c. Composition of arterial blood is more consistent.
   d. Venous blood is subject to more collection errors.

9. The blood gas parameter HCO_3 measures the amount of:
   a. bicarbonate circulating in the blood.
   b. carbon dioxide dissolved in the blood.
   c. oxygen dissolved in the bloodstream.
   d. oxygen that is bound to hemoglobin.

10. Which of the following tests requires an arterial specimen?
   a. Blood culture
   b. Blood gases
   c. Blood glucose
   d. Blood typing

11. Which of the following analytes is routinely part of a blood gas analysis?
   a. CO
   b. NH_3
   c. PaO_2
   d. PO_4

12. Arterial blood gas evaluation would most likely be performed on a patient with:
   a. chronic hepatitis.
   b. hypothyroidism.
   c. osteochondritis.
   d. pulmonary disease.

13. Arterial puncture instruction typically includes:
   a. bedside patient diagnosis.
   b. minimal theory training.
   c. observation of procedures.
   d. practice on other students.

14. One of the main criteria for arterial puncture site selection is based on the:
   a. absence of underlying ligaments.
   b. available equipment in the room.
   c. existence of collateral circulation.
   d. presence of a strong rapid pulse.

15. One reason to favor a site as a choice for arterial puncture is:
   a. a recent puncture can provide a landmark.
   b. an active fistula can be used for the draw.
   c. that an IV in the arm is placed distal to the site.
   d. that it has very little tissue covering the artery.

16. The preferred and most common site for arterial puncture is the:
   a. brachial artery.
   b. femoral artery.
   c. radial artery.
   d. ulnar artery.

17. Which artery is generally easiest to access during low cardiac output?
   a. Brachial
   b. Femoral
   c. Radial
   d. Ulnar

18. The biggest advantage of choosing the radial artery for ABG collection is that:
   a. it can be felt during low blood pressure.
   b. it is easy to compress it to stop bleeding.
   c. it is superficial and very easy to palpate.
   d. it usually has good collateral circulation.

19. Which of the following is a disadvantage of using the radial artery for ABG collection?
   a. It has a high risk of hematoma.
   b. It has no collateral circulation.
   c. It is not easy to fully compress.
   d. It is small and hard to puncture.

20. Which of the following is an advantage of using the brachial artery for arterial blood collection?
   a. It is large and fairly easy to palpate.
   b. It is not as deep as the radial artery.
   c. Risk of hematoma formation is low.
   d. The artery is very easy to compress.

21. One disadvantage of puncturing the brachial artery is that it:
   a. has irregular blood pressure.
   b. has ligaments underlying it.
   c. is superficial and rolls easily.
   d. lies near the median nerve.

22. Which arterial site poses the greatest risk of infection?
a. Brachial
b. Femoral
c. Radial
d. Ulnar

23. Of the following arteries, the *best* choice for arterial specimen collection would be the:
a. brachial artery of an infant or child.
b. common carotid artery in the neck.
c. dorsalis pedis artery of most adults.
d. ulnar artery of a nondominant arm.

24. Supplemental information on an arterial blood gas requisition typically includes:
a. age at onset of respiratory disease.
b. patient activity and body temperature.
c. previous arterial blood gas values.
d. the required blood collection system.

25. Which of the following is required for ABG collection?
a. A 1- to 5-mL self-filling syringe
b. A container full of crushed ice
c. A disposable tourniquet strap
d. A povidone–iodine prep pad

26. Arterial blood gas specimens are collected in syringes rather than tubes because:
a. a syringe holds the right amount of blood.
b. anaerobic conditions are easier to maintain.
c. evacuated tube pressure can change results.
d. the sterility of the specimen is guaranteed.

27. PPE used when collecting arterial specimens includes:
a. gloves and hair cover.
b. lab coat and gloves.
c. N95-type respirator.
d. mask and shoe covers.

28. Commercially prepared arterial sampling kits rarely contain a:
a. 1% lidocaine-filled syringe.
b. cover for the syringe hub.
c. needle with safety device.
d. special heparinized syringe.

29. Heparin is used in arterial sample collection to:
a. increase blood flow in the area.
b. numb the area around the site.
c. prevent clotting of the specimen.
d. stabilize the oxygen content.

30. Lidocaine is sometimes used during arterial puncture to:
a. anesthetize the site prior to the puncture.
b. help dissolve air bubbles in the specimen.
c. keep clots from forming in the specimen.
d. maintain the specimen in an anaerobic state.

31. Prior to ABG collection, a patient should have been in a steady state for at least:
a. 5 to 10 minutes.
b. 10 to 15 minutes.
c. 15 to 20 minutes.
d. 20 to 30 minutes.

32. A patient in a steady state for ABG collection has:
a. been fasting for at least eight hours.
b. been sleeping for at least an hour.
c. had no oxygen therapy for 12 hours.
d. had no suction changes in 20 minutes.

33. The purpose of performing the modified Allen test prior to arterial specimen collection is to:
a. assess patient ventilation status.
b. determine collateral circulation.
c. locate the pulse in the ulnar artery.
d. measure the radial artery pressure.

34. When performing the modified Allen test, which artery is released first?
a. Brachial
b. Femoral
c. Radial
d. Ulnar

35. What constitutes a positive modified Allen test?
a. The blood pressure increases in the radial artery.
b. The color drains from the hand within 30 seconds.
c. The hand color returns to normal in 15 seconds.
d. The pulse in the ulnar artery becomes irregular.

36. Which of the following is proper procedure if the Allen test is negative?
a. Check collateral circulation in the other arm.
b. Collect the specimen from the femoral artery.
c. Perform arterial puncture on the radial artery.
d. Perform arterial puncture on the ulnar artery.

37. A patient who has collateral circulation:
a. does not need respiratory therapy or assessment.
b. does not need to undergo radial artery puncture.
c. has multiple arteries supplying blood to an area.
d. has normal arterial pressure in both wrist areas.

38. Which of the following actions associated with the radial ABG procedure are in the correct order?
a. Assess, position, clean, puncture, fill, expel, label.
b. Clean, position, assess, puncture, fill, label, expel.
c. Label, clean, position, puncture, fill, assess, expel.
d. Position, clean, assess, puncture, fill, expel, label.

39. Which of the following radial ABG specimen collection steps is optional?
a. Administration of local anesthetic
b. Assessment of collateral circulation
c. Determination of current steady state
d. Verification of required conditions

40. Positioning of the arm for radial ABG specimen collection includes:
a. placing the arm higher than the heart.
b. having the dorsal side of the hand face up.
c. having the patient's hand support the arm.
d. extending the wrist approximately 30 degrees.

41. Which of the following would be a reason to terminate an arterial puncture?
a. Bright red blood spurting into the syringe.
b. Missing the artery so that needle redirection is required.
c. The patient's complaints of extreme pain and discomfort.
d. A dark bluish-red color of the specimen.

42. An example of improper antisepsis prior to arterial specimen collection would be:
a. allowing the site to air-dry before puncturing.
b. cleaning the phlebotomist's nondominant finger.
c. maintaining antisepsis at the puncture site.
d. scrubbing the site with alcohol for two minutes.

43. In performing arterial puncture, the needle must be directed:
a. away from the hand, facing the blood flow.
b. bevel down to prevent reflux of the blood.
c. perpendicular to the wrist and lower arm.
d. toward the hand, against the blood flow.

44. Which of the following is an acceptable angle of needle insertion for drawing radial arterial blood gases?
a. 15 degrees
b. 20 degrees
c. 45 degrees
d. 90 degrees

45. The proper angle of needle insertion for drawing femoral arterial blood gas is:
a. 15 degrees.
b. 30 degrees.
c. 45 degrees.
d. 90 degrees.

46. The typical needle used to collect blood from a radial artery is:
a. 18-gauge, 1 in.
b. 22-gauge, 1 in.
c. 23-gauge, 1½ in.
d. 25-gauge, 1½ in.

47. How do you know when you have "hit" an artery during arterial blood gas collection?
a. A flash of blood appears in the syringe hub.
b. Blood immediately seeps around the needle.
c. The pulse in the artery becomes very erratic.
d. The syringe needle bends owing to resistance.

48. Which of the following is the *best* way to tell if a specimen is arterial? As the specimen is collected, the blood will:
a. appear bright red in color.
b. contain small air bubbles.
c. look darker than venous blood.
d. pump or pulse into the syringe.

49. As soon as the needle is withdrawn following ABG specimen collection, the:
a. nurse should apply a special arterial puncture bandage.
b. patient should apply pressure to the site for three to five minutes.
c. phlebotomist should apply a pressure bandage to the site.
d. phlebotomist should apply site pressure for three to five minutes.

50. Proper specimen handling immediately following collection involves:
a. mixing the specimen to prevent clotting.
b. placing the specimen in a green-top tube.
c. only removing excess air bubbles from it.
d. using the safety needle to cap the syringe.

51. After performing arterial puncture, the phlebotomist should check the pulse:
a. distal to the puncture site.
b. in the ulnar artery in the wrist.
c. medial to the puncture site.
d. proximal to the puncture site.

52. What should the phlebotomist do if the pulse is absent or faint following ABG collection?
a. Apply a pressure bandage as soon as possible.
b. Gently massage the patient's wrist and hand.
c. Nothing, because an arteriospasm is expected.
d. Notify the patient's nurse or physician ASAP.

53. An arterial specimen collected in an appropriate plastic syringe is typically transported:
a. at room temperature.
b. in a small heat block.
c. in a cup of ice slurry.
d. vertically in a syringe.

54. Specimens for electrolyte testing in addition to arterial blood gas analysis should be:
a. kept in a heat block during delivery.
b. placed in a cup of ice slurry ASAP.
c. transferred to a red-top test tube.
d. transported at room temperature.

55. If the patient has an elevated white blood cell count, the ABG specimen should be:
a. analyzed within 5 minutes.
b. collected using K_2EDTA.
c. kept in a heat block.
d. mixed continually.

56. Which of the following is a common arterial puncture complication even when proper procedure is used?
a. Arteriospasm
b. Bacteremia
c. Clot formation
d. Hematoma

57. Blood gas specimen rejection criteria include:
a. improper labeling or missing label.
b. inadequate volume of the specimen.
c. visible hemolysis of the specimen.
d. All of the above.

58. Sudden fainting during arterial puncture is:
a. called vasovagal syncope.
b. caused by anesthetic use.
c. related to hypoglycemia.
d. triggered by hypertension.

59. Which of the following is most likely to cause erroneous ABG results?
a. An arteriospasm during the draw.
b. Failure to place the syringe on ice.
c. Microclots present in the specimen.
d. Testing 25 minutes after collection.

60. Which ABG specimen is most likely to be rejected for testing?
a. A specimen drawn in a heparinized syringe.
b. A specimen maintained at 37°C until tested.
c. A specimen that is dark bluish red in color.
d. A specimen that was capped before mixing.

61. Which artery is located on the underside of the wrist on the thumb side?
a. Brachial
b. Femoral
c. Radial
d. Ulnar

62. What is hypoxia?
a. Absence of collateral blood flow
b. Elevated pH level in the blood
c. Decreased blood or fluid volume
d. Low oxygen levels in the tissues

63. Normal blood pH is:
a. 7.25–7.35.
b. 7.35–7.45.
c. 7.55–7.65.
d. 7.65–7.75.

64. What does abducted mean?
a. Directed toward the side of the wrist
b. Facing into the arterial blood flow
c. Out to the side, away from the body
d. Wrist flexed at a 30-degree angle

65. Which of the following is normal ABG procedure?
a. Collect the ABGs in a glass syringe.
b. Deliver specimens to the lab ASAP.
c. Have the patient apply pressure for 5 minutes.
d. Transport the specimen ASAP in an ice slurry.

Answers and Explanations

1. Answer: a

WHY: Pain or irritation caused by needle penetration of the artery muscle and even patient anxiety can cause a reflex (involuntary) contraction of the artery referred to as an arteriospasm. This condition is transitory but can make it difficult to obtain a specimen.

REVIEW: Yes ☐ No ☐

Have some fun by finding this term in the scrambled words activity in the WORKBOOK. Take a look at Matching Exercise 14-1 in the WORKBOOK to see if you can define other key terms.

2. Answer: c

WHY: Injury to the intima, or inner wall of the artery, can lead to thrombus, or clot formation. A tourniquet is not used during arterial puncture. An arteriospasm does not damage the intima. A thrombus can impair the artery drawn, not the one providing collateral circulation. An arterial puncture should not be performed if the artery that provides collateral circulation is already impaired.

REVIEW: Yes ☐ No ☐

3. Answer: c

WHY: Undetected microclots can lead to erroneous results. All acceptable sites for arterial puncture will result in accurate values if the procedure is performed correctly. Applying the antiseptic improperly could result in infection at the site but should not affect testing. Blood cells continue to metabolize at room temperature, so testing the specimen as soon as possible using a point of care testing analyzer would help ensure accurate results.

REVIEW: Yes ☐ No ☐

4. Answer: b

WHY: The integrity of a blood gas specimen can be affected if the blood-to-anticoagulant ratio is not correct. Vasovagal syncope (faintness or fainting due to increased vagus nerve activity on the artery) can occur during arterial puncture but will not affect the integrity of the sample. The ETS system should not be used to collect an ABG specimen because the tube's vacuum can affect test results. Heparin is the anticoagulant of choice for collecting an ABG specimen.

REVIEW: Yes ☐ No ☐

5. Answer: a

WHY: The thumb should never be used to feel for an artery because it has a pulse, which could be misleading in locating an artery.

REVIEW: Yes ☐ No ☐

6. Answer: b

WHY: Numbness is a complication associated with arterial puncture. Hemolysis, the breaking of red cells, is not a complication for the patient but an issue with the blood sample. Phlebitis is inflammation of a vein and not a consideration in arterial puncture. Venostasis is defined as trapping of blood in an extremity by compression of the veins and is usually the result of tying the tourniquet too tight and leaving it in place for too long. A tourniquet is not used for arterial punctures.

REVIEW: Yes ☐ No ☐

7. Answer: d

WHY: The radial artery is located in the thumb side of the wrist. The brachial artery is located in the antecubital area. The femoral artery is located in the groin. The ulnar artery is located in the little finger (pinky) side of the wrist.

REVIEW: Yes ☐ No ☐

8. Answer: c

WHY: Arterial blood is the ideal specimen for many blood tests because its composition is normally consistent throughout the body, whereas the composition of venous blood varies relative to the metabolic needs of the area it serves. Analytes in venous specimens are relatively stable with proper handling. Arterial puncture is technically more difficult to perform. Both arterial and venous blood specimens are subject to collection error.

REVIEW: Yes ☐ No ☐

9. Answer: a

WHY: HCO_3 is bicarbonate. This ABG component is a measure of the amount of bicarbonate in the blood and is used to evaluate the bicarbonate buffer system of the kidneys. Metabolic disturbances alter HCO_3 levels.

REVIEW: Yes ☐ No ☐

10. Answer: b

WHY: The primary reason for performing arterial puncture is to obtain blood for evaluation of arterial blood gases (ABGs). Blood cultures, blood glucose, and blood typing are typically performed on venous specimens.

REVIEW: Yes ☐ No ☐

11. Answer: c

WHY: Arterial blood gas components commonly measured include $PaCO_2$, pH, and PaO_2. PO_4 is the designation for phosphate and is not a blood gas component. NH_3 is the designation for ammonia, which is not a blood gas component. CO

stands for carbon monoxide, which is not part of a routine blood gas analysis.
REVIEW: Yes ☐ No ☐


More routine ABG analytes can be found in Table 14-1 of the **TEXTBOOK**.

12. Answer: d
WHY: Arterial blood gas evaluation is used in the diagnosis and management of respiratory or pulmonary disease to provide information about a patient's oxygenation, ventilation, and acid–base balance.
REVIEW: Yes ☐ No ☐

13. Answer: c
WHY: Personnel who perform ABG procedures are normally certified by their healthcare institutions after successfully completing extensive training involving theory, demonstration of technique, observation of the actual procedure, and performance of arterial puncture under the supervision of qualified personnel. Diagnosis is not part of the phlebotomist's training or duties. Due to the hazardous nature of arterial puncture, practice on other students is not normally part of arterial puncture instruction.
REVIEW: Yes ☐ No ☐

14. Answer: c
WHY: One of the main criteria for arterial puncture site selection is the presence of collateral circulation. The presence—not the absence—of underlying ligaments to support compression is a reason to choose a site. Several different sites can be used for arterial puncture, and the choice of site is never based on what equipment is available in the room or on the phlebotomist's tray. A strong pulse may make it easier to palpate an artery, but a rapid pulse has no bearing on site selection.
REVIEW: Yes ☐ No ☐

15. Answer: d
WHY: An artery that has little tissue covering it is relatively close to the surface. This is a reason to favor the site because it should make it easier to locate and puncture the artery. The presence of an IV, fistula, or recent arterial puncture at the site are reasons to avoid a site as a choice for arterial puncture.
REVIEW: Yes ☐ No ☐

16. Answer: c
WHY: The radial artery (**Figure 14-1**) located on the thumb side of the wrist is the preferred and therefore the first choice and most common site used for arterial puncture. The brachial artery is the second choice. Puncture of the femoral artery (**Figure 14-2**) is typically performed only in emergency situations by physicians and specially trained emergency room personnel. The ulnar artery is reserved to provide collateral circulation to the hand if the radial artery is damaged; it is never used for arterial puncture.
REVIEW: Yes ☐ No ☐

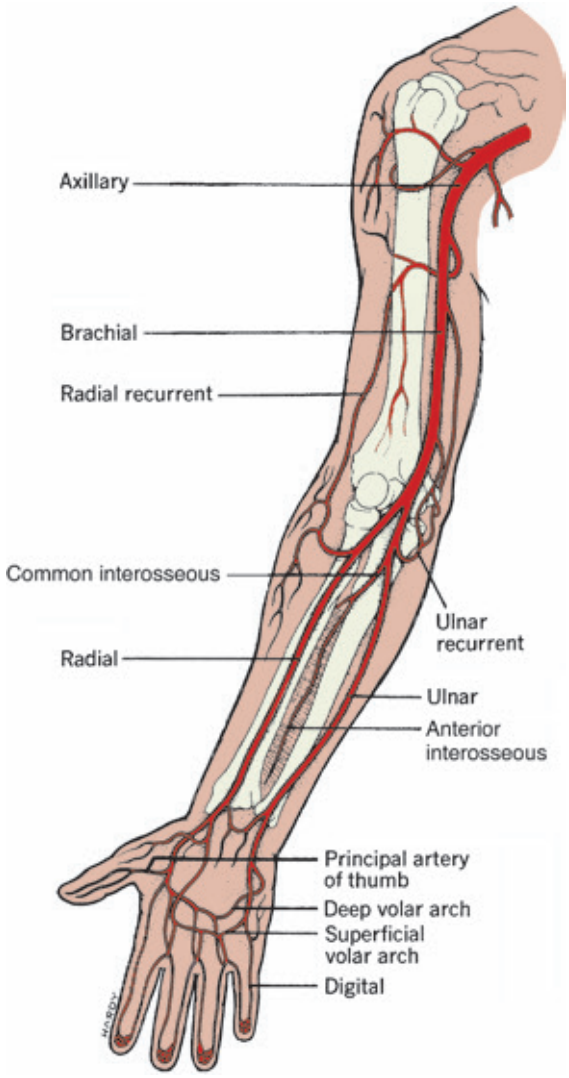

Figure 14-1 Arteries of the arm and hand.

17. Answer: b
WHY: The femoral artery is large and easily located and punctured. It is sometimes the only site where arterial sampling is possible on patients with low cardiac output.
REVIEW: Yes ☐ No ☐

18. Answer: d
WHY: The biggest advantage of choosing the radial artery for ABG collection is that it normally has good collateral circulation. Collateral circulation means that more than one artery supplies blood to the area. If the radial artery were to be inadvertently damaged, the ulnar artery would still supply blood to the hand.
REVIEW: Yes ☐ No ☐

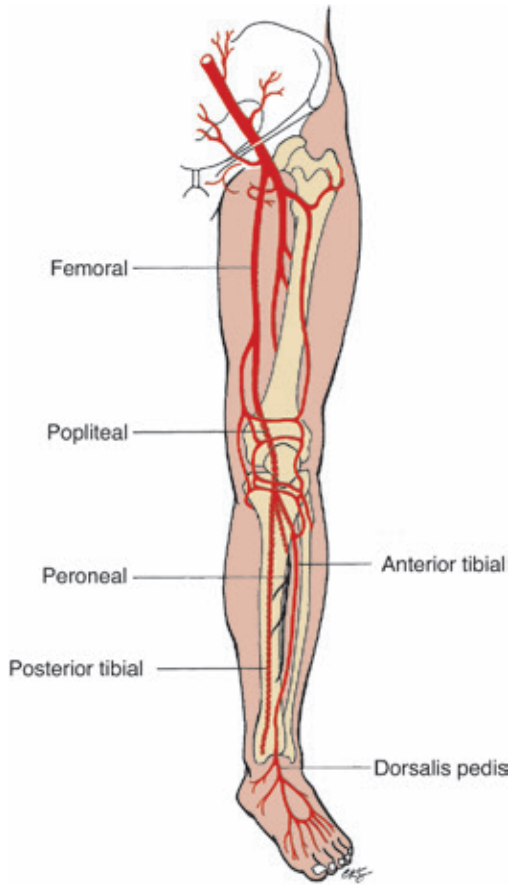

Figure 14-2 Arteries of the leg.

Do WORKBOOK activity Matching 14-2 to test your knowledge of the advantages and disadvantages of all of the arteries commonly used to collect ABGs. Review advantages and disadvantages of all three main arteries used for ABG collection in Chapter 14 of the TEXTBOOK.

19. Answer: d

WHY: One disadvantage of collecting ABGs from the radial artery is that it takes considerable skill to puncture successfully since it is so small. The presence of ligaments and bone in the area makes it easy to compress and decreases the risk of hematoma formation, which are advantages. The presence of collateral circulation via the ulnar artery is also an advantage.

REVIEW: Yes ☐ No ☐

20. Answer: a

WHY: One advantage of using the brachial artery is that it is normally large and relatively easy to palpate. However, it is located deeper than the radial artery, rather than not as deep, which is a disadvantage. In addition, there is increased risk of hematoma formation, not less, because the lack of underlying ligaments or bones to support compression makes it harder to compress.

REVIEW: Yes ☐ No ☐

21. Answer: d

WHY: Disadvantages of puncturing the brachial artery are that it is deeper and harder to puncture than the radial artery; it lies close to the basilic vein and the median nerve, both of which could be inadvertently punctured, and the area lacks bone and ligaments to support compression of the artery after puncture. Blood pressure in the brachial artery should be consistent with the arterial system throughout the body and would not be significantly different than that of the radial artery.

REVIEW: Yes ☐ No ☐

22. Answer: b

WHY: The femoral artery (see Figure 14-2) is located superficially in the groin lateral to the pubic bone. This area poses the greatest risk of infection because its location and the presence of pubic hair make it difficult to achieve an aseptic site.

REVIEW: Yes ☐ No ☐

23. Answer: c

WHY: In addition to the radial, brachial, and femoral arteries, arterial specimens may be obtained from the dorsalis pedis (foot) arteries of adults, scalp and umbilical arteries in infants, and indwelling lines. The brachial artery of a child is not a good choice and is not normally used because it has inadequate collateral circulation. Arterial specimens should not be collected from the carotid artery or the ulnar artery.

REVIEW: Yes ☐ No ☐

24. Answer: b

WHY: An ABG requisition typically includes the patient's body temperature, respiratory rate, method of ventilation or delivery, and patient activity and body position in addition to normal patient identification information. The patient's age at onset of respiratory disease, previous blood gas values, or information on the type of equipment to use is not found on the requisition.

REVIEW: Yes ☐ No ☐

25. Answer: a

WHY: An ABG specimen is typically collected in a 1- to 5-mL syringe. Ice is no longer required for ABG specimen transportation except under special circumstances. A tourniquet is not needed to find an artery and is not used when collecting an arterial specimen. Povidone–iodine is no longer the recommended antiseptic for arterial puncture. The current recommended antiseptic for ABG collection is isopropyl alcohol. Arterial blood gas equipment is shown in **Figure 14-3**.

REVIEW: Yes ☐ No ☐

Figure 14-3 ABG equipment.

See the list of ABG equipment in Box 14-2 in the TEXTBOOK.

26. Answer: c

WHY: Arterial blood gas specimens are not collected in evacuated tubes because the tube pressure or vacuum would alter test results.

REVIEW: Yes ☐ No ☐

27. Answer: b

WHY: Personal protective equipment (PPE) required in collecting arterial specimens includes a fluid-resistant lab coat, gown, or apron, gloves, and face protection. An N-95 respirator is not required unless the patient is in airborne isolation. Hair covering and shoe covering are not normally required.

REVIEW: Yes ☐ No ☐

28. Answer: a

WHY: Commercially prepared arterial sampling kits are available from several manufacturers. A kit typically contains a safety needle, a heparinized syringe with a filter that removes residual air, and a cap or other device to plug or cover the syringe hub after specimen collection to maintain anaerobic conditions. Use of local anesthetic is optional; consequently, equipment to administer local anesthetic (eg, a lidocaine-filled syringe) is not normally part of a prepared ABG kit.

REVIEW: Yes ☐ No ☐

29. Answer: c

WHY: Arterial blood gas tests are performed on whole-blood specimens. Therefore, an anticoagulant is needed to keep the specimen from clotting. The anticoagulant of choice is heparin.

REVIEW: Yes ☐ No ☐

30. Answer: a

WHY: Lidocaine is sometimes used to numb the site before arterial puncture. Although once part of standard arterial puncture procedure, use of a local anesthetic is now optional. The advent of improved thin-wall needles that make arterial puncture less painful has made the routine administration of anesthetic prior to arterial puncture unnecessary.

REVIEW: Yes ☐ No ☐

31. Answer: d

WHY: Current body temperature, breathing pattern, and the concentration of oxygen inhaled all affect arterial blood gas results. Consequently, it is best if a patient has been in a steady state (i.e., no exercise, suctioning, or respirator changes) for 20 to 30 minutes before blood gases are obtained.

REVIEW: Yes ☐ No ☐

32. Answer: d

WHY: Steady state, which is required prior to ABG collection, means that the patient has had no exercise, suctioning, or respiratory changes during the 20 to 30 minutes immediately preceding specimen collection.

REVIEW: Yes ☐ No ☐

33. Answer: b

WHY: The modified Allen test, shown in **Figures 14-4** and **14-5**, is performed to determine the presence of collateral circulation. Collateral circulation means that the area of the body receives blood from more than one artery. Collateral circulation is necessary in case the artery is damaged during arterial puncture. If the patient has circulation through an alternate artery, the area of the body that is normally fed by the damaged artery will receive blood from the alternate artery.

REVIEW: Yes ☐ No ☐

Figure 14-4 Obstruction of radial and ulnar arteries during the Allen test.

Figure 14-5 Ulnar artery released to allow return of blood to the hand.

Test your grasp of the Allen test procedure by doing Skills Drill 14-3 in the WORKBOOK.

34. Answer: d

WHY: The modified Allen test checks for the presence of collateral circulation to the hand via the ulnar artery. Circulation via the ulnar artery is important in case the radial artery is damaged during arterial puncture. Consequently, when one is performing the modified Allen test, the ulnar artery is released first (see Figure 14-5).

REVIEW: Yes ☐ No ☐

Review all of the steps of this important test in Procedure 14-1 in the TEXTBOOK.

35. Answer: c

WHY: When one is performing the modified Allen test, both the ulnar and radial arteries are compressed to stop arterial flow to the hand. With both arteries compressed, the hand should appear blanched, or drained of color. If the patient has collateral circulation, the hand will flush pink or normal color within 15 seconds when the ulnar artery is released even though the radial artery is still compressed. The presence of collateral circulation via the ulnar artery constitutes a positive modified Allen test.

REVIEW: Yes ☐ No ☐

36. Answer: a

WHY: If the modified Allen test result is negative, the patient does not have collateral circulation and arterial puncture cannot be performed on the radial artery of that arm. At this point, the phlebotomist should check for collateral circulation in the other arm. Phlebotomists are not normally trained to perform femoral punctures. Arterial puncture should never be performed on the ulnar artery.

REVIEW: Yes ☐ No ☐

37. Answer: c

WHY: A patient who has collateral circulation has more than one artery supplying blood to that area of the body.

REVIEW: Yes ☐ No ☐

38. Answer: a

WHY: Radial ABG procedure includes the following steps: (1) assess steady state, (2) position arm, (3) clean the site, (4) puncture at a 30- to 45-degree angle, (5) fill the syringe to a proper level, (6) expel air bubbles, and (7) label the specimen.

REVIEW: Yes ☐ No ☐

If your knowledge of radial ABG procedure needs firming up, go over Procedure 14-3 in the TEXTBOOK and Skills Drill 14-4 in the WORKBOOK to assess your knowledge of this procedure.

39. Answer: a

WHY: Administration of local anesthetic to numb the site before arterial puncture is optional. Verification of required conditions, assessment of steady state, and determination of the presence of collateral circulation are mandatory steps of the procedure.

REVIEW: Yes ☐ No ☐

40. Answer: d

WHY: Proper arm positioning before puncture of the radial artery includes having the patient's arm abducted (out to the side), with the palm up and the wrist extended at approximately 30 degrees and supported (eg, by a rolled towel placed under it).

REVIEW: Yes ☐ No ☐

41. Answer: c

WHY: Arterial puncture is typically more painful than venipuncture but should not cause the patient extreme pain. Extreme or significant pain indicates nerve involvement and requires immediate termination of the procedure. It is not unusual for arterial blood to spurt into the syringe during collection. Arterial blood from a patient with pulmonary function problems may be dark bluish-red (because of reduced oxygen content) rather than the typical bright red of normal arterial blood. Slight redirection of the needle to successfully access the artery is acceptable.

REVIEW: Yes ☐ No ☐

42. Answer: d

WHY: Proper antisepsis before collecting an arterial specimen is important. The site must be cleaned using a suitable

antiseptic such as isopropanol and allowed to air-dry. The phlebotomist's nondominant index finger should be prepped in the same manner because it will be used to relocate the artery. Antisepsis of the site must be maintained. Scrubbing the site with alcohol for two minutes is unnecessary and may irritate the skin at the site.
REVIEW: Yes ☐ No ☐

43. Answer: a
WHY: During puncture of the radial artery, the needle with the bevel up is directed away from the hand, facing the arterial blood flow.
REVIEW: Yes ☐ No ☐

44. Answer: c
WHY: The correct angle of needle insertion during radial arterial blood gas collection is 45 degrees (**Figure 14-6**).
REVIEW: Yes ☐ No ☐

45. Answer: d
WHY: The proper angle of needle insertion in collecting femoral arterial blood gases is 90 degrees, owing to the deep location of the femoral artery.
REVIEW: Yes ☐ No ☐

46. Answer: b
WHY: Needles that are 20- to 23-gauge and 25-gauge can be used for arterial puncture, depending on the collection site. However, a 22-gauge 1-in needle is most commonly used for radial artery puncture. Needles 1½ in long are generally reserved for brachial and femoral punctures.
REVIEW: Yes ☐ No ☐

47. Answer: a
WHY: Under normal circumstances, a flash of blood appears in the hub of the syringe when an artery is entered, and blood continues to pump into the syringe under its own power.
REVIEW: Yes ☐ No ☐

48. Answer: d
WHY: Blood pumping into the syringe under its own power is the best way to be certain that a specimen is arterial. Color is not a reliable indicator of successful arterial puncture. Although normal arterial blood is bright red, arterial blood of patients with abnormal pulmonary function may appear almost as dark as venous blood. Arterial specimens do not normally contain air bubbles. Introduction of air into the specimen causes erroneous results and should be avoided.
REVIEW: Yes ☐ No ☐

49. Answer: d
WHY: The phlebotomist should apply manual pressure (**Figure 14-7**) to the site for three to five minutes as soon as the needle is withdrawn following arterial puncture. The patient should never be allowed to hold pressure because they may not apply it firmly enough. A pressure bandage should never be used in place of manual pressure over the site. A pressure bandage can be applied after manual pressure has been held for the appropriate amount of time and bleeding has stopped.
REVIEW: Yes ☐ No ☐

50. Answer: a
WHY: As soon as the ABG needle is removed from the arm, the needle safety feature is activated. The needle is then removed from the syringe, air bubbles are ejected from the specimen, and the syringe is capped with a device that prevents exposure of the specimen to air. The specimen is mixed as soon as possible to prevent clotting and transported to the lab in the syringe. An ABG specimen must be maintained in anaerobic conditions and consequently cannot be transferred to an evacuated tube at any time. In addition, if the blood is drawn into an evacuated tube from the syringe, evacuated tube pressure can affect ABG results negatively.
REVIEW: Yes ☐ No ☐

Figure 14-6 Needle inserted in the radial artery at a 45-degree angle.

Figure 14-7 Clean folded gauze held firmly over the site after needle removal.

51. Answer: a

WHY: After performing arterial puncture, the pulse is checked distal to or below the puncture site to ensure that blood flow is normal and no damage has occurred during the draw. If the pulse is faint or absent, a blood clot, or thrombus, may be obstructing blood flow, and the patient's nurse or physician must be notified immediately so that steps can be taken to restore proper circulation.

REVIEW: Yes ☐ No ☐

52. Answer: d

WHY: An absent or faint pulse following arterial puncture is not normal and indicates that blood flow may be partially or completely blocked by a blood clot, or thrombus. The patient's nurse or physician must be notified immediately so that steps can be taken to restore proper circulation. An arteriospasm does not cause a faint or absent pulse.

REVIEW: Yes ☐ No ☐

An absent pulse is serious; if you aren't sure what to do, see Procedure 14-3 in the **TEXTBOOK**.

53. Answer: a

WHY: An arterial specimen should be transported ASAP according to laboratory protocol. At one time, it was standard procedure to transport ABG specimens on ice. CLSI guidelines now call for transporting ABG specimens at room temperature if they are to be analyzed within 30 minutes of collection. If the patient has an elevated white blood cell or platelet count, the specimen should be analyzed within five minutes of collection. If a delay is expected, the specimen should be collected in a glass syringe and placed in ice slurry.

REVIEW: Yes ☐ No ☐

54. Answer: d

WHY: Specimens for electrolyte testing in addition to ABG analysis should be transported at room temperature. They should never be placed on ice because cooling affects potassium levels. Placing the specimen in a heat block would adversely affect both ABG and electrolyte results. The vacuum draw of a test tube can negatively affect ABG results.

REVIEW: Yes ☐ No ☐

55. Answer: a

WHY: If the patient has an elevated white blood cell count, an ABG specimen should be transported at room temperature and analyzed within five minutes of collection. If analysis cannot occur within five minutes, the specimen should be collected in a glass syringe and transported in ice slurry. ABG specimens should never be placed in a heat block or collected in EDTA. An ABG specimen should not be mixed continually because hemolysis may result.

REVIEW: Yes ☐ No ☐

56. Answer: a

WHY: Arteriospasm is a reflex constriction of the artery, which can occur even when proper technique is used. It can be caused by patient anxiety, pain during the procedure, or irritation caused by needle penetration of the artery muscle. Although this common complication is transitory, it may make it difficult to obtain a specimen. Hematoma, thrombus (clot) formation, and infection are less common complications that are often the result of improper technique.

REVIEW: Yes ☐ No ☐

57. Answer: d

WHY: Blood gas rejection criteria include improper or missing labeling, inadequate volume of specimen, and visible hemolysis of the specimen.

REVIEW: Yes ☐ No ☐

Look up other ABG specimen rejection criteria in Box 14-3 in the **TEXTBOOK**.

58. Answer: a

WHY: Vasovagal syncope is sudden fainting related to hypotension caused by a nervous system response to abrupt pain or trauma. It is not triggered by hypertension or related to hypoglycemia. Use of an anesthetic can result in an allergic reaction but not sudden fainting. Hypoglycemia can make a person feel faint but is associated with a low glucose level and would not come on as suddenly.

REVIEW: Yes ☐ No ☐

59. Answer: c

WHY: Microclots in the specimen can cause erroneous ABG results and machine malfunction. An arteriospasm can make it difficult to collect a specimen but should not affect test results. CLSI guidelines no longer recommend transporting ABG specimens on ice if they are processed within 30 minutes of collection.

REVIEW: Yes ☐ No ☐

Explore other causes of erroneous ABG results in Chapter 14 of the **TEXTBOOK**.

60. Answer: b

WHY: An ABG specimen would be automatically rejected if the syringe were brought to the testing site in a 37-degree heat block or warmer. An ABG specimen should be drawn in a heparinized syringe; it should be capped and mixed

immediately after collection to prevent air exposure and microclot formation. A dark bluish-red color to the ABG specimen may cause suspicion that it is a venous specimen but is not an automatic cause for rejection. Low oxygen content causes some arterial specimens to appear dark bluish-red, or wine-colored, rather than bright red.
REVIEW: Yes ☐ No ☐

61. Answer: c
WHY: The radial artery is located in the underside of the wrist on the thumb side. The brachial artery is found in the medial antecubital AC fossa near the attachment of the biceps muscle. The femoral artery is located superficially in the groin, lateral to the pubis bone. The ulnar artery is located in the underside of the wrist on the little finger side, and is never used for arterial puncture.
REVIEW: Yes ☐ No ☐

62. Answer: d
WHY: Hypoxia is the term for low oxygen levels in the tissues. Hypoxia causes confusion, difficulty breathing, and cyanosis, which are indications that ABG testing is needed. Absence of collateral blood flow means there is not an alternate artery supplying blood to an area. Elevated pH is called alkalosis. Decreased blood or fluid volume is hypovolemia.
REVIEW: Yes ☐ No ☐

63. Answer: b
WHY: Normal blood pH is 7.35–7.45. A higher-than-normal pH is called alkalosis. A lower-than-normal pH is called acidosis.
REVIEW: Yes ☐ No ☐

64. Answer: c
WHY: Abducted means away from the body and out to the side and is the correct position of the arm for arterial puncture. You are cautioned that the needle should *not* be directed toward the side of the wrist when performing radial artery puncture. The needle bevel should be facing into the arterial blood flow when collecting an ABG specimen. The wrist should be extended, *not* flexed at a 30-degree angle during ABG collection.
REVIEW: Yes ☐ No ☐

65. Answer: b
WHY: Most hospital laboratories require ABG specimens to be delivered to the lab within 15 minutes of collection. Normal ABG collection requires a heparinized plastic, *not* glass, syringe. Only if a delay in delivery or testing is expected, are ABGs collected in a glass heparinized syringe and placed in ice slurry. The phlebotomist should be the one to apply pressure for arterial puncture, and *never* the patient.
REVIEW: Yes ☐ No ☐