## Administrative Procedures
- Perform basic administrative medical assisting functions
- Schedule, coordinate and monitor appointments
- Schedule inpatient/outpatient admissions and procedures
- Understand and apply third-party guidelines
- Obtain reimbursement through accurate claims submission
- Monitor third-party reimbursement
- Understand and adhere to managed care policies and procedures
- Negotiate managed care contracts

## Practice Finances
- Perform procedural and diagnostic coding
- Apply bookkeeping principles

## General
### Professionalism
- Display a professional manner and image
- Demonstrate initiative and responsibility
- Work as a member of the health care team
- Prioritize and perform multiple tasks
- Adapt to change
- Promote the CMA credential
- Enhance skills through continuing education
- Treat all patients with compassion and empathy
- Promote the practice through positive public relations

### Communication Skills
- Recognize and respect cultural diversity
- Adapt communications to individual’s ability to understand
- Use professional telephone technique

- Denotes advanced skills.

## Clinical
### Fundamental Principles
- Apply principles of aseptic technique and infection control
- Comply with quality assurance practices
- Screen and follow up patient test results

### Diagnostic Orders
- Collect and process specimens
- Perform diagnostic tests

### Patient Care
- Adhere to established patient screening procedures
- Obtain patient history and vital signs
- Prepare and maintain examination and treatment areas
- Prepare patient for examinations, procedures and treatments

### Operational Functions
- Assist with examinations, procedures and treatments
- Prepare and administer medications and immunizations
- Maintain medication and immunization records
- Recognize and respond to emergencies
- Coordinate patient care information with other health care providers
- Initiate IV and administer IV medications with appropriate training and as permitted by state law

## General
### Instruction
- Instruct individuals according to their needs
- Explain office policies and procedures
- Teach methods of health promotion and disease prevention
- Locate community resources and disseminate information
- Develop educational materials
- Conduct continuing education activities

### Operational Functions
- Perform inventory of supplies and equipment
- Perform routine maintenance of administrative and clinical equipment
- Apply computer techniques to support office operations
- Perform personnel management functions
- Negotiate leases and prices for equipment and supply contracts

## General
### Source:
Reprinted by permission of the American Association of Medical Assistants from the AAMA Role Delineation Study: Occupational Analysis of the Medical Assisting Profession.
Learning Objectives
After completing this chapter, you should be able to:

- Define and spell the terms to learn for this chapter.
- List the components of blood, including the liquid and cellular portions and functions of each.
- Describe how to prepare a patient for collection of a blood specimen via venipuncture and capillary puncture methods.
- Discuss how to process a blood specimen for routine testing in a physician’s office.
- State the normal values for each of the blood tests discussed.

Terms to Learn
antecubital space, hematology, heparin
capillaries, hematopoiesis, plasma
electrolytes, hemoglobin, platelets
erthrocyte sedimentation rate (ESR)

Case Study
MARY O’SHEA, CMA HAS JUST BEEN HIRED AS A MEDICAL ASSISTANT at a physician’s office. The first task that Mary has been asked to do is to obtain blood samples from a male patient. The order in the patient’s chart indicates that blood samples are to be drawn for the following tests: CBC, serum chemistry tests, and a prothrombin time. What method(s) should Mary use to collect the samples?
hematology is the study of blood and the tissues that produce it. Blood and its components are studied to detect pathological conditions and to determine the appropriate course of treatment. Blood analysis is one of the most common diagnostic tests performed in the doctor’s office. As a result, the medical assistant must have a thorough understanding of how to collect, handle, package, and analyze a blood specimen correctly.

The Medical Assistant’s Role
When the physician orders a blood test, the role of the medical assistant is to collect the specimen. The actual testing of the blood is not commonly done in the medical office but rather is done in an outside laboratory that is contracted with the patient’s medical insurance. When a patient’s blood is drawn, the medical assistant must ensure that proper specimen labeling has occurred and that the blood is stored correctly until the laboratory courier has arrived for pickup.

Blood Formation and Components
The formation of blood cells is called hematopoiesis. Hematopoiesis begins at the stem cell level during fetal development. Blood is formed with both cellular and liquid components.

Cellular Formation and Components
All blood cells originate from the hematopoietic stem cell, but mature into one of seven individual cells:

1. Red blood cells (erythrocytes)
2. White blood cells (leukocytes)—five types
   A: Granular leukocytes (have granules in their cytoplasm):
      • Neutrophil
      • Eosinophil
      • Basophil
   B: Nongranular leukocytes (do not have granules in their cytoplasm):
      • Lymphocyte
      • Monocyte
3. Platelets (thrombocytes)

Hematopoiesis occurs primarily in the bone marrow of the adult. Lymphocytes, one of the types of white blood cells (WBCs), are produced in the lymph nodes.

Red Blood Cells
Red blood cells (RBCs) are formed in the bone marrow. They are important for the human body because they contain hemoglobin. Hemoglobin has two functions. The first is to carry oxygen from the lungs to the cells of the body. The second function is to carry carbon dioxide (a waste product) from the body back to the lungs, where it can be expelled with exhalation. When the hemoglobin is carrying oxygen, it is called oxyhemoglobin. When it is carrying carbon dioxide, it is called carboxyhemoglobin. Arterial blood has a higher concentration of oxygen, explaining its bright red color. Venous blood is darker in color because of the carboxyhemoglobin.

The formation of red blood cells is controlled somewhat by erythropoietin, which is secreted by the kidneys in an adult, and by the liver in a fetus. When the amount of erythropoietin is decreased, red blood cells will not be formed in proper amounts, which may result in certain types of anemia. For instance, patients who are being treated with chemotherapy may develop anemia that then can be treated with an artificial erythropoietin called Procrit that assists in the reproduction of red blood cells. Red blood cells last for about 4 months and are continually being reproduced in the body. The normal RBC range for a male adult is 4.5 to 6 million/mm$^3$. The normal female RBC range is 4 to 5.5 million/mm$^3$.

White Blood Cells
White blood cells are also known as leukocytes, which are produced in the bone marrow and are divided into several different types. They originate in the bone marrow from stem cells. White blood cells are larger than red blood cells and their principal function is to defend against infection. The five types of white blood cells are neutrophils, lymphocytes, monocytes, eosinophils, and basophils. The range of WBCs in an adult is 4.5 to 11 thousand/mm$^3$.

NEUTROPHILS Neutrophils are divided into two categories: segmented neutrophils and nonsegmented neutrophils. Segmented neutrophils have a nucleus that is divided into multiple segments connected by small thin threads. Nonsegmented neutrophils are also called stabs (or bands) and are more immature neutrophils than the segmented ones. The presence of a large number of stabs may indicate the existence of a bacterial infection. Neutrophils are named this because the granules are neutral in color on the laboratory-stained slide. The body reproduces neutrophils on an ongoing basis, and they only survive for a few days. Reproduction is increased when bacterial infection is occurring. Neutrophils combat infection by phagocytosis. Phagocytosis is the process in which the neutrophil surrounds, swallows, and digests the bacteria.

EOSINOPHILS Eosinophils are also assumed to be produced by the bone marrow. Detection of a large number of eosinophils can indicate a parasitic condi-
tion or the presence of certain allergic conditions. Eosinophils have granules that produce a red color on the laboratory-stained slide. Eosinophils are called this due to the stain eosin, which is used in the staining of blood smears.

**BASOPHILS** Like the other white cells, basophils are thought to be produced by the bone marrow, and they produce heparin. **Heparin** is a substance that prevents clotting. When an individual has a condition that is creating inflammation, heparin may be used to assist in diminishing or preventing the occurrence of clotting. Increased amounts of basophils may be found in patients who have had their spleen removed. Patients who have had excessive exposure to radiation may also have increased basophils.

**LYMPHOCYTES** Lymphocytes are produced in the bone marrow and in the lymphoid tissue such as the spleen and lymph nodes. The function of lymphocytes is primarily to produce antibodies against foreign substances such as bacteria, viruses, and pollens. Lymphocytes are small and large and can proliferate into B and T cells. B cells may convert into plasma cells, which produce antibodies. T cells can produce helper cells, cytotoxic cells, and suppressor cells. To diagnose an individual with HIV, testing is performed to evaluate the type and amount of T cells present. Lymphocytes do not have granules and are nonsegmented.

**MONOCYTES** Monocytes are formed in the bone marrow from stem cells. Monocytes assist in phagocytosis. They ingest foreign particles or bacteria that the neutrophils are unable to digest and assist in cleaning up cellular debris that may have been left from the infection. An increase in monocytes is seen in patients who have certain diseases such as tuberculosis, typhoid, and Rocky Mountain spotted fever.

**Platelets** Platelets (also called thrombocytes) are the smallest cells found in the blood and are formed in the bone marrow. The main function of platelets is to assist in the clotting of blood. Platelets increase around an area that is bleeding to assist in the formation of clots. The platelets and the injured tissue release thromboplastin. The thromboplastin combines with other elements in the blood to produce thrombin. The thrombin acts on a protein in the blood called fibrinogen, resulting in the formation of fibrin. Fibrin is tiny threads that create a mesh that catches the red cells and other cells to form a clot. There are typically between 150,000 and 400,000 platelets/mm³.

Understanding the process of normal clotting and absence of normal clotting is important because laboratory tests are designed to determine why clotting is not occurring properly, particularly in patients who are receiving anticoagulant drugs such as heparin and Coumadin.

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**Liquid Blood Formation and Components**

For the medical assistant to understand how blood is formed requires a thorough comprehension of the cellular and liquid components of blood. The liquid component of blood is called **plasma**. Plasma is about 55% of the composition of blood and carries cellular elements and other substances. Plasma transports substances in the blood to the different parts of the body. Plasma does contain fibrinogen, which converts to fibrin during the clotting process. Plasma without the fibrinogen is called serum.

Ninety percent of plasma is water, while the other 10% is solid substances, called solutes. These solutes may include the plasma proteins (albumin, globulin, fibrinogen, and prothrombin), **electrolytes** (sodium, potassium, and chloride), glucose, amino acids, lipids and carbohydrates, metabolic waste products (urea, lactic acid, uric acid), creatinine, respiratory gases (oxygen and carbon dioxide), and miscellaneous substances (hormones, antibodies, enzymes, vitamins, and mineral salts).

**Function of Blood**

The function of blood is transportation and protection. It carries oxygen and nutrients to the body and removes the waste product carbon dioxide. The blood carries the waste products to the liver, kidneys, and skin for elimination.
The heart pumps blood through the body by way of the arteries, veins, and capillaries. The capillaries connect the arteries and veins that pump the blood to and from the heart. When blood flows away from the heart it flows in arteries, and when it returns back to the heart it flows through veins. Arteries have thick walls that allow them to withstand the pressure sustained when the heart is pumping. The blood carried in the arteries contains oxygen. This blood with its high level of oxygen sustains tissue function. As oxygen is being released from the blood, carbon dioxide is being transported to the lungs to be expelled as a waste product.

The blood regulates body temperature. When the body becomes warm, the capillaries dilate and release heat, which in turn cools the body. When the body is cold, the capillaries constrict allowing for less blood flow, which increases the body temperature.

Blood Specimen Collection

Laboratory testing of blood and the collection of all blood and body fluids is strictly regulated by OSHA regulations, and the CDC’s Universal Precautions must be followed at all times. CLIA (Clinical Laboratory Improvement Amendments) 1988 requires that certain lab tests be performed only in CLIA-certified laboratories.

Blood specimen collection also involves strict adherence to OSHA guidelines, which are largely based on recommendations from the CDC. It is legal in most states for a medical assistant to perform a venipuncture. Check with the local American Association of Medical Assistants (AAMA) chapter for specifics in your state. When performing basic in-office lab tests, the medical assistant must keep all results confidential. Confidentiality is a moral and ethical obligation for all healthcare team members.

Legal and Ethical Issues

It is legal in most states for a medical assistant to perform a venipuncture. Check with the local American Association of Medical Assistants (AAMA) chapter for specifics in your state. When performing basic in-office lab tests, the medical assistant must keep all results confidential. Confidentiality is a moral and ethical obligation for all healthcare team members.

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Improvement Amendments) sets the standards that all laboratories must adhere to, including training of personnel and testing and transport of specimens (see Chapter 42). It is important when performing specimen collection that the medical assistant follow the regulation guidelines established by these organizations (see Procedure 43-1).

The type and amount of specimen to be acquired is determined by the test to be done. If a very small amount is needed, then the specimen may be obtained by capillary puncture. Larger volumes are collected through venipuncture.

**Venipuncture**

Three methods of venipuncture are used: the vacuum tube method, the syringe and needle method, and the butterfly method (see also Legal and Ethical Issues).

**Methods**

The most common method of venipuncture is the vacuum container method because multiple samples can be obtained at the same time, requiring fewer “sticks” for the patient and faster collection for the medical assistant. In using the vacuum container method, it is important to use a large vein, because the vacuum can collapse smaller veins. If the patient has no accessible larger veins, then it is appropriate to use a small needle with a syringe to obtain the specimen. (See Figures 43-1 and 43-2 and Procedure 43-2 for obtaining venous blood with a sterile syringe and needle.)

The butterfly method uses a needle that is attached to 6-to-12-inch tubing. The end of the tubing can attach to the syringe or the vacuum container tube holder. The butterfly method is used for small veins that are difficult to draw with the standard vacuum container method or syringe and needle method. It is called the butterfly method because the needle on the end has a winged portion that keeps the needle from turning and anchors the needle into the small vein. The needle used for the butterfly method is a small 21-, 23-, or 25-gauge needle. The drawback to performing the butterfly method is the cost. The needle is more expensive than a standard needle. The butterfly method is not used for the majority of blood draws due to its expense.

**Equipment**

Figure 43-3 shows the equipment that a medical assistant will need to perform a venipuncture using the
vacuum container method. All equipment should be assembled and the expiration dates checked prior to attempting to use. Expired tubes should not be used, because they may not have a vacuum. There are various types of tubes, marked by their color. Each tube has a different chemical additive (anticoagulant) to keep the blood from clotting for different types of tests.

- Red top tubes: Contain no anticoagulant and have a sterile interior. A red top tube is typically used for blood bank and serological testing.
- Serum separator tubes (SST tube): these tubes can have a gold top or a red/gray top (sometimes called tiger top or marbled top). The SST tubes contain a gel that separates the serum from the clot after the tube has been centrifuged. These tubes also contain a clot activator that allows the blood to clot faster. SST tubes are routinely used for chemistry testing.
- Lavender/purple top tubes: These tubes contain ethylenediaminetetraacetic acid (EDTA) and are used for testing whole blood or plasma. This tube is used when testing a CBC or glycosylated hemoglobin.
- Green top tubes: These tubes contain heparin and are used for testing whole blood or plasma.
- Light blue top tubes: These tubes contain sodium citrate and are used when testing a PT/INR or PTT (clotting tests).
- Gray top tubes: These tubes contain potassium oxalate and are used when performing a glucose tolerance test.
- Yellow top tubes: These tubes contain Sodium Polyanethol Sulfonate (SPS) and are used when drawing blood for blood cultures.

Some laboratories may use additional tubes. Pink, tan, black, and royal blue topped tubes are sometimes used for specific laboratory tests.

Vacuum blood tubes come in 5-, 7-, 10-, and 15-mL sizes. The amount of blood needed for each test differs, so the tube sizes differ accordingly.
When drawing blood by the vacuum tube method, it is important to fill the tubes in the order of draw recommended by the Clinical Laboratory Standards Institute (CLSI formerly the NCCLS) in order to prevent contamination of the tubes with skin bacteria or with an additive from another blood tube.

1. Blood culture tube (yellow SPS) or bottles – sterile tubes/bottles must always be drawn first so as not to contaminate the specimen.
2. Plain red top – no additive, usually used for blood bank, or to prevent tissue contamination
3. Light blue tube – for coagulation studies
4. SST (red/grey) or gold – both are serum separator tubes, used for most chemistry tests
5. Green or light green – STAT metabolic panels or ammonia levels (make sure tube is put on ice)
6. Lavender – for hematological studies
7. Pink – sometimes used for blood bank
8. Gray – for glucose determinations
9. Dark blue – for heavy metal determinations

The medical assistant must make sure that each blood tube is filled completely. Partially filled tubes, especially the light blue tube, can cause erroneous patient results, resulting in the patient needing to be re-drawn. Upon each tube being filled, the medical assistant should gently invert the tube 6–8 times so the anticoagulant and blood have mixed properly. Care should be taken not to shake the tubes, since that action could cause the blood to become hemolyzed. The process of hemolysis is the releasing of the hemoglobin into the plasma of the cells.

Sites

The antecubital space is the most commonly used site for venipuncture. This is the space just below the joint in the elbow. This space has four large veins that are easy to access, making this the site of choice. The most common vein used is the median cephalic vein (see Figure 43-4). Depending on a patient’s condition, the medical assistant may need to obtain blood using a different site such as the back of the hand or heel of the foot.

Patient Preparation

The blood tests done in a physician’s office typically require little preparation (see Patient Education). For some tests, such as a glucose tolerance test, cholesterol, or lipid level test, the patient should fast for 12 to 14 hours prior to the test. Few other tests require fasting. If fasting is required it is important to educate the patient on how many hours to fast prior to the blood draw. If the medical assistant has any question about issues such as fasting in preparation for the blood draw, a good resource is the laboratory to which the specimen is being sent. Testing labs typically have a lab assistant available to address these questions.
At the time of the blood draw, some patients may be anxious. It is important for the medical assistant to communicate clearly what the process involves in order to assist in alleviating the patient’s fears (see Cultural Considerations). If the patient is a child, the parent’s participation may be helpful in calming the patient. Being prepared at the time of the blood draw can also help in diminishing patient anxieties. A patient is encouraged when sensing that the medical assistant is competent and knowledgeable in performing the blood draw. Competency can be demonstrated by having the appropriate equipment assembled prior to the blood draw and ensuring that the correct blood specimens are drawn correctly. Patients who experience callbacks due to errors such as incorrect specimen handling will lose confidence in the medical assistant and the physician’s office.

Unexpected events can happen when performing venipunctures. These include fainting, nausea, excessive anger exhibited by a patient, and uncontrollable bleeding. It is important that the medical assistant remain calm and deal with these situations professionally. When a patient begins to show signs of fainting, it is important to immediately withdraw the needle and request that the patient place his or her head and arms downward. The patient may need to lie down to further ensure his or her safety while recovering. Often in treatment rooms, ammonia is available and can be used to help revive a patient. If a patient does not immediately respond it is important to call another member of the clinical team for assistance.

When a patient becomes nauseous, have him or her breathe deeply through the mouth and provide an emesis basin if necessary. If a patient becomes angry during the procedure, it is important to remain calm and reassuring. If the behavior continues or is disruptive and endangers either the medical assistant or the patient, the procedure should be stopped immediately and the medical assistant should call for assistance in dealing with the situation.

Occasionally, uncontrollable bleeding can occur when the needle is withdrawn. If this occurs it is important to apply pressure to the site. Once pressure has been applied, it is important to call for assistance. Other complications can make it difficult to perform the procedure or obtain the necessary amount of blood. For example, if a patient has small veins, it is sometimes helpful to apply a hot compress to the area. By doing so the veins may expand and may be easier to access. When veins have a tendency to roll, it is important to place one finger above the area where the needle is to be inserted in order to prevent the vein from moving. An incomplete draw may occur if a patient’s vein does not produce enough blood. If this occurs, it will be necessary to obtain blood from a different vein. Some patients present a challenge to the inexperienced phlebotomist. Requesting that a more experienced professional perform the procedure may be necessary.

When drawing blood the medical assistant should wear personal protective equipment such as:

- Gloves
- Goggles and mask
- Gown or lab coat

Although these items are worn to protect the medical assistant from coming in contact with contaminated items, this attire can also promote a professional image that patients desire in their medical assistant. See Figure 43-5 for an illustration of venipuncture equipment. To perform a venipuncture utilizing the Vacutainer method, review the procedures as outlined in Procedure 43-3.

**Capillary Puncture (Manual)**

Capillaries are the microscopic blood vessels that are the bridges between arterioles and venules. Oxygen and carbon dioxide are exchanged at the capillary level. Small amounts of blood can easily be obtained from the capillaries in a capillary puncture or “fingerstick” (see Figure 43-7).

**Puncture Sites**

Figure 43-8 shows the common capillary puncture sites for adults and infants. When performing capillary punctures, the medical assistant should take precau-
tions to avoid using the thumb and index fingers on the hand of adults, because the skin is thicker there than on other fingers. The tissues on the lateral sides of the fingers are less sensitive than that in the middle, but a larger specimen can be obtained from the medial portions of the fingers. Earlobes are also a common site for adults. When doing a capillary puncture on infants, their fingers are not large enough to yield a sufficient sample, so the heels may be a better option.

**Equipment and Supplies**

Figure 43-9 shows the equipment needed for a capillary puncture. Lancets may be either manual or automatic (see Figure 43-10). The primary advantage of the automatic lancet is that the depth of the puncture is controlled by a spring-loaded mechanism, causing less pain to the patient. After a lancet is used, it should immediately be placed in a sharps container to prevent needle sticks. Procedure 43-4 outlines the process for a manual capillary puncture.

**Routine Blood Tests**

Blood analysis is one vital and routine tool of medicine. The medical assistant performs routine blood tests and procedures in the physician’s office. More complex tests are performed by specially trained individuals, either a medical lab technician (MLT) or medical technologist (MT). Figures 43-12 and 43-13 show different hematology analyzing systems.

Physicians frequently order a complete blood count (CBC). A CBC typically consists of a microhematocrit, hemoglobin, WBC count, RBC count, platelet count, and differential white blood cell count (diff).

The medical assistant may be asked to perform a coagulation test. This test is done to determine how well a patient’s blood is clotting. It is done on a routine basis with patients who are on blood-thinning medications such as Coumadin. This test is called a *prothrombin time*, more commonly referred to as a *protime*. Prothrombin is a protein in the blood plasma that is then converted to thrombin as part of the clotting process.

Often blood tests ordered for patients are ordered in panels. Common panels include the lipid panel and the liver panel. Included in the lipid panel are such tests as cholesterol, triglycerides, and high-density lipid. A liver panel includes tests such as SGOT and SGPT that can be used in the diagnosis of hepatitis. When performing blood tests, it is always essential that the medical assistant utilize the office lab manual to determine how much blood and the specific blood tube required for each test.

Diabetics monitor their blood sugar by the use of a portable machine such as the One Touch (Figure 43-14) or the Accu-chek. A patient who is diagnosed...
Performing a Venipuncture Using the Vacutainer Method

OBJECTIVE: Perform venipuncture by correctly assembling, locating, and entering vein and withdrawing blood sample.

Equipment and Supplies
- biohazard sharps container
- Vacutainer tubes
- multi-sample needle
- 2 or 3 2-inch gauze squares
- alcohol pads
- examination gloves
- Vacutainer sleeve
- tourniquet
- bandage
- cotton balls
- adhesive
- ink pen
- lab coat
- patient record
- ammonia ampules

Note: Follow Standard Precautions and safety guidelines when working with blood samples. Use care to avoid splashing or spilling blood. Wipe up all spills using guidelines established by OSHA.

Method
1. Perform hand hygiene.
2. Assemble equipment (refer to Figure 43-6A).
3. Identify the patient and explain the procedure.
   Ensure the patient is either sitting or lying down.

Rationale: Explaining the procedure helps decrease anxiety. A sitting or lying down position is safer if the patient becomes faint (to prevent falls).

FIGURE 43-6 Venipuncture procedure.
4. Apply examination gloves.

5. Screw the Vacutainer needle into the plastic sleeve (Figure 43-6B). Insert the tube into the other end of the sleeve. The top of the colored stopper should reach the thin guide line on the sleeve. Do not press tube. If the tube exceeds the line, discard the tube; it may not have a vacuum.

6. Apply the rubber tourniquet about 2 inches above the antecubital space (Figure 43-6C). Place the middle of the tourniquet on the posterior (elbow) side of the arm. Crisscross the ends. While holding one end stable, tuck the other end in. This creates a tie that can be quickly released with one hand. In addition, the tourniquet should apply enough tension to engorge the vein with blood.

7. The arm should be in an extended position with the palm facing up. Palpate the vein with your fingertips (Figure 43-6D). If a vein cannot be felt in one arm, try the other.

8. Wipe the site with an alcohol pad in a circular pattern beginning at the insertion site (Figure 43-6E). Let alcohol evaporate. Cleanse your gloved finger with alcohol in case you need to repalpate after site is cleansed.

9. Anchor or “fix” the vein by placing thumb of nondominant hand 2 inches below insertion site and pull skin toward hand. **Rationale:** Veins are superficial and may roll when needle is inserted.

10. While holding onto the tube’s sleeve with your dominant hand, insert needle smoothly and
Performing a Venipuncture Using the Vacutainer Method

1. Insert the needle rapidly at a 15–20-degree angle with the bevel up (see Figure 43-6F). The needle only needs to be inserted just past the bevel. If inserted too far, it will puncture both vein walls. Also keep needle in line with the vein.

11. While stabilizing the sleeve, push the tube into the sleeve. Use your thumb to push the tube and hold sleeve with index and middle finger on the flange (Figure 43-6H).

   **Rationale:** The sleeve must be perfectly stable or needle will damage the fragile vein and will result in a hematoma (bruise).

12. Allow the tube to fill. The vacuum will automatically fill the tube three-quarters full.

13. Remove the tube very carefully without moving the needle and apply a second tube if needed (Figure 43-6I). Gently roll the tube five to six times after removing it from the sleeve to allow the blood to mix with the additive. If both a red and purple tube are needed, collect blood in the red tube that contains no additive first.

14. Release tourniquet once the last tube has been inserted into the adaptor. Fill last tube remove it, and swiftly remove the needle and cover site with a clean gauze pad. Be careful not to push onto the needle when covering the puncture site, since that may cause the needle to scratch the patient’s arm. Gently invert collection tube.

   **Rationale:** the tube must be removed from the adaptor before the needle has been removed or additional bleeding may occur at the puncture site.

15. Immediately have patient apply firm, continuous pressure using a cotton ball or gauze square (Figure 43-6J).

   **Rationale:** Firm, continuous pressure will decrease chance of hematoma (bruise) formation.

16. Properly dispose of needle in biohazard container (Figures 43-6K, 43-6L and 43-6M).

17. Gently invert all tubes collected 8 to 10 times in a figure-eight pattern.

   **Rationale:** RBCs are fragile and may hemolyze if handled improperly.
18. Assess the patient. Check the venipuncture site for bleeding, then apply some cotton and a strip of adhesive or a bandage (Figure 43-6N). Ask if the patient is dizzy or lightheaded.  
*Rationale:* If patient is dizzy or lightheaded, he or she may faint when attempting to stand.

19. Label tubes with patient’s name, date, time, ID number, specimen type, tests to be done, and phlebotomist’s initials. Fill out laboratory requisition sheet (Figure 43-6O).


21. Record procedure on patient’s medical record.

**Charting Example**

2/28/XX | 1.00 P.M.
--- | ---
Withdraw 10 mL of blood from L arm, no complications. Sent blood to in-office lab for CBC.

M. King, RMA
with diabetes may be anxious about performing this test. Proper education of the patient will be helpful in addressing their concerns. A recheck visit or follow-up call to the patient may be necessary to ensure that the patient's comfort level is achieved. This daily test is very critical to address the patient's diabetic condition.

The physician will often order a glycosylated hemoglobin (HbA1C) to test the long-term control of diabetes. For this test it is critical that the patient be instructed to fast. If the patient fails to fast, the test results will be inaccurate. Concerns expressed by the patient regarding his or her medications should be directed to the physician. The physician will then determine if changes in medication must occur. To screen for blood glucose levels in diabetics, a glucometer may be utilized (see Procedure 43-5).

Other tests that a physician may order on a diabetic patient could include the glucose tolerance test. Although this test was traditionally done in a physician's office, it is now done more often in the outpatient department at a hospital. The patient should be given clear instructions as to the location of the outpatient hospital department. Often hospitals provide maps that are useful to provide to the patient. The patient should be informed that this test requires several hours. This is due in part to the preparation, which involves drinking a solution and several blood draws.

Laboratory results are reported from the lab to the physician's office in a variety of ways including phone calls from the laboratory or by copies of the report being faxed or sent by courier. If the medical assistant receives a call from the laboratory with results, it is important to write down the correct results. Often physicians' offices will have standard forms that are used to record laboratory results. Lab slips for common tests such as urinalysis and common blood panels are often provided. This makes the process of recording the phone information easier. If a lab report does come in by phone it must be followed up with the hard-copy containing the results from the lab. The contents of most lab slips include the patient's name, the written results of the test, and the range values. Table 43-1 provides a list of some commonly performed laboratory tests and the range values.
Performing a Capillary Puncture (Manual)

OBJECTIVE: Perform a capillary stick using a lancet or spring-loaded lancet following correct aseptic technique and obtaining an adequate sample.

Equipment and Supplies
- biohazard sharps container
- examination gloves
- alcohol pad
- 2 x 2 gauze square
- lancet or spring-loaded lancet
- capillary tubes
- sealing clay
- ammonia ampules
- bandage
- lab coat

Note: Follow Standard Precautions and safety guidelines. Use care to avoid splashing or spilling blood. Wipe up all spills using guidelines established by OSHA.

Method
1. Perform hand hygiene.  
   Rationale: Hand washing helps prevent the spread of infection.
2. Assemble equipment.
3. Identify the patient and explain the procedure. Have the patient either sitting or lying.
4. Apply examination gloves.
5. Select either the ring or great finger on the nondominant hand. Wipe the site with an alcohol pad. Let alcohol evaporate.
6. Remove plastic protective tip to expose the lancet.
7. Grasp patient's hand and gently squeeze the finger 1 inch below the chosen puncture site.
8. Puncture the site using a quick, jabbing motion across the fingerprints to obtain a full round drop of blood (Figure 43-11A). Do not puncture the direct center of the finger pad since the skin is generally tougher there. Immediately discard lancet in sharps container. (A spring-loaded lancet may also be used.)
9. Wipe away the first drop of blood with a gauze square.  
   Rationale: The first drop contains alcohol and tissue fluid and will not provide accurate test results (Figure 43-11B).
10. Obtain the sample using a microhematocrit capillary tube (Figure 43-11C). The finger may be gently massaged to increase blood flow. Seal one end of the capillary tube in clay sealer (Figure 43-11D).  
   Rationale: The reason for gently massaging rather than squeezing the finger is to avoid mixing the blood with other tissue fluids that may in turn hemolyze the red blood cells.
11. Apply clean gauze over the site and ask patient to apply firm, continuous pressure until the bleeding stops.  
   Rationale: Firm, continuous pressure will decrease hematoma formation.
12. Assess patient and the site. Apply a bandage, if needed. Ask patient if he or she is dizzy or lightheaded.
13. Remove gloves and perform hand hygiene.

Charting Example
2/28/XX 1:30 P.M.
Performed capillary puncture on L ring finger, no complications.  
M. King, RMA

FIGURE 43-11 Capillary puncture procedure.
Microhematocrit Procedure

The microhematocrit (crit) provides the physician with information about the patient’s red blood cell volume. A low hematocrit indicates anemia (decrease in the quantity of circulating RBCs) or hemorrhage. An elevated hematocrit indicates dehydration or polycythemia. A normal hematocrit is 40% to 50% in males and 35% to 45% in females.

To perform a microhematocrit, the patient’s blood must be drawn using capillary tubes. The patient’s finger is cleansed with an alcoholic sponge and then dried with sterile gauze. The patient’s finger is then punctured utilizing an automatic lancet or a manual lancet. The first drop of blood is wiped away with dry sterile gauze. The second and subsequent drops are drawn up using a capillary tube that is either tilted horizontally or slightly downward. When the tip of the tube touches the blood, the tube will automatically draw the blood up by capillary action. The tube should be filled two-thirds to three-quarters of the way full and then sealed on each end. These tubes are then placed in a microhematocrit centrifuge that

<table>
<thead>
<tr>
<th>Table 43-1 Common Laboratory Tests and Their Normal Values</th>
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<tbody>
<tr>
<td>Total cholesterol</td>
</tr>
<tr>
<td>Glucose</td>
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<tr>
<td>Triglycerides</td>
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<tr>
<td>Creatinine</td>
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<tr>
<td>Uric acid</td>
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<td>BUN</td>
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<td>Sodium</td>
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<td>CO₂</td>
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<tr>
<td>White blood cell count</td>
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<tr>
<td>Red blood cell count</td>
</tr>
<tr>
<td>Hemoglobin</td>
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<tr>
<td>Hematocrit</td>
</tr>
<tr>
<td>Sedimentation rate</td>
</tr>
<tr>
<td>Platelet count</td>
</tr>
</tbody>
</table>
For some medical assistants, blood draws can be both challenging and rewarding. If you find that performing laboratory tests are not your strength, be sure to work on this area while you are still in school. Ask your instructor to provide extra time in class or outside of class to test your skills. When selecting an externship, it will be important to select one that will continue to provide you encouragement and assistance in gaining skills in this area. Communication regarding areas that continue to be challenging will be important so that the right type of help can be provided to you so that your skills can be developed. With some assistance and practice, you will become proficient.

### Screening for Glucose (Blood Sugar) Level

**OBJECTIVE:** Determine blood glucose level using a glucometer.

**Equipment and Supplies**
- sterile lancet; reagent strips; glucometer; examination gloves; cotton balls; alcohol sponges; gauze squares; watch or clock; pen; lab coat; patient’s record

**Method**
1. Identify the patient and make sure the patient is fasting if required.
2. Assemble the equipment and supplies.
3. Make sure the glucometer has been turned on the required amount of time and has been calibrated for accuracy according to the manufacturer’s instructions.
4. Wash hands and put on examination gloves.
5. Perform a capillary blood puncture utilizing a sterile lancet.
6. Remove a plastic reagent strip from the bottle without touching the chemically treated portion.
7. Apply a large drop of blood from the capillary puncture to the chemically treated area so that it is completely covered.
8. Immediately begin timing for the duration specified by the manufacturer.
9. When the duration specified is complete, place the reagent strip into the glucometer and close the door.
10. At this time provide the patient with a dry gauze square to hold over the puncture site after wiping the site with an alcohol sponge.
11. Record the number of mg (milligrams) of glucose per 100 mL (milliliters) as displayed by the instrument.
12. Discard all used equipment and supplies. Remove gloves and wash hands.

**Note:** Several different types of testing instruments may be used to perform this test. It is critical to follow the manufacturer’s instructions for the testing equipment provided.

### Hemoglobin Determination

Hemoglobin (Hgb) provides the physician with information regarding the amount of hemoglobin present in the sample. A low Hgb may indicate iron-deficiency anemias, while elevated readings are present in patients with polycythemia and in extreme situations, such as burns. Normal values for adult females are 12 to 16 g/dL, and for males 14–18 g/dL.

Hemoglobin can either be measured by an automated blood analyzer or manually by using a hemoglobinometer (see Figures 43-16, 43-17, and 43-18). Typically, the manual method is less accurate and not as reliable as the automated blood analyzer.

Hemoglobin values can be determined utilizing two methods: the specific gravity method or the cyanmethemoglobin method. The specific gravity method is a screening method for blood donors. The cyanmethemoglobin performs cellular separation. For the complete procedure, review Procedure 43-6 and Figure 43-15.
Performing a Microhematocrit

OBJECTIVE: Perform a microhematocrit on a capillary blood sample using proper aseptic technique.

Equipment and Supplies
- biohazard sharps container; examination gloves; capillary tubes; sealing clay; microhematocrit centrifuge; whole blood; hematocrit card or other reader

Note: Follow Standard Precautions and safety guidelines when working with blood samples. Use care to avoid splashing or spilling blood. Wipe up all spills using guidelines established by OSHA.

Method
1. Perform hand hygiene and apply examination gloves.
2. Assemble equipment as shown in Figure 43-15A.
3. Fill two capillary tubes three-quarters full. The blood specimen can be obtained from a vacuum tube of anticoagulated blood using a plain capillary tube or directly from a fingerstick site using a heparinized capillary tube. Seal one end in the sealing clay.
4. Place capillary tubes in centrifuge with the sealed ends against the rubber gasket (Figure 43-15B). If more than one patient’s blood is being tested, mark down the number of the slot the patient’s tube is in. Spin for 3 to 5 minutes at 10,000 rpms. (Always check manufacturer’s recommendations for proper time and speed.) After centrifuging, the sample will be separated into three layers:
   - Top layer is the plasma.
   - Middle layer, or the buffy coat, is made up of WBCs and platelets.
   - Bottom layer is packed RBCs.
5. Remove tubes immediately after centrifuge stops. Rationale: If tubes are not removed immediately, blood may begin to mix together.
6. Determine results. Use the Hct card by placing the sealing clay just below the zero line on both tubes. Then on both tubes match the top of the plasma with the 100 line. Read results on both tubes directly below the buffy coat. Then add those results together and divide by 2.
7. Discard tubes into sharps container.
8. Remove gloves and perform hand hygiene.
9. Record the value as a percentage on the patient’s medical record.

Charting Example
2/28/XX 1:45 P.M. Hct 47%

M. King, CMA

FIGURE 43-15 (A) Centrifuge and supplies; (B) loading a centrifuge.
6.0 million/mm$^3$. An increase in the number of circulating RBCs may indicate polycythemia, whereas a decrease may indicate anemia. A manual RBC count is similar to a manual WBC count. Both require small samples of the specimen to be diluted in a special solution. Then the sample is placed on a hemocytometer, which is placed on a microscope used to count the red and white blood cells.

Automated testing for RBCs is more common than manual testing. Always follow the machine’s procedure manual exactly. The manual method of counting red blood cells is done with the hemacytometer.

**Differential White Blood Cell Count**

A differential white blood cell count (diff) determines the percentages of each type of WBC, RBC morphology, and platelet estimation. Performing this test manually is a skill that requires practice to achieve proficiency. The testing is done using a microscope with a bright light

**Red Blood Cell Count**

Normal RBC volume in an adult female is 4.5 to 5.0 million/mm$^3$. In the adult male, it is about 5.0 to 6.0 million/mm$^3$. An increase in the number of circulating RBCs may indicate polycythemia, whereas a decrease may indicate anemia.

A manual RBC count is similar to a manual WBC count. Both require small samples of the specimen to be diluted in a special solution. Then the sample is placed on a hemocytometer, which is placed on a microscope used to count the red and white blood cells.

Automated testing for RBCs is more common than manual testing. Always follow the machine’s procedure manual exactly. The manual method of counting red blood cells is done with the hemacytometer.
Red Blood Cells

RBCs are the most numerous, are salmon colored, and appear oval with a slightly pale center. RBCs have no nucleus or granules. RBCs with a nucleus are called reticulocytes (immature RBCs). Normal looking RBCs are recorded as “normal RBC morphology.”

Platelets

Platelets are the smallest of the formed blood elements. They are about half the size of a RBC. They stain purple.
and tend to appear in a clump, although they may also exist singly. They appear if they have a rough outer edge and contain small granules. There are between 200,000 and 300,000 platelets per cubic millimeter of the blood. There are typically between 5 and 20 platelets in one field of view. If this number is counted, then record the platelet count as “adequate platelet estimation.”

### White Blood Cells

There are five types of white blood cells, each of which has a distinct identifying characteristic when using the Wright's staining method. Count 100 WBCs, then express each of the cell types as a percentage. Normal values for adults are:

- Neutrophils 50–70%
- Eosinophils 1–4%
- Basophils 0–1%
- Lymphocytes 20–35%
- Monocytes 3–8%

Values may differ between manual and automated analyses.

### Granulated White Blood Cells

The neutrophil, or seg, is the most numerous WBC. The neutrophil has small cytoplasmic granules that stain pink or lilac with a multilobed nucleus with small strands connecting each of the lobes, which stain purple. A band neutrophil is an immature neutrophil. It appears similar to the neutrophil except that the nucleus is nonsegmented and curved with a band-like structure. Cytoplasmic granules stain blue to pink.

Eosinophils have segmented nuclei and large, reddish staining granules that are found in the cytoplasm. Basophils are rarely seen in a diff count. This WBC has an S-shaped nucleus and large, irregularly shaped purplish-blue granules that almost entirely cover the nucleus.

### Angranulocytic White Blood Cells

Lymphocytes have a single round or lightly indented nucleus, which almost completely fills the cell. The cytoplasm is clear and stains a pale blue. Lymphocytes are the smallest WBC.

Monocytes are the largest WBC and have a distinct kidney-bean-shaped nucleus. The cytoplasm is abundant and clear, and it stains a grayish blue.

### Erythrocyte Sedimentation Rate

The erythrocyte sedimentation rate (ESR) (also called the sed rate) measures the rate at which RBCs settle at the bottom of a tube. Drawing a patient's ESR can be done utilizing either the Wintrobe or Westergren method.

When performing the Wintrobe method, the Wintrobe tube is calibrated in mm/hr. The rate is the height of the RBCs in the bottom of the tube (see Procedure 43-9 and Figure 43-22).

Depending on the type of method used, the normal values may vary. Utilizing the Wintrobe method the normal ESR in an adult female is 0 to 20 mm/hr and in an adult male 0 to 9 mm/hr. Increased values may mean inflammation. An individual's ESR may also be elevated due to a variety of reasons including menstruation, pregnancy, and malignant tumors.

An ESR itself is not diagnostic, but it is used in conjunction with other tests for diagnosis. As an example, when testing for rheumatoid arthritis or fibromyalgia, an ESR may be done in conjunction with the antinuclear antibody test (ANA).

The sed rate is related to the condition of the red blood cells and the amount of fibrinogen in the plasma. When an individual presents with a disease, the surfaces of the membranes of the cells are affected. When a sed rate test is conducted on a patient, the rate at which the RBCs fall indicates the existence of possible conditions.

### Phenylketonuria

Phenylketonuria (PKU) is a congenital disease caused by a defect in the metabolism of the amino acid phenylalanine. The unmetabolized protein accumulates in the bloodstream and, if undetected and untreated, will result in mental retardation. The PKU test is always performed on newborns to determine the presence of the unmetabolized protein phenylalanine. The test is typically performed in the hospital but may be performed in the office if not done in the hospital. To perform the PKU test see Procedure 43-10.

### Mono Testing

The mono test, which is also known as the mononucleosis spot test, is used to help determine whether a patient has infectious mononucleosis (see Procedure 43-11). It is frequently ordered along with a CBC (complete blood count). A step test may be ordered with the mono test to determine whether a person's sore throat is due to a streptococcal infection instead of or in addition to mononucleosis.

A mono test is primarily ordered when an adolescent patient has symptoms such as fever, headache, swollen glands, and fatigue that the doctor suspects are due to infectious mononucleosis. The test may be repeated when it is initially negative but suspicion of mono remains high. The physician may order a repeat test in a week or so to see if heterophile antibodies
OBJECTIVE: Prepare a slide for a differential WBC count using correct aseptic procedure.

Equipment and Supplies
- clean, glass slides; whole blood (EDTA); examination gloves; biohazard container; eye dropper; Wright's stain; lab coat; ink pen; patient record

Note: Follow Standard Precautions and safety guidelines when working with blood samples. Use care to avoid splashing or spilling blood. Wipe up all spills using guidelines established by OSHA.

Method
1. Perform hand hygiene and apply examination gloves.
2. Assemble equipment.
3. Obtain a whole-blood sample using EDTA as the anticoagulant of choice. Blood must be mixed thoroughly before use.
4. Using a dropper, place one drop of room temperature blood on the end of a clean, glass slide (Figure 43-20A).
5. Using the short side of another clean, glass slide, back the slide to the drop of blood. Allow the blood to spread across the short side of the slide (Figure 43-20B). Holding the spreader slide at a 30-degree angle, spread the blood across the length of the slide (Figure 43-20C). Use gentle,
continuous pressure, and a smooth gliding motion to create a smear as pictured in Figure 43-20D. Notice that the smear has a thick side that gradually changes to a thin side. The thin side has a feathered edge, and the blood covers one-half to three-quarters the length of the slide.

6. Allow the slide to air dry on a rack (Figure 43-21A).

Rationale: Air drying will not distort cells.

7. Label on the frosted edge of the slide with patient’s name and the date.

8. Stain slide using Wright’s staining method. Flood slide with stain for exactly 45 seconds or amount of time indicated by manufacturer (Figure 43-21B).

9. Rinse with distilled water as in Figure 43-21C. Rinse until water is clear (Figure 43-21D).

10. Allow slide to air dry before examining under the microscope.

11. Abnormal findings may need to be referred to a laboratory technician for analysis. Record results on the patient’s medical record.

Charting Example

<table>
<thead>
<tr>
<th>2/28/XX</th>
<th>2:15 P.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential cell count: neutrophils 62%, lymphocyte 28%, monocytes 5%, eosinophils 5%, basophils 0%, RBC morphology—normal, adequate platelet estimation.</td>
<td></td>
</tr>
</tbody>
</table>

M. King, RMA

FIGURE 43-21 Wright’s staining process.
Performing an Erythrocyte Sedimentation Rate Test Using the Wintrobe Method

**OBJECTIVE:** Perform an ESR using the Wintrobe tube method and aseptic technique.

**Equipment and Supplies**
- examination gloves
- whole blood (EDTA)
- Wintrobe tube
- Wintrobe rack
- ink pen
- patient’s record
- lab coat
- biohazard sharps container

**Note:** Follow Standard Precautions and safety guidelines when working with blood samples. Use care to avoid splashing or spilling blood. Wipe up all spills using guidelines established by OSHA.

**Method**

1. Perform hand hygiene and apply examination gloves.
2. Assemble equipment.
3. Obtain a whole-blood sample using a purple top tube. Mix well. EDTA is the anticoagulant of choice.
5. Adjust meniscus of specimen to the zero line at the top of the tube.
6. Maintain the tube in an upright vertical position for 1 hour.
7. After 1 hour record the number of RBCs that settle. Read the ESR on same side of tube of zero line at the top.
8. Remove gloves and perform hand hygiene.
9. Record procedure on the patient’s medical record.

**Charting Example**

2/28/XX 2:00 P.M.

ESR (Wintrobe Method) 10 fall of cells/hr.

M. King, RMA

**Rationale:** Air bubbles will distort the results.

If a patient has a positive mono test, an increased number of white blood cells, reactive lymphocytes, and symptoms of mononucleosis, then the patient will be diagnosed with infectious mononucleosis. If symptoms and reactive lymphocytes are present but the mono test is negative, then it may be too early to detect the heterophile antibodies, or the affected patient may be in the small number of people who do not make heterophile antibodies. Other EBV antibodies and/or a repeat mono test may be performed to help conform or rule out the mononucleosis diagnosis.

Patients with negative mono tests and few or no reactive lymphocytes may be infected by another microorganism that causes mono-like symptoms (such as a cytomegalovirus or toxoplasmosis). If the infection occurs during pregnancy, it is important to determine the cause, because some of the mono-like infections (but not EBV infection) have been associated with pregnancy complications and damage to the fetus. It is also important to identify strep throat, whenever present, because it should be treated promptly with antibiotics.
**43-10**

**PROCEDURE**

**Performing a PKU Test**

**OBJECTIVE:** Collect blood specimen for PKU testing.

**Equipment and Supplies**
- sterile lancet; alcohol sponge; examination gloves;
- sterile dry gauze; special filter paper card, typically supplied by the State Health Department

**Method**
1. Perform hand hygiene and don examination gloves.
2. Cleanse the infant's heel with an alcohol sponge.
3. Puncture the lateral portion of the infant's heel with a sterile disposable lancet.
4. Wipe puncture site with a dry sterile gauze.
5. Allow large blood droplet to form.
6. Touch the blood droplet to the center of the circle on one side of the special filter paper card.
7. Ensure the blood has completely soaked through the paper card by looking at the reverse side.
8. Fill all required five circles on the paper card.
9. Do not squeeze heel excessively to avoid collecting tissue fluid mixed with blood.
10. Set card in an appropriate area to air dry for 2 hours at room temperature.
11. When completely dry place in the state-provided envelope and mail within 48 hours.

**43-11**

**PROCEDURE**

**Performing a Mono Test**

**OBJECTIVE:** Student will perform a mono test.

**Equipment and Supplies**
- antiseptic cleaner; biohazard waste container; disposable lancet; disposable gloves; capillary tube; test tube; mono test diluent; mono test stick(s); blood specimen

**Method**
1. Perform hand hygiene.
2. Don gloves.
3. Assemble equipment and supplies.
4. Perform a fingertip stick on patient.
5. Fill a capillary tube end to end, dispensing all of the blood into the test tube.
6. Slowly add 1 drop of diluent to the bottom of the test tube.
7. Mix.
8. Remove the test stick(s) from the container. Recap the container immediately.
9. Place the absorbent end of the test stick into the treated sample. Leave the test stick in the test tube.
10. Read result at 5 minutes. Positive results may be read as soon as the red control line appears.
11. Discard used test tubes, lancet, and test sticks in the biohazard waste container.
12. Remove gloves and dispose of them correctly. Perform hand hygiene.
13. Document findings in patient record:
   - **Positive:** A blue test line and a red control line is a positive result.
   - **Negative:** A red control line but no blue test line is a negative result.

**Note:** While the medical assistant is responsible for reporting abnormal (or positive results in the case of a mono test) to the physician, “interpreting” such tests as being positive or negative is NOT within the scope of practice for the medical assistant as such, should never be done. The medical assistant is only allowed to report the findings of “positive” or “negative.”

14. Clean work area and equipment according to OSHA guidelines.
SUMMARY

The proper collection, handling, and processing of blood specimens are vital to reliable test results. In addition, it is critical that a medical assistant has a thorough understanding of patient preparation and the theory of blood formation, including the cellular and liquid components of blood. Lastly, knowledge of and competency in, the performance of routine blood tests—CBCs, differentials, hemoglobins, microhematocrits, ESRs—are essential to proper patient care.

Chapter Review

COMPETENCY REVIEW

1. Define and spell the terms to learn for this chapter.
2. List, in order, the steps for performing a venipuncture.
3. Prepare a list of the different types of venipuncture collection tubes. Explain what makes each unique and the order in which they should be used.
4. Make a list of the types of white blood cells and the values of each that are expected in a normal differential.
5. Create a normal list (for male and female where applicable) for the WBC, RBC, Hct, Hgb and ESR.
6. List the equipment needed to perform an erythrocyte sedimentation rate test.

PREPARING FOR THE CERTIFICATION EXAM

1. A collection of blood below the surface of the skin is called:
   A. hematoma
   B. hemolysis
   C. hematemesis
   D. hematuria
   E. hematology

2. Which type of blood collection tube contains a clot activator and a gel that permanently separates the serum from the clot after centrifugation?
   A. red top
   B. purple top
   C. green top
   D. marbled top
   E. gray top

3. The best vein to use in order to obtain a venous sample of blood is the:
   A. median cephalic
   B. medial cubital
   C. basilic vein
   D. accessory cephalic
   E. small vein in the hand

4. The most commonly used anticoagulant for blood tests is
   A. heparin
   B. potassium oxylate
   C. sodium citrate
   D. potassium citrate
   E. EDTA

5. When drawing blood for a PT/INR and/or a PTT, which type of blood collection tube should be used?
   A. red top
   B. purple top
   C. green top
   D. light blue top
   E. gray top

6. If an angle of more than 15 degrees is used when inserting a needle into a patient’s arm:
   A. the needle may not puncture the vein
   B. the needle may break
   C. the needle may go through both vein walls
   D. the blood sample will hemolyzed
   E. a significant degree of pain will be caused

continued on next page
7. If the blood collection tube is pushed past the thin guideline on the plastic sleeve:
   A. blood will hemolyze
   B. the needle will dull
   C. the vacuum may be compromised
   D. blood will enter the tube too quickly
   E. the blood sample will be contaminated

8. Another name for a capillary puncture is a:
   A. fingerstick
   B. arterial blood draw
   C. phlebotomy
   D. arterioles draw
   E. venipuncture

9. The purpose behind applying pressure and a gauze or bandage after a capillary puncture is to:
   A. prevent an infection by keeping the site sterile
   B. decrease the likelihood of hematoma
   C. cause a sterile clot to form
   D. prevent the spread of infection
   E. reassure the patient that the procedure has ended

10. When performing an ESR, how long should the sample sit?
    A. 20 minutes
    B. 40 minutes
    C. 60 minutes
    D. 80 minutes
    E. 90 minutes

CRITICAL THINKING
1. What method(s) should Mary use to collect the samples?
2. What type of Vacutainer tubes should she use to collect the samples?
3. What individual tests comprise a CBC?

ON THE JOB
It is Wednesday and Drs. Joseph and Burg are not seeing patients. The office though is open for blood draws. Angie, a medical assistant, is in the office alone.

Matt, a 17-year-old upcoming college freshman, has just arrived to have his labs drawn so that Dr. Joseph can complete Matt’s college physical. He is extremely nervous, although he is trying very hard to exhibit a relaxed manner. Angie tries to reassure Matt, but the more she tries, the more nervous he gets. At Matt’s urging to “just get it over with,” Angie decides to go ahead and draw his blood. Unfortunately, as soon as the first collection tube begins to fill with blood, Matt notices it and slumps forward. He has fainted. What should Angie do?

What is your response?
1. What is the first thing that Angie should do?
2. Was Angie at all negligent in drawing Matt’s blood given that he was extremely nervous?
3. Does the fact that Matt is a minor influence how Angie should handle this situation? If so, how?
4. Does Matt have some level of complicity in this incident? If so, describe.
5. Is this considered a medical emergency?
6. Would the situation have been different or handled differently if Angie hadn’t been alone?
7. Does an incident report of some sort need to be filed? If so, what should be included and who should receive a copy?

INTERNET ACTIVITY
Go online and research materials to further understand OSHA regulations, the Centers for Disease Control and Prevention (CDC) Standard Precautions, and the laboratory regulations established by CLIA 1988.

MediaLink More on hematology, including interactive resources, can be found on the Student CD-ROM accompanying this textbook.