

National Healthcareer Association



Study Guide for Phlebotomy Technician

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2. Your full name, test ID and social security number must be clearly printed on the answer sheet in the appropriate boxes, as well as on the sign in sheet along with your complete mailing address. We must have a complete mailing address or we cannot process your exam and certifications.
3. **Do Not** write on the test booklet write only on the answer sheet. Anyone caught writing in the test booklet will be fined and risks being removed from the exam!
4. Please refrain from eating or drinking in the testing room.
5. Use of: beepers, radios, cellular phones, watch alarms, translators, dictionaries, and all other electronic devices are prohibited in the testing room. Please turn all electronic communications OFF.
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7. You should answer every question on the exam. If you are unsure of the correct answer, try to eliminate incorrect answers and take your best guess.
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INTRODUCTION

This study guide will provide information about phlebotomy as a specialized area of clinical laboratory practice. The role of a phlebotomist has expanded, thus, creating the need to replace on-the-job training with structured training programs, which, in turn, has led to certification in phlebotomy. Healthcare facilities are finding it advantageous to require national certification of their phlebotomists in order to be within compliance of changing requirements by state and federal agencies. The reader can use this booklet as a study guide for the National Healthcareer Association's Certified Phlebotomy Technician exam. As such, this is a supplement for a review and it is not meant to replace training textbooks and/or lecture notes.

PHLEBOTOMY AS A PROFESSION

Role of the phlebotomist:

1. Collect routine capillary and venous specimens for testing as requested.
2. Prepare specimen for transport, ensuring its stability.
3. Transport specimen to the laboratory.
4. Promote good public relations with hospital staff and patients.
5. Comply with new and revised procedures as described in the procedures manual.
6. Assist in collecting and documenting monthly workload and recording data.
7. Maintain safe working conditions.
8. Perform laboratory computer operations.
9. Participate in continuing education programs.
10. Perform other tasks assigned by supervisory personnel.

Professionalism

The phlebotomist is a member of a service-oriented industry that requires professional behavior at all times. Professionalism is an attitude and a set of personal characteristics needed to succeed in this area. Other characteristics imperative to a phlebotomist include:

- A. Dependability
- B. Honesty
- C. Integrity
- D. Empathy and compassion
- E. Professional appearance
- F. Interpersonal skills

Ethical Behavior

Ethical behavior entails conforming to a standard of right and wrong to avoid harming the patient in any way. Standards of right and wrong called the "code of ethics" provide personal and professional rules of performance and moral behavior that all phlebotomists are expected to follow.

Health Care Settings

The following are the medical facilities where the phlebotomist may find work:

- ◇ Physician office laboratories – can range from simple screening tests done in a single practice office or specialized testing done in large group practices.
- ◇ Reference laboratories – These large independent laboratories perform routine and highly specialized tests that cannot be done in smaller ones. The phlebotomist may do either on-site or off-site collections.
- ◇ Urgent care centers
- ◇ Nursing home facilities
- ◇ Wellness clinics

ANATOMY AND PHYSIOLOGY (An Overview)

This study guide will only touch on the basics of the anatomy and physiology of organ systems most relevant to phlebotomy, such as the heart and blood. It is highly recommended that all students who are candidates for Phlebotomy certification to have extensive knowledge of the anatomy of the heart; its' structure and function and all candidates should be prepared to demonstrate the ability to label the chambers and valves of the heart. For discussions of the other organ systems not within the scope of phlebotomy, the reader is directed to refer to textbooks on anatomy and physiology.

The circulatory system

The function of this system is to deliver oxygen, nutrients, hormones, and enzymes to the cells (exchange is done at the capillary level) and to transport cellular waste such as carbon dioxide and urea to the organs (lung and kidneys, respectively) where they can be expelled from the body. It is a transport system where the blood is the vehicle; the blood vessels, the tubes, and the heart work as the pump.

The heart

The heart acts as two pumps in series (right and left sides), connected by two circulations, with each pump equipped with two valves, the function of which is to maintain a one-way flow of blood. The two circulations are:

1. Pulmonary circulation - this carries deoxygenated blood from the right ventricle to the lungs (oxygenation takes place at the alveoli) and returns oxygenated blood from the lungs to the left atrium.
2. Systemic circulation – this carries oxygenated blood from the left ventricle throughout the body.

Each side of the heart (right and left) is composed of an upper chamber, the atrium, and a lower chamber, the ventricle. The right side has two valves:

The tricuspid valve – this is an atrioventricular valve, being situated between the right atrium and right ventricle.

The pulmonic valve – a semi lunar valve situated between the right ventricle and the pulmonary artery.

The left side also has two valves: The mitral valve (also known as the bicuspid valve) – this is another atrioventricular valve, being situated between the left atrium, and left ventricle.

The aortic valve – a semi lunar valve situated between the left ventricle and the aorta.

The heart has three layers:

Endocardium - The endothelial inner layer lining of the heart.

Myocardium - The muscular middle layer. This is the contractile element of the heart.

Epicardium - The fibrous outer layer of the heart. The coronary arteries, which supply blood to the heart, are found in this layer.

The blood vessels

The blood vessels are: Aorta, arteries, arterioles, capillaries, venules, veins, superior and inferior vena cavae.

The blood vessels, except for the capillaries, are composed of three layers. The outer connective tissue layer is called the tunica adventitia. The middle smooth muscle layer is called the tunica media. The inner endothelial layer is called the tunica intima.

The aorta, arteries, and arterioles carry oxygenated blood from the heart to the various parts of the body; while the venules, veins and the superior and inferior vena cavae carry deoxygenated blood back to the heart.

The capillaries, composed only of a layer of endothelial cells, connect the arterioles and venules. As such, capillary blood is a mixture of arterial and venous blood. The thin walls allow rapid exchange of oxygen, carbon dioxide, nutrients and waste products between the blood and tissue cells.

Blood

The average adult has 5 to 6 liters of blood. It is composed of a liquid portion called the 'plasma', and a cellular portion called the 'formed elements'. Plasma comprises 55% of the circulating blood and it contains proteins, amino acids, gases, electrolytes, sugars, hormones, minerals, vitamins, and water (92%). It also contains waste products such as urea that are destined for excretion.

The formed elements constitute the remaining 45% of the blood. They are **erythrocytes** (red blood cells), which comprise 99% of the formed elements, the leukocytes (white blood cells) and the **thrombocytes** (platelets). All blood cells normally originate from stem cells in the bone marrow.

The **erythrocytes** contain hemoglobin, the oxygen-carrying protein. It enters the blood as an immature reticulocyte where in one to two days, it matures into an erythrocyte. There are 4.2 to 6.2 million RBC's (red blood cells) per microliter of blood. The normal life span of an RBC is 120 days.

The **leukocytes** function is to provide the body protection against infection. The normal amount of WBC's (white blood cells) for an adult is 5,000 to 10,000 per microliter. Leukocytosis, which is an increase in WBCs, is seen in cases of infection and leukemia. Leukopenia, which is a decrease in WBCs, is seen with viral infection or chemotherapy.

There are five types of WBCs in the blood. A differential count determines the percentage of each type:

Neutrophils – the most numerous, comprise about 40% to 60% of WBC population. They are phagocytic cells, meaning, they engulf and digest bacteria. Their number increases in bacterial infection, and often, the first one on the scene.

Lymphocytes - the second most numerous, comprising about 20% to 40% of the WBC population. Their number increases in viral infection, and they play a role in immunity.

Monocytes – comprising 3% to 8% of the population, they are also the largest WBCs. They are monocytes while in the circulating blood, but when they pass into the tissues, they transform into macrophages and become powerful phagocytes. Their number increases in intracellular infections and tuberculosis.

Eosinophils - represent 1% to 3% of the WBC population. They are active against antibody-labeled foreign molecules. Their numbers are increased in allergies, skin infections, and parasitic infections.

Basophils - account for 0% to 1% of WBCs in the blood. They carry histamine, which is released in allergic reactions

The **thrombocytes** (platelets) are small irregularly shaped packets of cytoplasm formed in the bone marrow from megakaryocytes. Essential for blood coagulation, the average number of platelets is 140,000 to 440,000 per micro liter of blood. They have a life span of 9 to 12 days.

HEMOSTASIS

Hemostasis is the process by which blood vessels are repaired after injury. This process starts from vascular contraction as an initial reaction to injury, then to clot formation, and finally removal of the clot when the repair to injury is done. It occurs in four stages:

Stage 1: Vascular phase

Injury to a blood vessel causes it to constrict slowing the flow of blood.

Stage 2 – Platelet phase

Injury to the endothelial lining causes platelets to adhere to it.

Additional platelets stick to the site finally forming a temporary platelet plug in a process called 'aggregation'.

Vascular phase and platelet phase comprise the primary hemostasis. Bleeding time test is used to evaluate primary hemostasis.

Stage 3 – Coagulation phase

This involves a cascade of interactions of coagulation factors that converts the temporary platelet plug to a stable fibrin clot. The coagulation cascade involves an intrinsic system and extrinsic system, which ultimately come together in a common pathway.

Activated partial thromboplastin time (APTT) – test used to evaluate the intrinsic pathway. This is also used to monitor heparin therapy.

Prothrombin time (PT) – test used to evaluate the extrinsic pathway. This is also used to monitor coumadin therapy.

Stage 4 – Fibrinolysis

This is the breakdown and removal of the clot. As tissue repair starts, plasmin (an enzyme) starts breaking down the fibrin in the clot. Fibrin degradation products (FDPs) measurement is used to monitor the rate of fibrinolysis.

SITE SELECTION

The preferred site for venipuncture is the antecubital fossa of the upper extremities. The vein should be large enough to receive the shaft of the needle, and it should be visible or palpable after tourniquet placement.

Three major veins are located in the antecubital fossa, and they are:

- A. **Median cubital vein** – the vein of choice because it is large and does not tend to move when the needle is inserted.
- B. **Cephalic vein** - the second choice. It is usually more difficult to locate and has a tendency to move, however, it is often the only vein that can be palpated in the obese patient.
- C. **Basilic vein** - the third choice. It is the least firmly anchored and located near the brachial artery. If the needle is inserted too deep, this artery may be punctured.

Unsuitable veins for venipuncture are:

- A. **Sclerosed veins** - These veins feel hard or cordlike. Can be caused by disease, inflammation, chemotherapy or repeated venipunctures.
- B. **Thrombotic veins**
- C. **Tortuous veins** – These are winding or crooked veins. These veins are susceptible to infection, and since blood flow is impaired, the specimen collected may produce erroneous test results.

Note: Do not draw blood from an arm with IV fluids running into it. The fluid will alter the test results. Select another site. Do not draw blood from an artificial a-v fistula site, such as those surgically implanted in dialysis patients.

VENIPUNCTURE

The basic step in performing venipuncture is to have the necessary supplies and/or equipment organized for proper collection of specimen and to ensure the patient's safety and comfort. The recommended supplies are as follows:

- A. Laboratory requisition slip and pen.
- B. Antiseptic –
 - Prepackaged 70% isopropyl alcohol pads are the most commonly used.
 - For collections that require more stringent infection control such as blood cultures and arterial punctures Povidone-iodine solution is commonly used.
 - For patients allergic to iodine, chlorhexidine gluconate is used.
- C. Vacutainer tubes –
 - Color-coded for specific tests and available in adult and pediatric sizes.
- D. Vacutainer needles-
 - These are disposable and are used only once both for single-tube draw and multidraw (more than one tube).
 - Needle sizes differ both in length and gauge. 1-inch and 1.5-inch long are routinely used.
 - The diameter of the bore of the needle is referred to as the gauge. The smaller the gauge the bigger the diameter of the needle; the bigger the gauge the smaller the diameter of the needle (i.e. 16 gauge is large bore and 23 gauge is small bore.) Needles smaller than 23 gauge are not used for drawing blood because they can cause hemolysis.
- E. Needle adapters -
 - Also called the tube holder. One end has a small opening that connects the needle, and the other end has a wide opening to hold the collection tube.
- F. Winged infusion sets -
 - Used for venipuncture on small veins such as those in the hand. They are also used for venipuncture in the elderly and pediatric patients.
 - The most common size is 23gauge, ½ to ¾ inch long.
- G. Sterile syringes and needles -
 - 10-20 ml syringe is used when the Vacutainer method cannot be used.
- H. Tourniquets –
 - Prevents the venous outflow of blood from the arm causing the veins to bulge thereby making it easier to locate the veins.
 - The most common tourniquet used is the latex strip. (Be sure to check for latex allergy). Tourniquets with Velcro and buckle closures are also available.
 - Blood pressure cuffs may also be used as tourniquet. The cuff is inflated to a pressure above the diastolic but below the systolic.
- I. Chux –
 - An impermeable pad used to protect the patient's clothing and bedding.
- J. Specimen labels -

- To be placed on each tube collected after the venipuncture.
- K. Gloves -
- Must always be worn when collecting blood specimen
- L. Needle disposal container –
- Must be a clearly marked puncture-resistant biohazard disposal container.
 - **Never recap a needle without a safety device.**

COMPLICATIONS ASSOCIATED WITH PHLEBOTOMY

- **Hematoma:** The most common complication of phlebotomy procedure. This indicates that blood has accumulated in the tissue surrounding the vein. The two most common causes are the needle going through the vein, and/or failure to apply enough pressure on the site after needle withdrawal.
- **Hemoconcentration:** The increase in proportion of formed elements to plasma caused by the tourniquet being left on too long. (More than two (2) minutes)
- **Phlebitis:** Inflammation of a vein as a result of repeated venipuncture on that vein.
- **Petechiae:** These are tiny non-raised red spots that appear on the skin from rupturing of the capillaries due to the tourniquet being left on too long or too tight.
- **Thrombus:** This is a blood clot usually a consequence of insufficient pressure applied after the withdrawal of the needle.
- **Thrombophlebitis:** Inflammation of a vein with formation of a clot
- **Septicemia:** This is a systemic infection associated with the presence of pathogenic organism introduced during a venipuncture.
- **Trauma:** This is an injury to underlying tissues caused by probing of the needle.

FACTORS TO CONSIDER PRIOR TO PERFORMING THE PROCEDURE:

- **Fasting** – some tests such as those for glucose, cholesterol, and triglycerides require that the patient abstain from eating for at least 12 hours. The phlebotomist must ascertain that the patient is indeed in a fasting state prior to the testing.
- **Edema** –is the accumulation of fluid in the tissues. Collection from edematous tissue alters test results.
- **Fistula** - is the permanent surgical connection between an artery and a vein. Fistulas are used for dialysis procedures and must never be used for venipunctures due to the possibility of infection.

QUALITY ASSURANCE AND SPECIMEN HANDLING

Quality assurance (QA) is defined as a program that guarantees quality patient care by tracking the outcomes through scheduled audits in which areas of the hospital look at the appropriateness, applicability, and timeliness of patient care. A QA program is a continuous program, established by the healthcare facility, which will provide guidelines, protocols and continuing education for their employees. Areas in phlebotomy that are subject to quality control:

Patient preparation procedures:

Quality control actually starts before the specimen is collected from the patient. To obtain an acceptable specimen, the patient must be prepared properly. In a hospital setting the phlebotomist must check the floor book, to ensure that the nursing department has performed all pre-test preparations. Pre-test preparation will include fasting for specific tests. The phlebotomist must then ensure this information is correct, by asking the patient. The Laboratory/Phlebotomy Specimen Collection Procedures Manual has established these guidelines.

ANALYTICAL ERRORS

Before Collection:	During Collection	After Collection
Patient misidentification	Extended tourniquet time	Failure to separate serum from cell
Improper Time of Collection	Hemolysis	Improper use of serum separator
Wrong Tube	Wrong order of draw	Processing delays
Inadequate fast	Failure to invert tubes	Exposure to light
Exercise	Faulty technique	Improper storage conditions
Patient posture	Under filling tubes	Rimming clots
Poor coordination with other treatments		
Improper site preparation		
Medication interference		

ROUTINE VENIPUNCTURE

- 1) Verify the requisition for the tests.
- 2) **Identify the patient: check the patient's ID number and have him/her state his/her name.**
- 3) Identify yourself to the patient, explain the procedure, and secure his/her consent.
- 4) Palpate the veins in the antecubital fossa using your index finger.
- 5) Gather the necessary equipment.
- 6) **Wash hands; put on gloves.**
- 7) Tie on the tourniquet; it should be applied 3-4 inches above the site where the venipuncture will be made. Ask the patient to make a fist or open and close his/her hand to help engorge the vein.
- 8) Palpate the vein while looking for the straightest point. Cleanse the area using a circular motion starting at the inside of the venipuncture site.
- 9) Assemble the needle and tube holder while the alcohol is drying. Uncap the needle and examine it for defects such as blunted or barbed point.
- 10) Hold the patient's arm, by placing four fingers under the forearm and your thumb below the antecubital area slightly pulling the skin back to anchor the vein.
- 11) With the bevel facing upward, insert the needle at an angle of 15-30 degrees.

- 12) Once the needle is inside the vein (you will feel a “give” as the vein is entered), push the collection tube into the holder to puncture the tube stopper with the back-end of the needle.
 - 13) Release the tourniquet once blood flow has begun. The tourniquet should not be left on for more than one (1) minute in order to prevent hemoconcentration.
 - 14) Fill the needed tubes, according to the order of draw.
 - 15) Pull out collection tube from the holder.
 - 16) Place folded gauze over the venipuncture site and withdraw the needle. Then apply pressure until bleeding stops. This is done to prevent hematoma. Do not ask the patient to bend the arm as it does not offer enough pressure.
 - 17) Discard needle into the biohazards sharp container.
 - 18) Label each collected specimen, writing the patient’s name and ID number, the time and date of collection, and your initials.
 - 19) Place labeled tubes inside the biohazards transport bag.
 - 20) Before leaving, check the venipuncture site. If it is still bleeding, apply pressure for another 2 minutes. If after this time, it is still bleeding, continue to apply pressure for another 3 minutes. If bleeding persists after a total of 8 minutes of applying pressure, call for help.
 - 21) At any point when the bleeding stops, an adhesive bandage is applied over a folded gauze square. The patient should be instructed to remove the bandage within an hour.
 - 22) Clean up everything and dispose of waste properly.
 - 23) Leave the patient’s call light within his/her reach.
 - 24) Remove the gloves, wash your hands, say good-bye to the patient and inform him/her that his/her physician will deliver the results.
- ✓ Do not label the tubes prior to the venipuncture.
 - ✓ Do not leave the patient’s room before labeling the tubes.
 - ✓ Do not dismiss an outpatient before labeling the tubes.
 - ✓ Do not label tubes using a pencil; black ink should be used.
 - ✓ Do not leave the patient until you checked and ensure that the bleeding has stopped.

FAILURE TO OBTAIN BLOOD

Most venipunctures are routine, but in some instances, complications can arise resulting in failure to obtain blood. The following are some of the common causes:

- The tube has lost its vacuum. This is may be due to:
 - A manufacturing defect
 - Expired tube
 - A very fine crack in the tube
- Improperly positioned needle. In many instances, slight movement of the needle can correct this.
 - The bevel of the needle is resting against the wall of the vein. Slightly rotate the needle.
 - The needle is not fully in the vein. Slowly advance the needle.
 - The needle has passed through the vein. Slowly pull back on the vein.
 - The vein was missed completely. With a gloved finger, gently determine the positions of the vein and the needle, and redirect the needle.

- Collapsed vein. This may be due to excessive pull from the vacuum tube; use of a smaller vacuum tube may remedy the situation. If it does not, remove the tourniquet, withdraw the needle, and select another vein preferably using either a syringe or butterfly.

SPECIAL VENIPUNCTURE

Some venipunctures are done using special collecting or handling procedures specific to the test being requested. Some require patient preparation such as fasting, while some needs to be collected at a specific time. Still, others may need special handling such as protection from light.

Fasting Specimens

This requires collection of blood while the patient is in the basal state, that is, the patient has fasted and refrained from strenuous exercise for 12 hours prior to the drawing. It is the phlebotomists responsibility to verify if the patient indeed, has been fasting for the required time.

Timed Specimens

They are often used to monitor the level of a specific substance or condition in the patient. Blood is drawn at specific times for different reasons. They are:

- To measure blood levels of substances exhibiting diurnal variation. (e.g., cortisol hormone)
- To determine blood levels of medications. (e.g., digoxin for cardiovascular disease)
- To monitor changes in a patient's condition. (e.g., steady decrease in hemoglobin level)

Two-Hour Postprandial Test

This test is used to evaluate diabetes mellitus. Fasting glucose level is compared with the level 2 hours after eating a full meal or ingesting a measured amount of glucose.

Oral Glucose Tolerance Test (OGTT)

This test is used to diagnose diabetes mellitus and evaluate patients with frequent low blood sugar. 3-hour OGTT is used to test hyperglycemia (abnormally high blood sugar level) and diagnose diabetes mellitus. 5-hour OGTT is used to evaluate hypoglycemia (abnormally low blood sugar level) for disorders of carbohydrate metabolism. OGTT are scheduled to begin between 0700 and 0900.

Therapeutic Drug Monitoring

This test is used to monitor the blood levels of certain medication to ensure patient safety and also maintain a plasma level. Blood is drawn to coincide with the trough (lowest blood level) or the peak level (highest blood level). Trough levels are collected 30 minutes before the scheduled dose. Time for collecting peak level will vary depending on the medication, patient's metabolism, and the route of administration (I.V., I.M., or oral).

Blood Cultures (BC)

They are ordered to detect presence of microorganisms in the patient's blood. The patient will usually have chills and fever of unknown origin (FUO), indicating the possible presence of pathogenic microorganisms in the blood (septicemia). Blood cultures are usually ordered STAT or as timed specimen, and collection requires strict aseptic technique.

PKU

This test is ordered for infants to detect phenylketonuria, a genetic disease that causes mental retardation and brain damage. Test is done on blood from newborn's heel or on urine.

SPECIAL SPECIMEN HANDLING

Cold Agglutinins

Cold agglutinins are antibodies produced in response to *Mycoplasma pneumoniae* infection (atypical pneumonia). The antibodies formed may attach to red blood cells at temperatures below body temperature, and as such, the specimen must be kept warm until the serum is separated from the cells. Blood is collected in red-topped tubes pre-warmed in the incubator at 37 degrees Celsius for 30 minutes.

Chilled specimens

Some tests require that the specimen collected be chilled immediately after collection in crushed ice or ice and water mixture. Likewise, the specimen must be immediately transported to the laboratory for processing. Some of the tests that require chilled specimen are: arterial blood gases, ammonia, lactic acid, pyruvate, ACTH, gastrin, and parathyroid hormone.

Light-sensitive specimens

Specimens are protected from light by wrapping the tubes in aluminum foil immediately after they are drawn. Exposure to light could alter the test results for: Bilirubin, beta-carotene, Vitamins A & B6, and porphyrins.

DERMAL PUNCTURES (Microcapillary collection)

When venipuncture is inadvisable, it is possible to perform a majority of laboratory tests on micro samples obtained by dermal (skin) puncture, with the exception of ESR, blood cultures and other tests that require a large amount of serum. Dermal puncture may be done on both pediatric and adult patients.

Punctures should never be performed with a surgical blade or hypodermic needle because they can be difficult to control. Deep penetration into the skin can cause serious injury such as osteomyelitis (inflammation of the bone and bone marrow). A lancet should be used, which delivers a pre-determined depth that can range from 0.85mm for infants to 3.0 mm for adults.

Site selection for dermal puncture

Infants:

The heel is used for dermal punctures on infants less than 1 year of age. Areas recommended are the medial and lateral areas of the plantar surface of the foot. These are determined by drawing imaginary lines medially extending from the middle of the great toe to the heel and laterally from the middle of the fourth and fifth toes to the heel.

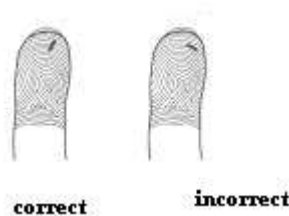
The American Academy of Pediatrics recommends that heel punctures for infants not exceed 2.0mm.

Observe the following precautions when performing dermal puncture:

- do not puncture deeper than 2.0mm
- do not perform dermal punctures on previous puncture sites
- do not use the back of the heel or arch of the foot.
- use the medial and lateral areas of the plantar surface of the heel

Older children and Adults

The distal segment of the third or fourth finger of the non-dominant hand is the recommended site. Puncture is made in the fleshy portion of the finger slightly to the side of the center perpendicular to the lines of the fingerprint.



Dermal puncture procedure

1. Identify the patient
2. Assemble equipment
3. Warm the site: this is an essential part of the procedure when collecting specimens for pH or blood gases. Warming the site can increase the blood flow up to seven times the normal amount. The specimen is referred to as arterialized specimen because of the increase arterial flow to the area. This is accomplished by warming the site for a minimum of three minutes with a warm moistened towel (no greater than 108 F), or with a commercial warming device.
4. Clean the site: Use 70% isopropyl alcohol. Allow the site to dry for maximum antiseptic action. Alcohol residue can cause hemolysis of the red blood cells and may interfere with glucose testing. Povidone- iodine (Betadine) is not used for cleaning the site because it interferes with several tests like bilirubin, uric acid, phosphorous, and potassium.
5. Prepare the puncture device
6. Perform the dermal puncture

Order of draw for capillary specimens

1. Lavender tube
2. Tubes with other additives
3. Tubes without additives

Microsamples are labeled with the same information required for venipuncture specimens.

ORDER OF DRAW

Often requests are for more than one test to be performed; and as such, more than one collection tube needs to be drawn. The correct order of draw is:

First — blood culture tubes or vials;

Second — sodium citrate tubes (e.g., blue tops);

Third — serum tubes with or without clot activator or gel; (e.g., red tops);

Fourth — heparin tubes (e.g., green tops);

Fifth — EDTA tubes (e.g., lavender tops);

Sixth — oxalate/fluoride tubes (e.g., gray tops).

As you know, it is important for you, the Healthcare Professional to stay current with changes in your industry. Therefore, the National Healthcareer Association and the certification exam, Certified Phlebotomy Technician, CPT, will only accept this as the correct order of draw.

TEST TUBES, ADDITIVES AND TESTS

◇ **Lavender top tube -**

Contains the anticoagulant ethylenediaminetetraacetic acid (EDTA). EDTA inhibits coagulation by binding to calcium present in the specimen. The tubes must be filled at least two-thirds full and inverted eight times.

Common tests: CBC (Complete Blood Count); Includes: RBC count, WBC count and Platelet count; WBC differential count; Hemoglobin and Hematocrit determinations; ESR (Erythrocyte Sedimentation Rate); Sickle Cell Screening

◇ **Light-Blue top tube -**

Contains the anticoagulant Sodium Citrate, which also prevents coagulation by binding to calcium in the specimen. Sodium citrate is the anticoagulant used for coagulation studies because it preserves the coagulation factors. The tube must be filled completely to maintain the ratio of nine parts blood to one part sodium citrate, and should be inverted three to four times..

Common tests: Coagulation Studies- Prothrombin Time (PT) – evaluates the extrinsic; system of the coagulation cascade and monitors; Coumadin therapy; Activated Partial Thromboplastin Time (APTT, PTT) - Evaluates the intrinsic system of the coagulation cascade and monitors Heparin therapy. Fibrinogen Degradation Products (FDP) Thrombin Time (TT); Factor assays, Bleeding Time (BT)

◇ **Green top tube -**

Contains the anticoagulant Heparin combined with sodium, lithium, or ammonium ion. Heparin works by inhibiting thrombin in the coagulation cascade. It is not used for hematology because heparin interferes with the Wright's stained blood smear. This tube should be inverted eight times.

Common tests: Chemistry tests: performed on plasma such as Ammonia, carboxyhemoglobin & STAT electrolytes.

◇ **Gray top tube –**

Contains additives and anticoagulants. All gray top tubes contain glucose preservative (antiglycolytic agent): sodium fluoride- preserves glucose for 3days; or lithium iodoacetate- preserves glucose for 24 hours. May also contain the anticoagulant potassium oxalate, which prevents clotting by binding calcium. This tube should be inverted eight times.

Common tests: Fasting blood sugar (FBS); Glucose tolerance test (GTT); Blood alcohol levels; Lactic acid measurement

◇ **Red/Gray (speckled) top tube -**

Also called tiger-top tube and serum separator tubes (SST). Contain clot activators: glass particles, silica and celite which hastens clot formation, and thixotropic gel, a serum separator which when centrifuged forms a barrier between the serum and the cells preventing contamination of the serum with cellular elements. Tubes must be inverted five times.

Common tests: Most chemistry tests

◇ **Red top tube -**

Also known as plain vacuum tube and contains no additive or anticoagulant. Collected blood clots by normal coagulation process in 30 minutes. There is no need to invert the tube after collection.

Common tests – Serum chemistry tests; Serology tests; Blood bank

◇ **Yellow top tube - (sterile)**

Contains the anticoagulant sodium polyanetholesulfonate (SPS). These are used to collect specimens to be cultured for the presence of microorganisms. The SPS aids in the recovery of microorganisms by inhibiting the actions of complement, phagocytes, and certain antibiotics. These tubes should be inverted eight times.

CLINICAL LABORATORY SECTIONS

Hematology Section

This is the section where the formed elements of the blood are studied by enumerating and classifying the red blood cells, white blood cells, and platelets. By studying and examining the cells, disorders and infections are detected and treatment instituted or monitored. Whole blood is the most common specimen analyzed and usually collected in lavender-top tube containing the anti-coagulant EDTA.

Aside from complete blood count (CBC), which is the primary analysis performed, other tests such as: Erythrocyte sedimentation rate (ESR), Lupus erythematosus (LE) prep, Reticulocyte (retic) count, and Sickle cell. The coagulation section is usually a part of hematology. However, in large laboratories they are separated. This is the area where hemostasis is evaluated. Plasma is usually the specimen analyzed drawn from blood collected in light-blue top tube with the anticoagulant sodium citrate. The tube must be inverted three to four times. Some of the tests frequently performed in the coagulation area are: Activated partial thromboplastin time (APTT); Thrombin Time (TT); Prothrombin time (PT); Bleeding Time (BT).

Chemistry Section

The most automated section in the laboratory. This section is divided into several areas:

- ◇ **Electrophoresis** – analyzes chemical components of blood such as hemoglobin and serum, urine and cerebrospinal fluid, based on the differences in electrical charge.
- ◇ **Toxicology** - analyzes plasma levels of drugs and poisons.
- ◇ **Immunochemistry** – This section uses techniques such as radio immunoassay (RIA) and enzyme immunoassay to detect and measure substances such as hormones, enzymes, and drugs.

Some tests in the chemistry section are ordered by profiles, which are groups of tests ordered by a physician to evaluate the status of an organ, body system or general health of the patient.

Examples of these profiles are:

- ◇ Liver profile: tests may include ALP, AST, ALT, GGT and Bilirubin
- ◇ Coronary risk profile: tests may include Cholesterol, Triglycerides, HDL, LDL

Blood Bank Section

This is the section where blood is collected, stored and prepared for transfusion. Strict adherence to procedures for patient identification and specimen handling is a must to ensure patient safety.

Blood collected may be separated into components: packed cells, platelets, fresh frozen plasma, and cryoprecipitate.

Serology (Immunology) Section

Performs tests to evaluate the patient's immune response through the production of antibodies. This section uses serum to analyze presence of antibodies to bacteria, viruses, fungi, parasites and antibodies against the body's own substances (autoimmunity).

Microbiology Section

This section is responsible for the detection of pathogenic microorganisms in patient samples and for the hospital infection control. The primary test performed is culture and sensitivity (C&S). It is used to detect and identify microorganisms and to determine the most effective antibiotic therapy. Results are usually available within 24 to 48 hours; but cultures for tuberculosis and fungi require several weeks. One instance when culture and sensitivity is used is to diagnose the cause of a patient's fever of unknown origin (FUO).

Urinalysis Section

This section performs tests on the urine to detect disorders and infection of the kidney and urinary tract and to detect metabolic disorders such as diabetes mellitus. Urinalysis has three components:

- Physical examination- evaluates the color, clarity and specific gravity
- Chemical examination- determines pH, glucose, ketones, protein, blood, bilirubin, urobilinogen, nitrites, and leukocytes.
- Microscopic examination- identifies presence of casts, bacteria, yeast, and parasites.

SAFETY

Safety hazards abound in the healthcare setting, many of which can cause serious injury or disease. The Occupational Safety and Health Administration (OSHA) is responsible for the identification of the various hazards present in the workplace and for the creation of rules and regulations to minimize exposure to such hazards. Employers are mandated to institute measures that will assure safe working conditions and health workers have the obligation to know and follow those measures.

Types of Hazards

- **Biologic:** infectious agents that can cause bacterial, viral, fungal, or parasitic infections.
- **Sharps:** needles, lancets, and broken glass can puncture and cut and cause blood-borne pathogen exposure.
- **Chemical:** preservatives and chemicals used in the laboratory. There is possible exposure to toxic, carcinogenic or caustic substances.
- **Electrical:** high-voltage equipment can cause burns and shock.
- **Fire or explosive:** Bunsen burners, oxygen and chemicals can cause burns or dismemberment.
- **Physical:** wet floors, heavy lifting can cause falls, sprains and strains.
- **Allergic reaction:** latex sensitivity that can cause allergic reactions ranging from simple dermatitis to anaphylaxis.

Emergency First Aid

The ability to recognize and react quickly to an emergency may be the difference of life or death for the patient. As patients react differently to various situations, it is important for all healthcare professionals to be prepared in an emergency.

External Hemorrhage: controlling the bleeding is most effectively accomplished by elevating the affected part above heart level and applying direct pressure to the wound. Do not attempt to elevate a broken extremity as this could cause further damage.

Shock occurs when there is ‘insufficient return of blood flow to the heart, resulting in inadequate supply of oxygen to all organs and tissues of the body.’ Patients experiencing trauma may go into shock and for some patients, seeing their own blood may induce shock. Common symptoms:

- ◇ Pale, cold, clammy skin
- ◇ Rapid, weak pulse
- ◇ Increased, shallow breathing rate
- ◇ Expressionless face/staring eyes.

First Aid for Shock:

- ◇ Maintain an open airway for the victim
- ◇ Call for assistance
- ◇ Keep the victim lying down with the head lower than the rest of the body
- ◇ Attempt to control bleeding or cause of shock (if known)
- ◇ Keep the victim warm until help arrives

Cardiopulmonary Resuscitation. Most healthcare institutions require their professionals to be certified in CPR. It is important for all professionals to maintain all certifications acquired.

Infection Control/Chain Of Infection

This consists of links, each of which is necessary for the infectious disease to spread. Infection control is based on the fact that the transmission of infectious diseases will be prevented or stopped when any level in the chain is broken or interrupted.



Agents– are infectious microorganisms that can be classified into groups namely: viruses, bacteria, fungi, and parasites. When infectious diseases are identified according to the specific disease-causing microorganism, the disease may be prevented with the use of anti-infective drugs or infection control practices.

Portal of exit –the method by which an infectious agent leaves its reservoir. Standard Precautions and Transmission-Based Precautions are control measures aimed at preventing the spread of the disease as infectious agents exit the reservoir.

Mode of transmission –specific ways in which microorganisms travel from the reservoir to the susceptible host. There are five main types of mode of transmission:

- Contact : direct and indirect
- Droplet
- Airborne
- Common vehicle
- Vectorborne

Portal of entry – allows the infectious agent access to the susceptible host. Common entry sites are broken skin, mucous membranes, and body systems exposed to the external environment such as the respiratory, gastrointestinal, and reproductive. Methods such as sterile wound care, transmission-based precautions, and aseptic technique limit the transmission of the infectious agents.

Susceptible host – The infectious agent enters a person who is not resistant or immune. Control at this level is directed towards the identification of the patients at risk, treat their underlying condition for susceptibility, or isolate them from the reservoir.

Medical Asepsis

Best defined as “the destruction of pathogenic microorganisms after they leave the body.” It also involves environmental hygiene measures such as equipment cleaning and disinfection procedures. Methods of medical asepsis are Standard Precautions and Transmission-Based Precautions.

Handwashing

Hand washing is the most important means of preventing the spread of infection. A routine hand wash procedure uses plain soap to remove soil and transient bacterial. Hand antisepsis requires the use of antimicrobial soap to remove, kill or inhibit transient microorganisms. It is important that all healthcare personnel learn proper hand washing procedures.

Barrier Protection

Protective clothing provides a barrier against infection. Used properly, it will provide protection to the person wearing it; disposed of properly it will assist in the spread of infection. Learning how to put on and remove protective clothing is vital to insure the health and wellness of the person wearing the PPE. PPE's or personal protective equipment includes:

- Gloves. Gloves are worn for three reasons:
 - Gloves are worn to provide protective barrier and to prevent gross contamination of the hands when touching blood, body fluids, secretions, excretions, mucous membranes, and nonintact skin.
 - Gloves are worn to reduce the likelihood that microorganisms present on the hands of personnel will be transmitted to patients during invasive or other patient-care procedures that involve touching a patient's mucous membranes and nonintact skin.
 - Gloves are worn to reduce the likelihood that hands of personnel contaminated with microorganisms from a patient or a fomite can transmit these microorganisms to another patient.
- Masks
- Goggles
- Face Shields
- Respirator.

Isolation Precautions

For many years, the CDC recommended universal precautions, which is a method of infection control that assumed that all human blood and body fluids were potentially infectious. The CDC issued a revised guidelines consisting of two tiers or levels of precautions: Standard Precautions and Transmission-Based Precautions.

Standard Precautions

This is an infection control method designed to prevent direct contact with blood and other body fluids and tissues by using barrier protection and work control practices.

Under the standard precautions, all patients are presumed to be infective for blood-borne pathogens. Infection control practices to be used with all patients. These replace universal precautions and body substance isolation. They are used when there is a possibility of contact with any of the following:

- ◇ Blood
- ◇ All body fluids, secretions, and excretions (except sweat), regardless of whether or not they contain visible blood
- ◇ Nonintact skin
- ◇ Mucous membranes designed to reduce the risk of transmission of microorganisms from both
- ◇ Recognized and unrecognized sources of infections.

The standard precautions are:

- Wear gloves when collecting and handling blood, body fluids, or tissue specimen.
- Wear face shields when there is a danger for splashing on mucous membranes.
- Dispose of all needles and sharp objects in puncture-proof containers without recapping.

Transmission- Based Precautions the second tier of precautions and are to be used when the patient is known or suspected of being infected with contagious disease. They are to be used in addition to standard precautions. All types of isolation are condensed into three categories:

Contact precautions: are designed to reduce the risk of transmission of microorganisms by direct or indirect contact. Direct-contact transmission involves skin-to-skin contact and physical transfer of microorganisms to a susceptible host from an infected or colonized person. Indirect-contact transmission involves contact with a contaminated intermediate object in the patient's environment

Airborne precautions: are designed to reduce the risk of airborne transmission of infectious agents. Microorganisms carried in this manner can be dispersed widely by air currents and may become inhaled by or deposited on a susceptible host within the same room or over a longer distance from the source patient. Special air handling and ventilation are required to prevent airborne transmission.

Droplet precautions: are designed to reduce the risk of droplet transmission of infectious agents. Droplet transmission involves contact with the conjunctivae or the mucous membranes of the nose or mouth of a susceptible person with large-particle droplets generated from the source person primarily during coughing, sneezing, or talking. Because droplets generally travel only short distances, usually three feet or less, and do not remain suspended in the air, special air handling and ventilation are not required.

Disinfection. the third procedure used in medical asepsis using various chemicals that can be used to destroy many pathogenic microorganisms. Since chemicals can irritate skin and mucous membranes, they are used only on inanimate objects.

The least expensive and most readily available disinfectant for surfaces such as countertops is a 1:10 solution of household bleach. Boiling water (temperature of 212 F) is considered a form of disinfection, but use of it in today's medical setting is limited to items that:

1. will not be used in invasive procedures;
2. will not be inserted into body orifices nor be used in a sterile procedure.

Latex Sensitivity

Latex sensitivity is an emerging and important problem in the health care field. Following the development of Universal Precaution Standards (OSHA, 1980), the use of natural rubber latex gloves for infection control skyrocketed. Within the last decade, however, the incidence of latex sensitivity has grown. Every health care worker must be concerned about latex sensitivity. Individuals with a known sensitivity to latex should wear a medical alert bracelet.

Type Reaction	Symptoms/Signs	Cause	Prevention / Management
Irritant Contact Dermatitis	Scaling, drying, cracking of skin	Direct skin irritation by gloves, powder, soaps/detergents, incomplete hand drying	Obtain medical diagnosis, avoid irritant product, consider use of cotton glove liners, consider alternative gloves/products
Allergic Contact Dermatitis (Type IV delayed hypersensitivity or allergic contact sensitivity)	Blistering, itching, crusting (similar to poison ivy reaction)	Accelerators (e.g., thiurams, carbamates, benzothiazoles) processing chemicals (e.g., biocides, antioxidants) Consider penetration of glove barrier by chemicals	Obtain medical diagnosis, identify chemical. Consider use of glove liners such as cotton Use alternative glove material without chemical Assure glove material is suitable for intended use (proper barrier)
NRL Allergy - IgE/histamine mediated (Type I immediate hypersensitivity) ----- A) Localized contact urticaria which may be associated with or progress to: B) Generalized Reaction	----- Hives in area of contact with NRL ----- Include: generalized urticaria, rhinitis, wheezing, swelling of mouth, and shortness of breath. Can progress to anaphylactic shock	NRL proteins: direct contact with or breathing NRL proteins, including glove powder containing proteins, from powdered gloves or the environment	Obtain medical diagnosis, allergy consultation, substitute non-NRL gloves for affected worker and other non-NRL products Eliminate exposure to glove powder - use of reduced protein, powder free gloves for coworkers Clean NRL-containing powder from environment Consider NRL safe environment

LEGAL CONSIDERATIONS

Needle Stick Prevention Act

OSHA has put into force the Occupational Exposure to Bloodborne Pathogen (BBP) Standard when it was concluded that healthcare employees face a serious health risk as a result of occupational exposure to blood and other body fluids and tissues. The standards outline necessary engineering and work practice controls that OSHA believes will help minimize or eliminate exposure to employees. The standard was revised in 2001 to conform to the Needlestick Safety and Prevention Act passed in November 2000. The act directed OSHA to revise the BBP standard in four key areas:

- Revision and updating of the exposure control plan.
- Solicitation of employee input in selecting engineering and work practice controls.
- Modification of definitions relating to engineering controls (i.e., sharps disposal containers, self-sheathing needles, needleless systems).
- New record keeping requirements.

The employer must establish and maintain a sharps injury log for percutaneous injury from contaminated sharps and it must be done in such a manner to protect the confidentiality of the injured employee.

The sharps injury log must contain, at a minimum:

- a. The type and brand of device involved in the incident.
- b. The department or work area where the exposure incident occurred.
- c. An explanation of how the incident occurred.

** See Appendix B for further clarification.

Informed consent

This is consent given by the patient who is made aware of any procedure to be performed, its risks, expected outcomes, and alternatives.

Patient confidentiality

This is the key concept of HIPAA. All patients have a right to privacy and all information should remain privileged. Discuss patient information only with the patient's physician or office personnel that need certain information to do their job. Obtain a signed consent form to release medical information to the insurance company or other individual.

Negligence

This is the failure to exercise the standard of care that a reasonable person would give under similar circumstances and someone suffers injury because of another's failure to live up to a required duty of care.

The four elements of negligence, (4 Ds), are:

1. Duty: duty of care
2. Derelict: breach of duty of care
3. Direct cause: legally recognizable injury occurs as a result of the breach of duty of care.
4. Damage: wrongful activity must have caused the injury or harm that occurred.

Tort

Is a wrongful act that results in injury to one person by another. Some examples of common torts that can occur in the clinic are the following:

Battery - The basis of tort in this case is the unprivileged touching of one person by another. When a procedure is to be performed on a patient, the patient must give consent in full knowledge of the procedure and the risk it entails (informed consent).

Invasion of privacy – This is the release of medical records without the patient’s knowledge and permission.

Defamation of character – This consists of injury to another person’s reputation, name, or character through spoken (slander) or written (libel) words.

Good Samaritan Law - This law deals with the rendering of first aid by health care professionals at the scene of an accident or sudden injury. It encourages health care professionals to provide medical care within the scope of their training without fear of being sued for negligence.

APPENDIX A: PATIENTS BILL OF RIGHTS

As a patient in XXX Hospital you have the right, consistent with law, to:

1. Receive treatment without discrimination as to race, color, religion, gender, national origin, disability, or source of payment.
2. Receive considerate and respectful care in a clean and safe environment free of unnecessary restraints.
3. Receive emergency care if you need it.
4. Be informed of the name and position of the doctor who will be in charge of your care in the hospital.
5. Know the names, positions and functions of any hospital staff involved in your care.
6. Receive complete information about your diagnosis, treatment and prognosis.
7. Receive all the information that you need to give informed consent for any proposed procedure or treatment. This information shall include the possible risks and benefits of the procedure or treatment.
8. Receive all the information you need to give informed consent for an order not to resuscitate. You also have the right to designate an individual to give this consent for you if you are too ill to do so. If you would like additional information, please ask
9. Refuse treatment, examination, or observation, if retired or a family member, and be told what effect this may have on your health.
10. Refuse to take part in research. In deciding whether or not to participate, you have the right to a full explanation.
11. Privacy while in the hospital and confidentiality of all information and records regarding your care.
12. Participate in all decisions about your treatment and discharge from the hospital.
13. Review your medical record without charge. Obtain a copy of your medical record for which the hospital can charge a reasonable fee. You cannot be denied a copy solely because you cannot afford to pay.
14. Receive a bill and explanation of all charges.
15. Complain without fears of reprisals about the care and services you are receiving and to have the hospital respond to you; and if requested, a written response. If you are not satisfied with the hospital's response, you can complain to the Patient Representative Office located here in the hospital.
16. Receive information about pain and pain relief measures, be involved in pain management plan, and receive a quick response to reports of pain.
17. Receive healthcare in an environment that is dedicated to avoiding patient harm and improving patient safety.
18. The right to request information about advance directives regarding your decisions about medical care.
19. Make known your wishes in regard to anatomical gifts. You may document your wishes in your health care proxy or on a donor card, available from the hospital.
20. Understand and use these rights. If for any reason you do not understand or you need help, the hospital will attempt to provide assistance, including an interpreter.

Patient Responsibilities

Provision of Information: You have the responsibility to provide, to the best of your knowledge, accurate and complete information about present complaints, past illness, hospitalizations, medications, and other matters relating to your health. You have the responsibility to report unexpected changes in your condition to the responsible practitioner. You are responsible for making it known whether you clearly comprehend a contemplated course of action and what is expected of you.

Compliance with Instructions: You are responsible for following the treatment plan recommended by the practitioner primarily responsible for your care. This may include following the instructions of nurses and allied health personnel as they carry out the coordinated plan of care and implement the responsible practitioner's orders, and as they enforce the applicable hospital rules and regulations. You are responsible for keeping appointments and, when you are unable to do so for any reason, for notifying the responsible practitioner or the hospital.

Refusal of Treatment: You are responsible for your actions if you refuse treatment or do not follow the practitioner's instructions.

Hospital Rules and Regulations: You are responsible for following hospital rules and regulation affecting patient care and conduct.

Respect and Consideration: You are responsible for being considerate of the rights of other patients and hospital personnel and for assisting in the control of noise, smoking and the number of visitors. You are responsible for being respectful of the property of other persons and the hospital.

Patient Representative

The Patient Representative's primary assignment is to assist you in exercising your rights as a patient. He/she is also available to act as your advocate and to provide a specific channel through which you can seek solutions to problems, concerns and unmet needs. You may call the Patient Representative at (000)000-0000.

The Patient Bill of Rights for Pain Management

You have the right to:

- Information about pain and pain relief
- A caring staff who believe your reports of pain
- A care staff with concern about your pain
- A quick response when you report your pain

You have the responsibility to:

- Ask for pain relief when your pain first starts
- Help those caring for you to assess your pain
- Tell those caring for you if your pain is not relieved
- Tell those caring for you about any worries that you have about taking pain medications
- Decide if you want your family and/or significant others to aid in your relief of pain

APPENDIX B: OSHA REGULATIONS



Revision to OSHA's Bloodborne Pathogens Standard Technical Background and Summary

April 2001

Background

The Occupational Safety and Health Administration published the Occupational Exposure to Bloodborne Pathogens standard in 1991 because of a significant health risk associated with exposure to viruses and other microorganisms that cause bloodborne diseases. Of primary concern are the human immunodeficiency virus (HIV) and the hepatitis B and hepatitis C viruses.

The standard sets forth requirements for employers with workers exposed to blood or other potentially infectious materials. In order to reduce or eliminate the hazards of occupational exposure, an employer must implement an exposure control plan for the worksite with details on employee protection measures. The plan must also describe how an employer will use a combination of engineering and work practice controls, ensure the use of personal protective clothing and equipment, provide training, medical surveillance, hepatitis B vaccinations, and signs and labels, among other provisions. Engineering controls are the primary means of eliminating or minimizing employee exposure and include the use of safer medical devices, such as needleless devices, shielded needle devices, and plastic capillary tubes.

Nearly 10 years have passed since the bloodborne pathogens standard was published. Since then, many different medical devices have been developed to reduce the risk of needlesticks and other sharps injuries. These devices replace sharps with non-needle devices or incorporate safety features designed to reduce injury. Despite these advances in technology, needlesticks and other sharps injuries continue to be of concern due to the high frequency of their occurrence and the severity of the health effects.

The Centers for Disease Control and Prevention estimate that healthcare workers sustain nearly 600,000 percutaneous injuries annually involving contaminated sharps. In response to both the continued concern over such exposures and the technological developments which can increase employee protection, Congress passed the **Needlestick Safety and Prevention Act** directing OSHA to revise the bloodborne pathogens standard to establish in greater detail requirements that employers identify and make use of effective and safer medical

devices. That revision was published on Jan. 18, 2001, and became effective April 18, 2001.

Summary

The revision to OSHA's bloodborne pathogens standard added new requirements for employers, including additions to the exposure control plan and keeping a sharps injury log. It does not impose new requirements for employers to protect workers from sharps injuries; the original standard already required employers to adopt engineering and work practice controls that would eliminate or minimize employee exposure from hazards associated with bloodborne pathogens.

The revision does, however, specify in greater detail the engineering controls, such as safer medical devices, which must be used to reduce or eliminate worker exposure.

Exposure Control Plan

The revision includes new requirements regarding the employer's Exposure Control Plan, including an annual review and update to reflect changes in technology that eliminate or reduce exposure to bloodborne pathogens. The employer must:

- Take into account innovations in medical procedure and technological developments that reduce the risk of exposure (e.g., newly available medical devices designed to reduce needlesticks); and
- Document consideration and use of appropriate, commercially available, and effective safer devices (e.g., describe the devices identified as candidates for use, the method(s) used to evaluate those devices, and justification for the eventual selection).

No one medical device is considered appropriate or effective for all circumstances. Employers must select devices that, based on reasonable judgment:

- Will not jeopardize patient or employee safety or be medically inadvisable; and
- Will make an exposure incident involving a contaminated sharp less likely to occur.

Employee Input

Employers must solicit input from non-managerial employees responsible for direct patient care regarding the identification, evaluation, and selection of effective engineering controls, including safer medical devices. Employees selected should represent the range of exposure situations encountered in the workplace, such as those in geriatric, pediatric, or nuclear medicine, and others involved in direct care of patients.

OSHA will check for compliance with this provision during inspections by questioning a representative number of employees to determine if and how their input was requested.

Documentation of employee input

Employers are required to document, in the Exposure Control Plan, how they received input from employees. This obligation can be met by:

- Listing the employees involved and describing the process by which input was requested; or
- Presenting other documentation, including references to the minutes of meetings, copies of documents used to request employee participation, or records of responses received from employees.

Record keeping

Employers who have employees who are occupationally exposed to blood or other potentially infectious materials, and who are required to maintain a log of occupational injuries and illnesses under existing record keeping rules, must also maintain a sharps injury log. That log will be maintained in a manner that protects the privacy of employees. At a minimum, the log will contain the following:

- The type and brand of device involved in the incident;
- Location of the incident (e.g., department or work area); and
- Description of the incident

The sharps injury log may include additional information as long as an employee's privacy is protected. The employer can determine the format of the log.

Modification of Definitions

The revision to the bloodborne pathogens standard includes modification of definitions relating to engineering controls. Two terms have been added to the standard, while the description of an existing term has been amended.

Engineering Controls

Engineering Controls include all control measures that isolate or remove a hazard from the workplace, such as sharps disposal containers and self-sheathing needles. The original bloodborne pathogens standard was not specific regarding the applicability of various engineering controls (other than the above examples) in the healthcare setting. The revision now specifies that "safer medical devices, such as sharps with engineered sharps injury protections and needleless systems" constitute an effective engineering control, and must be used where feasible.

Sharps with Engineered Sharps Injury Protections

This is a new term which includes non-needle sharps or needle devices containing built-in safety features that are used for collecting fluids or administering medications or other fluids, or other procedures involving the risk of sharps injury. This description covers a broad array of devices, including:

- Syringes with a sliding sheath that shields the attached needle after use;
- Needles that retract into a syringe after use;
- Shielded or retracting catheters
- Intravenous medication (IV) delivery systems that use a catheter port with a needle housed in a protective covering.

Needleless Systems

This is a new term defined as devices that provide an alternative to needles for various procedures to reduce the risk of injury involving contaminated sharps. Examples include:

- IV medication systems which administer medication or fluids through a catheter port using non-needle connections; and
 - Jet injection systems that deliver liquid medication beneath the skin or through a muscle.
-

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Sample Test Questions

1. The proper way to dispose of a needle is to:
 - A. Recap it and put it in a sharps container
 - B. Throw it recapped into a biohazard bag
 - C. Put it into a sharps container, without recapping, immediately after withdrawing it
 - D. Collect them in a cup for disposal at the end of the day
2. The “Good Samaritan Law” encourages healthcare professionals to:
 - A. Report abuse to the proper authorities
 - B. Provide medical care within the scope of their training at the scene of an accident without fear of being sued for negligence.
 - C. Provide for medical care to the elderly and poor
 - D. Provide for legal representation for all health care providers within a charity care based hospital
3. If a patient refuses a venipuncture procedure, the phlebotomist should:
 - A. Inform the patient that they will be responsible to pay for the procedure anyway
 - B. Have the patient restrained
 - C. Inform the patient that they must leave the facility
 - D. Immediately report the refusal and actions taken to the nurse
4. Microorganisms that cause disease are:
 - A. Hereditary
 - B. Normal flora
 - C. Nonpathogenic
 - D. Pathogenic
5. Which of the following veins in the arm is most subjected to venipuncture?
 - A. Median cubital vein
 - B. Brachial vein
 - C. Basilic vein
 - D. Cephalic vein
6. Post-prandial means:
 - A. Fasting
 - B. Before a meal
 - C. After a meal
 - D. Before bedtime
7. Tourniquets may be left on the patient for:
 - A. 1 minute
 - B. 3 minutes
 - C. 5 minutes
 - D. There is no specific limit
8. This complication results from repeated venipuncture of the same vein
 - A. Petechiae
 - B. Hemolysis
 - C. Thrombus
 - D. Phlebitis

9. Which of the following is not a component that makes up the chain of infection?
- A. Mode of transportation
 - B. Source
 - C. Susceptible host
 - D. Mode of transmission
10. A hematoma can be prevented if:
- A. Pressure is placed on the venipuncture site until the bleeding stops
 - B. The needle is removed before the tourniquet is released
 - C. A gauze and adhesive strip is immediately placed on venipuncture site after the needle is removed
 - D. A butterfly needle is used
11. Arterial blood gases need special handling. What is the handling requirement?
- A. Specimen must be chilled after collection
 - B. Specimen must be protected from light
 - C. Specimen must be pre-warmed in an incubator
 - D. Specimen must be collected after an eight hour fast
12. The recommended depth for an infant microcapillary collection should not exceed
- A. 0.2 mm
 - B. 2.0 mm
 - C. 2.5 mm
 - D. 2 inches
13. Which of the following represents the correct order of draw?
- A. Gray, Lavender, Green, Red, Light Blue,
 - B. Green, Gray, Light Blue, Red
 - C. Yellow, Light Blue, Green, Gray
 - D. Red, Blue, Gray, Lavender
14. Which test tube would be used for “Fasting Blood Sugar” or “Glucose Tolerance Test”
- A. Red
 - B. Light Blue
 - C. Lavender
 - D. Gray
15. Which of the following is not a common symptom of shock:
- A. Pale, cold clammy skin
 - B. Rapid, weak pulse
 - C. Thrombus
 - D. Expressionless face/staring eyes
16. Bacteria, viruses, fungus or parasites belong to which type of hazard:
- A. Biologic
 - B. Chemical
 - C. Physical
 - D. Allergic

17. Which of the following is not considered a PPE:
- A. Goggles
 - B. Face Shield
 - C. Mask
 - D. Bio hazard bags
18. Isolation is condensed into three categories which are:
- A. Airborne, droplet and contact
 - B. Droplet, allergy and airborne
 - C. Contact, droplet and isoteric
 - D. Airborne, contact and allergy
19. Which of the following is considered a preanalytical error?
- A. Wrong order of draw
 - B. Exposure to light
 - C. Under filling tubes
 - D. Inadequate fast
20. Latex sensitivity is a type of:
- A. Biologic hazard
 - B. Allergic reaction
 - C. Physical hazard
 - D. Chemical hazard

Answers:

- | | |
|-------|-------|
| 1. C | 11. A |
| 2. B | 12. B |
| 3. D | 13. C |
| 4. D | 14. D |
| 5. A | 15. C |
| 6. C | 16. A |
| 7. A | 17. D |
| 8. D | 18. A |
| 9. A | 19. D |
| 10. A | 20. B |