

Allied Health Career Training, LLC

Phlebotomy

A how-to guide for drawing blood

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CHAPTER 1. Introduction to Phlebotomy

So, you've decided you want to become what we jokingly refer to as a certified vampire and draw blood for a living. What is more commonly known as a phlebotomist, these individuals are also known as specimen handlers or blood collectors (but not blood drinkers 😊).

Why is it necessary to draw blood? What do we do with all this body fluid? Well, phlebotomists play a very big part in treating and diagnosing patients. If it wasn't for lab testing, doctors would just be guessing! Lab results are critical to patient care. Some of the most important aspects of lab tests are:

- Diagnostic and screening – to figure out what is wrong with a patient
- Therapeutic assessment – to develop the correct treatment or choose right drugs
- Monitoring health – to make sure the therapy or treatment is working

Phlebotomy Origins

The word “phlebotomy” (and most medical terminology) is derived from the Greek language.

Phleb – A prefix meaning veins or blood vessels

tomy – A suffix meaning to cut or make an incision

The most common methods of today for blood collecting are:

- **venipuncture** - withdrawing venous blood sample using a needle.
- **skin puncture** - puncturing the skin (usually on a finger or heel) for a small amount of capillary blood (*Skin punctures are also referred to as dermal sticks, capillary draws, finger sticks, and heel sticks.)

The practice of phlebotomy has been documented as far back as the Stone Age. Markings on tombs found in Egypt show men applying leeches for bloodletting purposes. Bloodletting was a common medical practice that extended from those ancient times until the late 19th century, spanning nearly 2,000 years. The death of our country's first president, George Washington, in 1799 is attributed in part to the several liters of blood that were drawn after he developed an infection from weather exposure.

In the early 1900's it was generally barbers who practiced phlebotomy and also tooth extraction in their shops. This is where the red and white striped barber shop poles come from. The white represented bandages and the red represented blood. Many crude tools and objects have been used over the centuries, but modern medicine has come a long way!

Necessary Character Traits

There are certain character traits a person needs in order to work in the healthcare field. Some of the most important traits are:

- Do not harm anyone intentionally
- Ability to perform according to job description and use good judgment
- Respect for patients' rights
- Have regard for dignity of all human beings

Let's start with the first one: **Do not harm anyone intentionally**. When dealing with the public in healthcare, let's face it: you will not see people at their best. Many of your patients may be dealing with chronic pain or illness, so naturally they may be grumpy. They may take it out on you, or blame you for things that are out of your control. It is not appropriate to cause the phlebotomy procedure to be even more painful just because they might have hurt your ego. Show compassion. When dealing with the public you must not take things personally. Always follow the golden rule: "Treat people the way you would want to be treated."

As a phlebotomist your duties are limited to what is outlined in your **job description**. Your supervisor and healthcare facility will have a job description for you to follow. This description will comply with state and federal laws. You must be properly trained and adhere to these laws when working in the healthcare field. If an accident occurs while you were working outside of your job description, there could be severe consequences, such as injury to yourself or patients, loss of your job, or lawsuits. When working in a hospital setting you need to be aware of your limitations. This does not mean you should ignore a patient's needs; always get a nurse or aid to assist them. It will *not* be in your job description to:

- Start IV's
- Administer medications
- Transfer patients (this includes helping patients to the restroom)
- Feed patients

Patients have the right to refuse medical treatment, which includes having their blood drawn. You do not have the right to do any procedure, phlebotomy or otherwise, without the consent of the patient and/or their medical guardian. You must **respect the patient's rights**. If a patient should refuse treatment, document the refusal and notify the nurse.

When performing a phlebotomy procedure, make sure to do it with as much privacy and **regard for the patient's dignity** as possible. It is not appropriate to perform a blood draw on a patient while they are on the toilet or commode. If a patient is being bathed, wait for a better time. Wait for patients to be fully clothed, if at all possible. Patients have the right to dignity and privacy, regardless of their condition.

Certification Eligibility

After reading about the characteristics needed for working in the healthcare field, let's talk about the necessary qualifications to become certified as a phlebotomist. To be eligible to sit for the National Healthcareer Association's CPT (Certified Phlebotomy Technician) Exam you must meet the following criteria:

1. You must have a High School Diploma or GED, OR you must expect to earn a High School Diploma or GED in the next 12 months.
2. You must have successfully performed 30 venipunctures and 10 capillary sticks on live individuals.
3. You must have completed a phlebotomy training program in the past five years.

Specimen Testing Phases

The process of specimen testing happens in three distinct phases, **pre-analytical**, **analytical**, and **post-analytical**.

- **Pre-Analytical Phase** - A phlebotomist's duties are part of the **pre-analytical** and **pre-examination** phase of testing. Pre-analytical and pre-examination have the same meaning, and refer to specimen collection. This process occurs before actual testing begins and is one of the most important roles in clinical testing. Most mistakes take place in the pre-analytical phase of testing. Things can go from good to very bad in this phase of testing if not done correctly. This phase includes the following:
 - Correctly identifying the patient and labeling the specimen
 - Accurately performing the collection
 - Transporting the specimen(s) to the lab in a timely manner

A phlebotomist's main goal is to assist the healthcare team in accurate, safe, and reliable collection and transportation of specimens for testing. When collecting specimens for testing make sure to identify your patient. It is important for the phlebotomist to be detailed-oriented when performing the tasks. Avoid distractions when labeling, have the patient spell his or her last name and first, and always ask for a date of birth. After obtaining your specimen, clearly label the specimen tube and/or container. Time can be of the essence in healthcare! It is very important to transport the specimen back to the lab in a timely manner. Kind of like delivering a pizza, it must be done in 30 minutes or less!

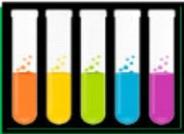
- **Analytical Phase** - The analytical phase is when testing of the specimen begins; more than likely your laboratory technicians will be involved with this phase (those are the ones in the lab coats). The specimen is transported to the lab and processed, after which testing begins. When the tests are complete the results are given to the doctor.

- **Post-analytical Phase** - Once results from the specimen testing are given to the doctor, the doctor then uses these results to determine a patient’s diagnosis and the patient is treated accordingly. This is why it is important that the patient and specimen are both correctly identified all the way back in the pre-analytical phase.

Here is an example of what can happen when errors occur in the process:

Mrs. Yappy is being treated for a blood clot. The doctor is treating Mrs. Yappy with a blood thinner. Routine lab tests are ordered every week to make sure her blood is not too thin or thick. One Monday, Mrs. Yappy and Mrs. Happy come to the lab at the same time. The phlebotomist mislabels Mrs. Yappy’s tube with Mrs. Happy’s tube. The specimens are tested and results are given to the doctor. Mrs. Yappy’s blood appears to not be thin enough, so the doctor orders a higher dose of blood thinner. Later in the week Mrs. Yappy ends up in the hospital with internal bleeding because her blood was way too thin.

Figure 1 shows an overview of how all three phases work together:

		
Preanalytical Phase	Analytical Phase	Postanalytical Phase
Preexamination Process What happens <i>before</i> testing	Examination Process What happens <i>during</i> testing	Postexamination Process What happens <i>after</i> testing
Laboratory examination request/orders	Using appropriate testing methods	Reporting the final test results
Use of standard precautions	Using appropriate equipment	Notifying appropriate providers of critical values when appropriate
Patient preparation and precollection assessment (identification, cleansing, etc.)	Performing quality control	Defining and adhering to turnaround times
Collection of specimen (venipuncture or capillary puncture)	Troubleshooting equipment and reagents	Entering critical laboratory data
Labeling specimen	Troubleshooting erroneous results and quality control errors	Correcting erroneous results
Transporting the specimen	Reviewing and verifying results	Storing specimens appropriately
Specimen receipt, handling, and storage	Interpreting other information that correlates with the test results	Obtaining information needed for follow-up or repeating testing
Evaluating condition of the specimen & Communicating when the specimen is unacceptable	Reconciling discrepancies in laboratory findings	Troubleshooting delays or failures to communicate critical/alert values
Processing the specimen	Maintaining turnaround times for this phase of testing	
Expediting urgent specimens		Figure 1

Good Standard of Care

Which speaks louder, actions or words? Action always speaks louder than words. If you are taking on this job in hopes to be popular, I hate to disappoint you, but no one is excited to see a needle. You can, however, soften the experience. As a healthcare worker you need to keep in mind that without patients, there would be no need for your job. Be compassionate, be sincere, and always put yourself in the patient's place. Remember, you will probably never see a patient on a good day. Be patient with them, treat them as how you would want to be treated.

Examples:

- **Introduce** yourself with your first and last name, along with what department you are with.
- **Eye contact** is important when gaining a person's trust. It will make your job much easier if you have the patient's cooperation.
- **Smile** when greeting patients. Regardless of what your day brings, you are not the one being stuck with the needle or needing medical treatment. So be kind and courteous.
- **Knock** before entering patient's room. They deserve privacy and respect.
- **Explain** to the patient the procedure that is about to take place. Talk to patient as a person, don't expect them to know or understand medical terminology. Use appropriate language, don't lie and claim this will not hurt. Trust means everything to patients.

Personal Grooming

Nobody wants to walk into a lab and be greeted by someone who looks like they just rolled out of bed! Always look professional with clean and ironed scrubs. Hair needs to be pulled back. Nail care is also important. Long nails and finger nail polish are not permitted as they can harbor bacteria that could get patients or yourself sick. A good rule of thumb is to have nails trimmed to less than ¼ inch. You should frequently wash your hands and shower daily. First impressions speak volumes; be the person you would want to have performing the phlebotomy procedure. Remember how I told you to shower daily? Imagine for a moment being confined in a phlebotomy chair or hospital room, while someone with body odor is in what is known as your comfort zone. Comfort zones differ from person to person but the list below is a breakdown of space definitions:

- Intimate space (direct contact, up to 8 inches)
- Personal space (18 inches to 4 feet)
- Social space (4 feet to 12 feet)
- Public space (more than 12 feet)

Which of these spaces do you think you will be in the most as you perform phlebotomy procedures? That's right, intimate space! In some cases, this can feel very intimidating and overwhelming. So layer up on the deodorant!

Patient Identification

This is where detail orientation comes into play. You always want to identify your patients properly, as this could mean life or death. The healthcare team relies on your ability to be accurate. They trust that you have labeled the specimen with the correct patient's name. If the wrong results go to the doctor this could cost someone their life. Always be honest if you have made a mistake; no job is worth another person's life.

- Ask the patient to verbally confirm or spell name
- Compare the patient's name with orders given
- Confirm name with ID bracelet or another reliable source (**If there are ANY discrepancies, ask a nurse!**)

Potential Complications:

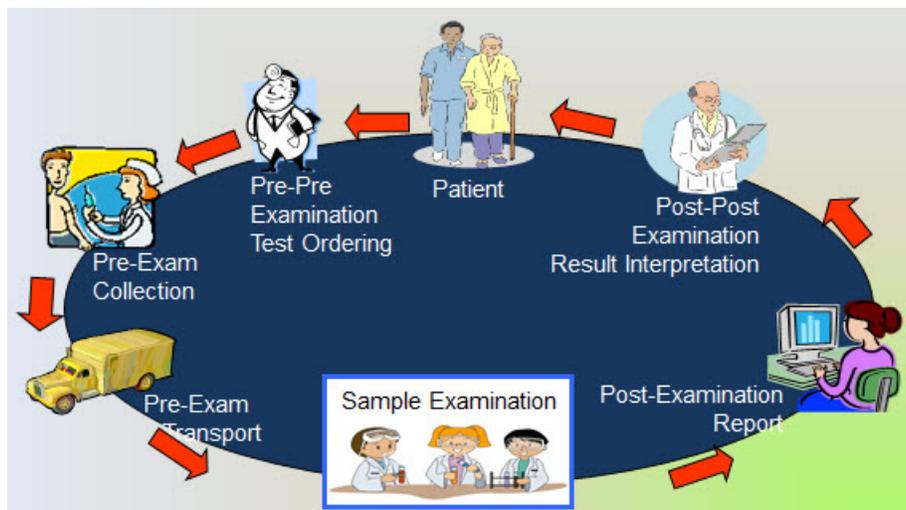
- **Hearing Impairment** – “WHAT? WHAT DID YOU SAY?” There will be situations in which extra steps will need to be taken to ensure that the patient understands the procedure. Make sure patients understand the phlebotomy procedure that is about to happen. When dealing with hearing-impaired patients, make sure to limit distractions and speak clearly. You can also try these steps:
 - Ask if anyone is accompanying the patient
 - Write down the procedure if needed
- **Vision Impairment** - Patients with low to no vision need instruction for each step. They are not going to be aware of their surroundings when entering a lab, or in a hospital room. Make sure to identify yourself and which department you are with. Explain, step by step, the procedure that is about to take place. Read aloud any forms that need signed.
- **Language Differences** – “Slow down, I have no idea what you said!” People come in all different shapes, sizes, and colors. The world would be a very boring place if we all spoke one language. Think how awful it would be if no one ever had an ACCENT! The horror! Language differences can make your task even more challenging. The first step in all phlebotomy procedure is to properly identify the patient, which includes those that don't understand you! Try these steps:
 - Find a translator
 - Use hand gestures
 - Use pictures
 - Have the patient read the name listed on the lab order form. (They should be able to recognize their name.)

Phlebotomy Process

How does this whole process start? How do I know when and where to do the phlebotomy procedure? How do I know what test needs to be drawn? Here is an overview of the whole process:

1. It all starts with the **patient**. A patient typically goes to the doctor's office to discuss symptoms.

2. The **doctor** evaluates the patient along with the symptoms. Once the doctor narrows down a few possibilities he might order lab work.
3. The doctor or his nurse then translates the lab order to the **phlebotomist**.
4. The **phlebotomist** collects the specimen and processes it.
5. The **lab technicians** test the specimen.
6. The **results** are given to the doctor.
7. The doctor then will **diagnose** and treat the patient!



Emergency Room Situations

If you decide to take your phlebotomy skills to a hospital setting, you may be required to collect blood in the emergency room. Sadly, it's nothing like you see on TV. Everyone in the emergency room has one common goal and that is to assess the patient. You must be quick without compromising patient care. There is not a lot of time to second-guess in emergency situations. Go in with confidence! Make sure to have everything necessary to perform the procedure, there is no time to go back to the lab for more supplies. In these particular cases you may be required to take what is known as a "verbal order". Verbal orders are giving by a nurse or doctor. They will let you know what lab tests they are needing during that time. Always repeat back verbal orders. There is no time for mistakes! These orders are STAT, meaning to be done as soon as possible. All STAT orders should come before any routine order.

Home Health or Clinic Setting

Phlebotomist are needed not only in hospitals, but also doctor's offices, nursing homes, reference laboratories, or home health situations. These types of patients are called **ambulatory** patients. Ambulatory is another word for mobile. These extra steps should be taken in these settings:

- Introduce yourself and explain what you are about to do
- Direct patient to sit or lie back
- Be familiar with your surroundings; locate sink/trash can before starting
- Identify the patient
- Puncture site must be properly cared for, never leave a patient if they are still bleeding
- **APPLY PRESSURE UNTIL THE BLEEDING HAS STOPPED!**

Spouses, Family, and Visitors

Family members can be comforting to a patient. If a situation occurs where visitors are too overwhelming, you may ask them to step out. Make sure to only answer questions related to the procedure. It is not in your job description or in your scope of practice to offer results to a patient or a patient's family members. Remember, the doctor makes the big bucks, let them do that job! When drawing blood from a child always have a co-worker present and a parent or guardian, if possible. Try to come at an appropriate time. If a doctor is speaking or assessing the patient, then come back at a later time.

Cultural Sensitivity

Culture is a system of values, beliefs, and practices that stem from an individual's concept of reality. At times culture could interfere with the procedure or who does the procedure. As a healthcare worker you must adhere to anyone's cultural beliefs. Some examples:

- It might be against their belief for blood to be withdrawn from their body, this may cause the patient to refuse lab work to be done.
- In some cultures, women are not to be touch by another man, this may require a female phlebotomist to perform the procedure.

Active Listening

Another effective way to communicate is to actively listen to what your patients are saying. This actually can help you in your job. You can get key factors from patient's if you actively listen. Many things can affect lab results. They may tell you whether they have eaten, which can affect the **fasting (nothing to eat or drink, except water, for 8-12 hrs.)** requirements on a lab test. If a patient has had labs drawn on several prior occasions they may have better suggestions on which method to use and which arm to stick.

Telephone and Email

Answering the phone and emails can be a part of your job. Never give out results to a patient over the phone or through email; this is not in your job description. Always direct them to their nurse. You may answer questions in regards to their lab orders, such as whether there are fasting requirements. Remember an email can be considered a legal document, so use caution while writing one. Always be pleasant and show good customer service skills. Without patients there would be no need for your job!

Quality Assessment of Phlebotomists

Your job is important and should be taken seriously. Don't be offended by constructive criticism; there is always room for improvement. Strive to do your best when collecting blood. You don't want to be the phlebotomist everyone fears! Quality specimens are vital in most cases. Any kind of contamination can affect lab results. It is your supervisor's job to assess you on these areas:

- Healthcare worker's technique
- Complications
- Recollections rates (due to contamination or inaccurate)
- Multiple sticks on the same patients
- Turnaround times

Quality Control (QC)

In order to do your job properly your equipment must work properly. This is a list small list of things that you will be in charge of for quality control:

- Expiration dates on tubes and needles
- Equipment checks for POCT testing
- Preventive maintenance on centrifuges
- Routine cleaning of all surfaces
- Organize supplies by date (Example: Tubes that have a shorter expiration date should be in the front, and used first)

The reason for quality control and assessment of healthcare personnel is because we play a big part in a patient's treatment. We are all responsible for preventing what is known as the 5 D's: death, disease, disability, discomfort, and dissatisfaction. This is why your place of employment must keep accurate records of your quality and accuracy. They must also provide continuing education programs for you.

Important Factors Affecting Quality

- **Anticoagulants and Preservatives** - Test tubes have anticoagulants and preservatives in them. It is important that these are not cross- contaminated. This is why we learn to draw them in a certain order. We call this the "**order of draw**", which we will discuss later. What does anticoagulant mean? Well, coagulation means to clot, so anticoagulation is to not clot. We all have a natural clotting factor in our blood. This clotting factor can affect some laboratory tests, and this is why we use anticoagulants in our test tubes. It is important to discard any outdated test tubes; they will not be sufficient for use.
- **Number of Attempts** - In our job you must know when to let another person take a "stab." I always say, "three strikes and you are out." This does not mean you are not good at your job; there could be many contributing factors. You could be having an "off" day, or the patient could be very dehydrated. Always know your stopping limit. (*Note: Cases*

involving small children should be one attempt and then you need to ask someone else for help.)

Point of Care Testing (POCT)

As phlebotomists, we don't always let the lab technicians have all the fun! Sometimes it is necessary, for patient care and comfort, to have the lab to come to them. That's why we do low complexity testing at the patient's bedside. These tests are also referred to as **Point of Care Testing (POCT)** or "waived tests," and they are tests that the phlebotomist can perform. This is when you will participate in all three phases of laboratory testing.

These are some examples of waived testing:

- **Urine analysis (UA)**- This test checks to see several different chemistries and bacteria in the urine. This test is very commonly used to treat and diagnosis urinary tract infections.
- **Influenza (FLU)**- Typically this test is done by a nasal swab sample. That's right you get to stick swabs up someone's nose! Eww! This test is used to treat and diagnosis the flu.
- **Blood sugars (Glucose Testing)**- Glucose testing is used to monitor a patient's blood sugars. Most patients that are diagnosis with diabetes must keep very close eye on their blood sugars. A small device known as a glucometer is used to perform this test.
- **Occult blood**- This test is performed with a small amount of stool sample. (I know what you are thinking. What?!? Phlebotomists work with poo?!? What can I say? It's a glamorous job.) The reasons behind this test is to check for blood in the stool specimen. Occult blood is used for various reasons, but the most common are internal bleeding and colorectal cancer.
- **Drug Testing**- With the certification given to you by the NHA you can do drug testing for "medical purposes". This helps doctors determine what narcotics or other drugs a patient is taking. If a drug tests must be performed for "work purposes" a clinical laboratory technician must perform the test. (Remember guys in white coats!)
- **Pregnancy Test (hCG)**- This tests the human chorionic gonadotropin (hCG) in a women's urine. This test helps determine the pregnancy stasis in a patient. When this test is performed "first mornings" urine is the best. The urine is concentrated, which means the hormone level be high, in return the test is more accurate.
- **Hemoglobin and Hematocrit**- This test the amount of red blood cells in your body, amongst other cells. In order for a person to donate blood, the donation center must determine if the donor can with stand the loss of the amount required. This test is also one of the first test in determining anemia.

There are many waived tests in the health care industry and more are being created each year. Health care workers need to be aware of how to perform the test with accuracy, also follow the instructions that is included in each test kit. As the testing personal it will be your responsibility to keep accurate records of all quality and control.

Blood Loss

If too much blood is taken from a patient, a serious condition known as **iatrogenic** anemia can occur. This is why it is important to keep accurate records of each patient and blood volume taken from them. The average adult has about two 2- pop liters of blood in their bodies, whereas an infant has about a soda-can worth of blood in their bodies.

To calculate infant blood volume:

- Convert the infant's weight from pounds to kilograms. Divide pounds by 2.2 (for example, 6.2 lbs./2.2=2.85 kg)
- Multiply the number by of kilograms by 100 (for example 2.82x100=282ml)
- Convert blood volume in mL to liters (for example 282 ml/1,000 = 0.28 L)
- When drawing blood from a newborn, 2.5 ml is the total amount that can be taken at one time.

The actual amount of blood collected in each tube must be documented so that, over time, calculation of total amount of blood removed can be ascertained. Always discuss any concerns with your supervisor or lab manger.

Stakeholders

A Stakeholder is basically another word for customer. Just like any other public service industries, everyone has to get paid.

External Stakeholders are people or groups of people who are outside of a facility or organization.

Internal Stakeholders are people or groups of people who are within a facility or organization.

Here are examples of **External Stakeholders vs. Internal Stakeholders**:

External Stakeholders

- Local community
- Insurance companies and employers that pay for services
- Grant agencies and/or foundations that provide funding
- Federal or state agencies
- Accrediting agencies (such as the Joint Commission)
- Advocacy groups (such as the AARP)

Internal Stakeholder (healthcare workers and/or persons receiving services)

- Inpatients and outpatients
- Patient's families, friends, and support groups
- Clinical lab staff
- Pathologists and other medical staff members
- Students, research staff, and/or volunteers

CHAPTER 2. Ethics and Laws

Ethics and laws differ in that **ethics** are social guidelines based on moral principles and values, while **laws** are rules or regulations that have penalties or consequences when violated. All healthcare workers are faced with ethical and legal decisions at one time or another. Situations may be legal but not ethical, and vice versa. Always try to be fair and honest. When faced with making an ethical decision, ask yourself these type of questions:

- Does your decision foster a “win-win” situation with the patient and my supervisor?
- How would I feel about myself if I read this decision in the newspaper?
- Can I live with my decision?
- Is the action legal?

Basic Legal issues

As a healthcare worker you are bound by law to give the best possible care to patients. Always remember it is a patient’s right to refuse any medical procedure. A patient’s refusal must always be documented. If it isn’t documented, it never happened. You should make yourself familiar with the legal terms and definitions below:

- **Negligence** - failure to provide proper care
- **Malpractice** - improper care of a patient by a health care professional, resulting in injury
- **Assault** - the attempt to touch a person or the threat to do so without permission
- **Battery** - the intentional touching of another person without their consent

Read the following hypothetical legal cases involving phlebotomy procedures and ask yourself if the phlebotomist or the facility is at fault and/or legally liable.

Scenario 1: After being approached by a healthcare worker to have their blood drawn, a child begins to cry and tries to escape. The healthcare worker then locks the child in the room and performs the procedure.

Scenario 2: A phlebotomist is drawing blood for a nursing home. Two patients with similar sounding names are drawn within a few minutes of each other. The phlebotomist does not validate the patient’s identification with their date of birth, causing the phlebotomist to mislabel the tubes. The specimens are processed, and results are given to the patient’s respective doctors.

Scenario 3: A patient had a blood specimen collected at a physician’s office. Blood had been collected from him at the same office on several prior occasions with no problem. The phlebotomist, who was new to the patient, was drawing blood and seemed to be in a hurry. She inserted the needle at a much steeper angle than the patient was used to and went through the vein. She redirected the needle several time before entering the vein. A

hematoma began to form at the venipuncture site. The phlebotomist told the patient that the draw would be over soon. Meanwhile, the patient informed the phlebotomist of immense pain in his arm. The patient suffered permanent nerve damaged due to the hematoma.

Scenario 4: A phlebotomist was working in a hospital setting. During her morning blood draws, a patient asked her for assistance to the restroom. The patient is a very large woman, but the phlebotomist lends a hand. During the transfer the women slips and falls on a wet spot on the floor. The phlebotomist is unable to prevent the fall and the patient fractures her arm.

In any of these cases, the court could rule in favor of the plaintiff. More than likely it would be the healthcare facility being sued, but in cases of assault or battery it could very well be the phlebotomist who is sued. In any case it is also very likely that the phlebotomist would no longer have a job with that facility. That is why you need to know and apply the correct techniques and stay within your job description.

Types of Consent

Have you ever gone to a doctor and felt like you were signing your life away? Among the many pages of paperwork that Admissions will give you, there will be a document known as a “Consent to Treat.” When a patient signs this document, it gives the healthcare facility the right to medically treat the patient, which also might include blood draws. As a phlebotomist you have the responsibility to inform your patient of any risks that could occur because of the procedure. These risks could include, but are not limited to, infection of the venipuncture site, temporary or permanent nerve damage, and hematoma (bleeding under the skin, bruising).

- **Informed consent** - the patient is given information regarding the procedure that is about to be done along with the risks involved. Verbal and written consent is given.
- **Implied consent** - the actions of the patient by body movement. Implied consent is normally given in emergency situations. This could occur in the emergency room or in a clinic setting. If a patient has had routine blood draw several times over they may just hold out an arm, already knowing the risks that are involved.

Medical Records

Medical records are necessary for every patient. A healthcare worker cannot be expected to remember a patient from whom blood was collected years ago. Medical records must be neat, legible, and accurate. They are extremely important if a medical malpractice case goes to court. Medical records are also used for nonmedical reasons that are not directly tied to medical services, such as billing, utilization review, quality improvement, and so on. Medical records are to be kept confidential. Medical records must keep up with the times! The government mandated all healthcare facility have to use some form of Electronic Medical Records (EMR). This ruling was

intended to improve patient care with more precise and accurate record keeping. (Less second-guessing the doctor's handwriting!)

HIPPA - Health Insurance Portability and Accountability Act

Oh HIPPA, how you make our lives complete! HIPPA is about keeping all patient information confidential. As a healthcare worker you are under legal obligation to keep all patient information as confidential as possible. Patient information is given only on a need-to-know basis. Huge fines may be levied if confidentiality is breached; it can cost healthcare facilities thousands of dollars.

Here are some examples of HIPPA violations:

- A member of lab personnel lets a co-worker use her password to log into her compute to check lab results on a family member.
- In the grocery store line, a wife asks about whether her husband's PSA results are in.
- A phlebotomist repeats back an order on the phone, which included a patient's name and date of birth, within hearing distance of other patients.
- A lab personnel leaves to go to lunch but leaves sensitive patient information showing on their computer.

HIV Related Issues

Since we are on the topic of HIPPA and need-to-know information, would you think it is your right to know a patient's HIV status? Well, it's actually not! The only time you have the right to know a patient's diagnosis is if you were to be stuck by a contaminated needle. In that case, both you and the patient must be tested for any blood borne pathogens. These tests would include testing for HIV/AIDS and Hepatitis. DO NOT be afraid of reporting any type of exposure. All exposures must be documented. If a healthcare worker should contract AIDS during their time of employment, there could be some unemployment benefits available.

We will go over how to protect yourself against blood borne pathogens in later chapters, but part of protecting yourself is to ***treat all blood as though it is infectious***. Some patients may not know that they are infected. In the early 1980's, HIV was new and very scary. Now there are many treatments available. Still, to date, the most commonly contracted blood borne pathogen is Hepatitis B.

CMS and CLIA

Have you ever heard of "state" visiting long term care facilities? Or health inspectors for restaurants? The Center for Medicare & Medicaid Services (CMS) is a federal agency which functions similarly to those, but for clinical laboratory testing facilities. CMS regulates all laboratory testing (except research) performed on humans in the U.S. through the Clinical Laboratory Improvement Amendments (CLIA). This federal agency has the power to close laboratories that are not meeting standards. CLIA mandates what you can and cannot do in the lab and inspects and ensures quality lab results. CLIA is what allows you to do blood draws, specimen collections, and waiver testing.

CLSI (Clinical and Laboratory Standards Institute)

A lot of effort goes into making sure that test results are accurate. Providers base their treatment and medication dosages on these test results. CLSI documents are developed by committees composed of experts in medical testing or ancillary aspects of these activities. The primary responsibility of the committees is drafting consensus documents and evaluating and addressing comments received during each phase of the consensus process. Development of CLSI standards is a dynamic process. Each CLSI committee produces consensus documents related to a specific discipline. Nine expert panels manage the development of documents and related products in their respective subject areas. They ensure that each document meets CLSI's requirements for consensus, technical accuracy, relevancy, and excellence.

- **Standards** are documents developed through the consensus process that clearly identify specific, essential requirements for materials, methods, or practices for use in an unmodified form. Standards may, in addition, contain discretionary elements, which are clearly identified.
- **Guidelines** are documents developed through the consensus process describing criteria for a general operating practice, procedure, or material for voluntary use. Guidelines may be used as written or modified by the user to fit specific needs.
- **Reports** are documents that have not been subjected to consensus review and are released by the appropriate consensus committee.
- **Companion products** include any item provided or sold that is intended to be used in conjunction with a CLSI standard or guideline. Examples include, but are not limited to, Quick Guides, Wall Charts, software, and templates. Companion products typically contain or refer to technical content taken directly from standards or guidelines.

Example of a CLSI guideline: When using asepsis for a venipuncture make long strokes back and forth covering a 2 in by 2 in area.

The Joint Commission

The Joint Commission accredits and certifies thousands of healthcare organizations in the United State. They are an independent, non-governmental, nonprofit organization. Its operational standards focus on continual improvement of patient safety and quality of care. The Joint Commission updates the continual improvement. The National Patient Safety Goals (NPSGs) program increases patient safety by setting requirements for issues including accurate identification, communication of test results, and necessary training of health care professions. The NPSGs require validating patient identification using a two-factor method. For example, confirm identification by matching the wristband to the medical record, and asking patients for their telephone number, home address, or date of birth. Always ask patients to state their name, then compare that the name on the wristband or laboratory requisition form. To ensure test results are reported as quickly as possible, NPSGs emphasize the need for active communication between the health care professional performing the test and the provider ordering it. Ongoing personnel training in safety and infection control through proper hand hygiene and use of disinfectants adds on additional layer of safety.

Chapter 3. Medical Terminology

While working in the healthcare field, it is important to know basic medical terminology. Yes, it looks like a whole other language! And that’s partly true, because much of medical terminology is based on Greek and Latin. It can be intimidating, but you don’t want to walk around not knowing what your co-workers are saying. We will start off slow and break some of this down. Let’s travel back to grammar school and take a look at word structure:

Root - The main part of the word

Prefix - Comes before the root word

Suffix - Comes after the root word

Combining vowel - These can connect a word together to help with pronunciation. Not all medical terminology will have a combining vowel.

Here are some examples:

Phlebotomy (phleb/o/tomy)

Endocarditis (endo/card/it is)

Building Medical Words – Three Basic Rules:

Rule 1. A root word links a suffix that begins with a vowel.

Example:

Root word	Suffix	Medical word	Meaning
hepat	-itis	Hepatitis	Inflammation of the liver

Rule 2. A combining form (root + o) links a suffix that begins with a vowel.

Example:

Combining form	Suffix	Medical word	Meaning
hepat/o	-cyte	Hepatocyte	Liver cell

Rule 3. A combining form links a root to another root to form compound words.

Note: this rule holds true even if the next root starts with a vowel.

Example:

Combining form	Root word	Suffix	Meaning
oset/o	arthr	-itis	Inflammation of bone and joint

CHAPTER THREE – MEDICAL TERMINOLOGY

Basic Terminology Lists:

Prefixes that pertain to position, location, direction, or placement:

ab away from	epi upon, above	intra within
ad toward	ex out, away from	meso middle
ana up	extra outside, beyond	para beside
ante before	hyper above, excessive	retro backward
cata down	hypo below, deficient	sub below, under
circum, peri around	infra below	supra above, beyond
endo within, innermost	inter between	trans across, through

Prefixes that pertain to numbers, amounts, or speed:

ambi both	hyper above, more than normal	primi first
bi two, double	hypo below, deficient	quadri four
brady slow	milli one-thousandth	quint five
centi a hundred	mono one, single	tachy fast
deca ten	multi many, much	tetra four
dipl double	nulli none	tri three
di(s) two	poly many	uni one

Prefixes that are descriptive and are used in general:

a, an without, lack of	dys bad, before, difficult	micro small
ante, anti, contra against	eu good, normal	nephr related to kidney
auto self	hepat related to the liver	oligo scanty, little
brachy short	hetero different	pan all
brady slow	homeo similar, same	pseudo false
cac, mal bad	hydro water	re again and again
de reversal of, without	mal bad, inadequate	sym, syn together

Primary root words related to the Cardiovascular System:

Root	Meaning	Root	Meaning
ang/i, angi/o, vas/o	vessel	infarct	necrosis
angina	to choke	lipid	fat
arter, arteri/o	artery	logos	study
ather/o	fatty substance or deposit	man/o	thin
capillus	hairlike	my/o	muscle
card, card/i, cardi/o	heart	phleb, phleb/o	vein
cubitum	elbow, forearm	pulmonary	lung
cyte	cell	rrhyth	rhythm
derm	skin	scler	hardening
diastole/o	dilating	sera	serum
electr/o	electricity	sphygm/o	pulse
embol	to cast, to throw	steth/o	chest
erg/o	work	systole/o	contracting
erythro/o	red	thromb	clot
hem/o	blood	ven/i	vein

I know you may be looking at the charts above with concerns of “how am I ever going to remember all of these?!” I will make it a little easier for you. There will not be a lot of medical terminology on the national phlebotomy certification exam. This is not where you should focus your time and effort. Make yourself familiar with the terms, but you don’t have to go flashcard crazy trying to memorize each one. Here are a few basic prefixes and suffixes that you will want to remember:

- cardio - heart**
- itis - inflammation**
- hemo - blood**
- ante - before**

You can breathe again! Moving on!

Anatomical Directions and Positions

These are the anatomical terms for directions:

Anterior - the front of the body (Ex: The phlebotomist will draw from *the anterior* part of the arm.)

Posterior - the back of the body (Ex: There is a skin tear on *the posterior* side of the arm.)

Medial - toward the midline (Ex: The heart is *medial* of the right shoulder.)

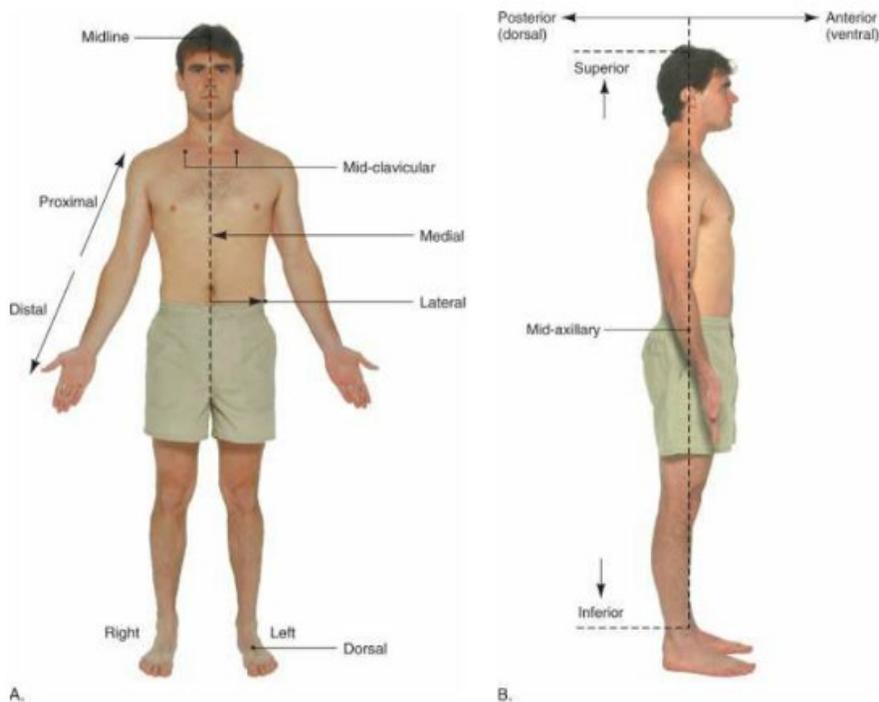
Lateral - toward the sides of the body (Ex: The hip is *lateral* of the navel.)

Distal - away from the center point of attachment (Ex: The rash was spreading *distal* from her knee all the way to her ankle.)

Proximal - near the center or point of attachment (Ex: Her leg broke *proximal* side of her ankle.)

External or Superficial - far from the surface of the body. (Ex: When performing a venipuncture, phlebotomists must feel for *superficial* veins.)

Internal or deep - far from the surface of the body. (Ex: Major arteries are in the *deep* tissue.)



These are the anatomical terms for positions:

- **Normal anatomic position** - Erect, standing position with arms at rest
- **Supine position** - lying or reclining face up
- **Prone position** - lying face down
- **Lateral recumbent position** - lying on left or right side



When performing a phlebotomy procedure, it is necessary to have the patient in either a sitting or supine position. This is to ensure the safety and comfort of the patient.

Homeostasis

Oh, how the body is a miraculous thing! **Homeostasis** means to remain the same. For our bodies to continue to live in a healthy state it must have constancy of its chemical components and processes in order to survive. Every organ and body structure play a part in maintaining homeostasis. How do we know if the body is in a healthy state? Well, healthcare workers assess homeostasis through taking vital signs, x-rays, laboratory testing and various other ways.

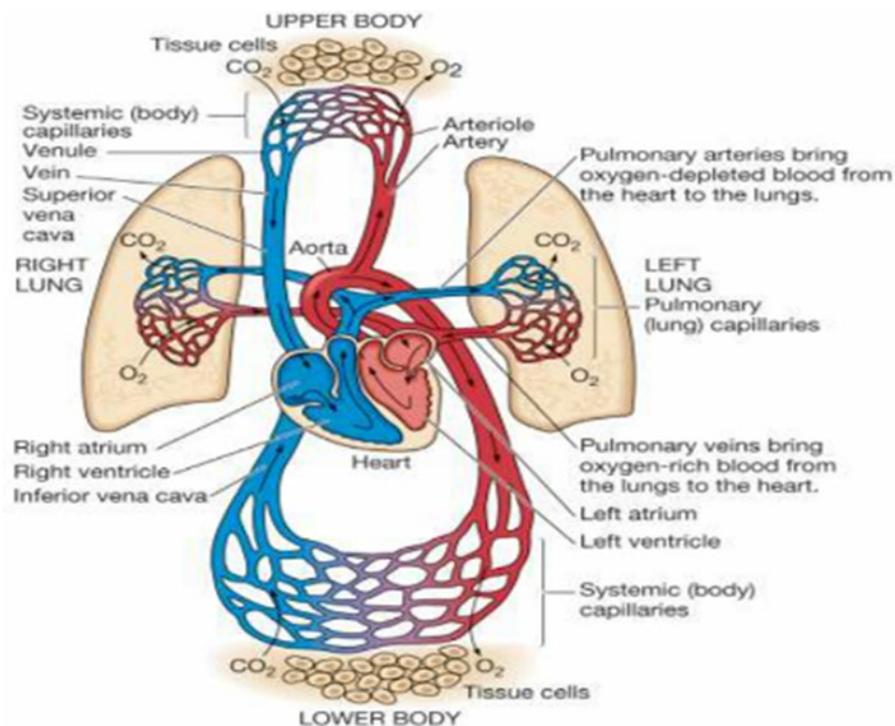
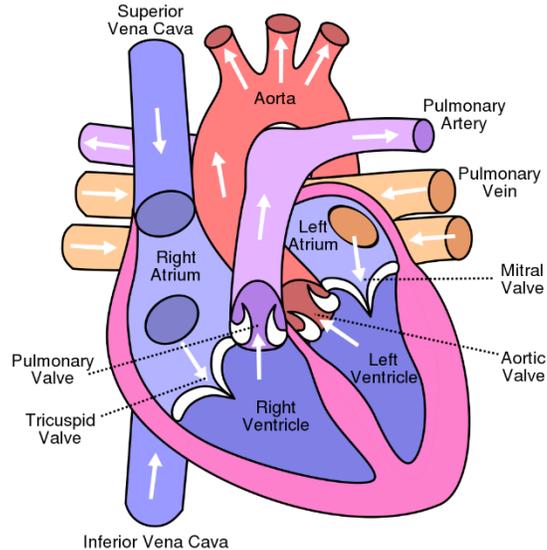
Cardiovascular System

Cardio relates to the heart; **vascular** includes veins, arteries, and capillaries. The cardiovascular system is a transport network that affects every part of the body within seconds. This system transports nutrients, electrolytes, hormones, enzymes, antibodies, cells, and gases, all to maintain homeostasis. This system is primarily made of:

- **Heart** - muscular organ, contracts to push blood throughout the body, beats 60-80 minutes
- **Aorta** - largest artery, exits heart from the left ventricle
- **Vena Cava** - largest vein
- **Pulmonary arteries/veins** - right ventricle of the heart pumps blood into the pulmonary arterial branches
- **Arteries** - transport oxygenated blood throughout the body
- **Veins** - transport deoxygenated blood back to the lungs
- **Capillaries** - carry blood that is a mixture of venous and arterial blood
- **Circulating blood** - regulates the body

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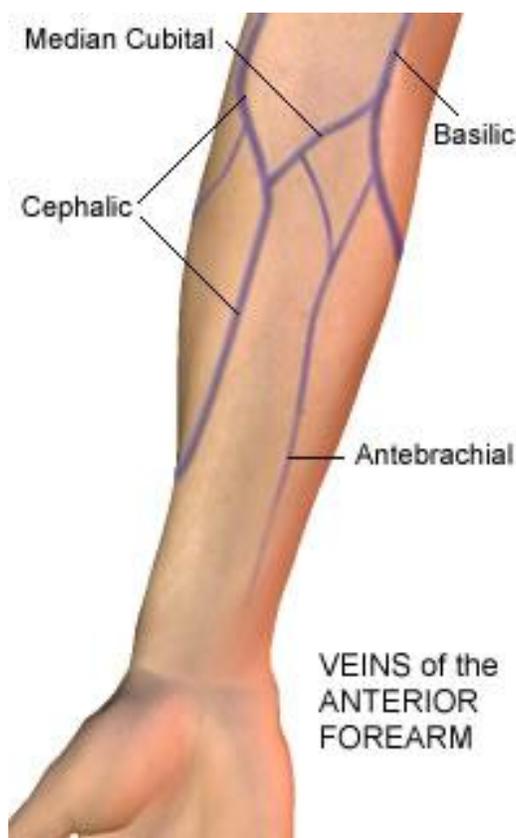
Oh, the ins and outs of the heart! Nope, not another tear-jerking chick flick, we are actually talking about that muscular organ that goes “bomp-bomp” about 60 times in one minute. It is what keeps the blood flowing throughout your body. It makes our job as phlebotomists much easier when there is good circulation.



Most common sites for venipunctures

Well, we don't stab and jab people just anywhere! There is a method to our madness. The most common site for venipunctures is the in antecubital area. This area is at the bend of the elbow. This area is at the bend of the elbow. Want to sound super smart?? Tell someone that the bend of the elbow is known as the antecubital area. We will talk about alternative sites in later chapters. When choosing a vein these are the three most commonly used areas:

- **Median cubital** – This vein is located in the middle of the antecubital area. This is the biggest of the three main veins and it is more anchored into the arms. You must be careful because it is located near a tendon. It is usually the first choice when doing a venipuncture.
- **Cephalic Vein** - This vein is located on the outer-thumb side of the antecubital area. It is more prominent in obese patients. It also tends to be the smallest of the three main veins, but it is still accessible.
- **Basilic vein** - This vein is located on the pinky side of the arm. It is the 3rd choice when performing a venipuncture. When using the Basilic vein you must be careful because it lies on top of, or close to, an artery.



Blood Components

Blood is a living tissue containing various cells and substances. It circulates through the heart, arteries, vein, and capillaries, carrying nourishment, vitamins, electrolytes, hormones, antibodies, warmth, and oxygen to the body’s tissues. Blood also transports wastes and carbon dioxide to organs that can excrete them from the body.

Blood Group Systems

Each person has one of four blood types in the ABO system (A, B, AB, or O-) and one of two designations in the Rhesus (Rh) system (Rh positive or Rh-negative). The presence or absence of the A and antigens determines the type:

- Type A blood has the A antigen.
- Type B has the B antigen
- Type AB has both antigens
- Type O has neither antigen

Furthermore, type A plasma contains anti-B antibodies, type B plasma contains anti-A antibodies, type AB contains no antibodies, plasma contains no antibodies, and type O contains both antibodies. People who are Rh-positive have the antigen for the Rh factor; Rh-negative people do not. Rh-negative individuals may donate to Rh-positive recipients but should only receive Rh-negative blood.

In an emergency, anyone can receive type O blood, and type AB individuals can receive blood of any type. Therefore, people who have type O blood are universal donors, and those who have type AB blood are universal recipients. In addition, AB donors can give plasma for all blood types. Type O is the most common ABO type, with type A being a little less common, type B a lot less common, and type AB the rarest.

Blood Bank

Blood banking refers to the process of collecting, separating, and storing blood. Donor blood is stored for future use to patients that may need a blood transfusion. It is important for patients to receive the right blood type. Only in emergency should a patient receive universal blood.

RELATIONSHIPS BETWEEN BLOOD TYPES AND ANTIBODIES				
Blood Type	Antigens on Red Blood Cell	Can Donate Blood To	Antibodies in Cerum	Can Recieve Blood From
A	A	A, AB	Anti-B	A, O
B	B	B, AB	Anti-A	B, O
AB	A and B	AB	None	AB, O
O	None	A, B, AB, O	Anti-A and Anti-B	O

Blood Terminology

The volume of blood in an individual varies according to body size and weight. The average adult body contains about 4 to 6 liters of blood. That’s about 4,000 to 6,000 ml, whereas infants who are about 6 lbs. may have between 240 and 340 ml of total volume of blood. Phlebotomists must be accurate with how much blood needs to be obtained in order to avoid causing **iatrogenic anemia**.

We test blood in several different forms. These are the three main forms that we use during laboratory testing, **whole blood**, **plasma**, and **serum**.

1. **Whole blood** consists of water, dissolved substances, and blood cells. There are three main types of blood cells circulating in the body. See the chart below:

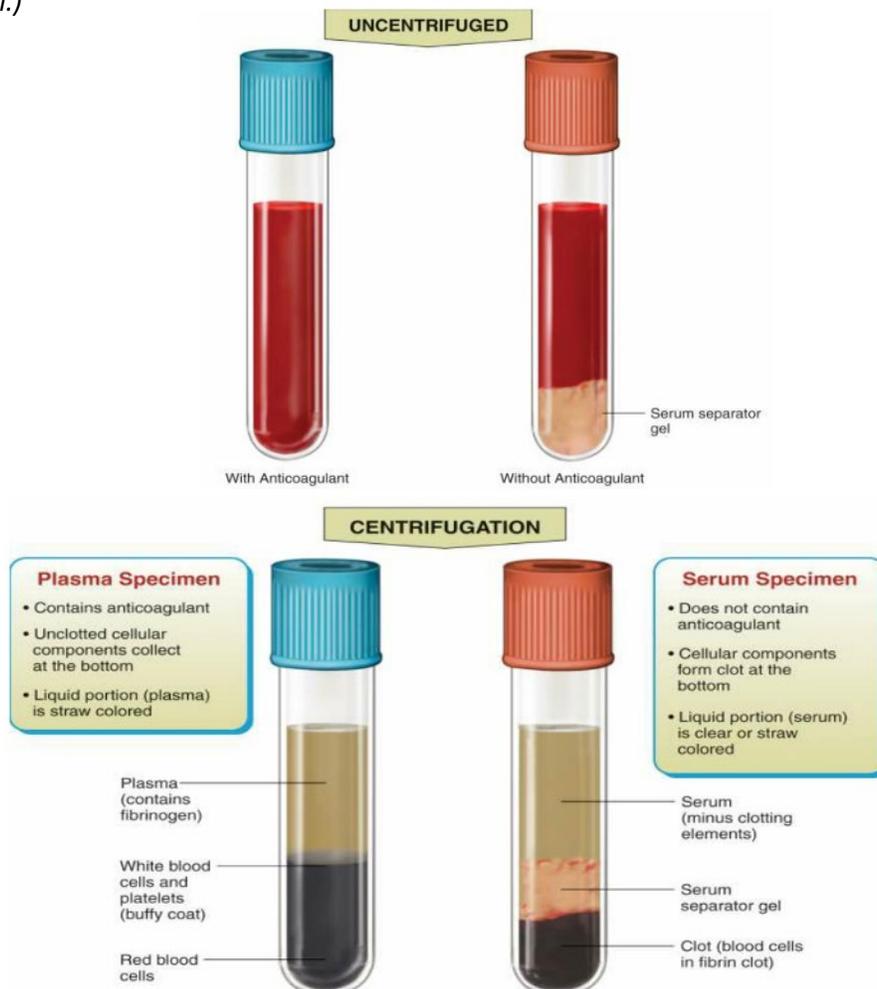
CELLS	FORMATION	DESTRUCTION
Erythrocytes (RBC’s)	Transport O2 and CO2	Life span: 120 days, fragmentation and removal in spleen, liver, and bone marrow
Leukocytes (WBC’s)	Defense	Life span: 1 day to 1 year, removed in spleen, liver, bone marrow
Thrombocytes (platelets)	Clotting	Life span: 9-12 days

- a. **Erythrocytes** – these are red blood cells and are the most common type of blood cell. Gases are carried throughout the body by RBC’s.
- b. **Leukocytes**
 - **Neutrophils** - are the most abundant (40% to 75%) type of white blood cells in humans and form an essential part of the immune system.
 - **Eosinophil** - are white blood cells and one of the immune systems components. Eos usually are high when your body is fighting an allergic reaction.
 - **Basophils** - are the least common of the granulocytes, representing about 0.01% to 0.03 % of white blood cells. They store histamine which secretes when stimulated, like from sneezing.
 - **Monocytes** - are another type of white blood cell. The important roles in the immune system, such as replenishing resident macrophages (white blood cells that engulf bacteria) under normal states, in response to inflammation signals, monocytes can move quickly to sites of infection in the tissue.
 - **Lymphocytes** - is any of three subtypes of white blood cells. They include natural killer cells, T cells, and B cells, which are all part of your immune system.
- c. **Thrombocytes (platelets)** – are colorless blood cells that help clot blood. Platelets stop bleeding by clumping and forming plugs in blood vessels.
 - **Fibrinogen**-a plasma protein that converts into fibrin to form a clot during bleeding.

2. **Plasma** is the liquid portion of blood. It is made up of 90% water and 10% dissolved substances and cells. Blood cells, oxygen and carbon dioxide (gases) and chemicals are suspended in plasma. IF you add an anticoagulant (blood thinner) to your specimen, you can then centrifuge it (spin it really fast) and create plasma. All of the cells will settle to the bottom of the tube. Plasma is clear yellow in color.

3. **Serum** - It takes about 30 minutes for blood to clot. If you collect blood in a tube with no anticoagulant in the tube, your blood will clot. This will turn whole blood into serum. Serum is plasma without the fibrin in it. Fibrin is the body's own natural coagulant. We allow that to clot then spin down the rest of the specimen. This turns the specimen into serum. If we did not allow it to clot, your specimen would have broken red blood cells and mixed within the serum. Most tubes have a gel barrier at the bottom that will separate the cell and the liquid portion. This makes it easier to get the specimen out of the tube for testing. These tubes are referred to as SST tubes, or Serum Separator Tubes. Serum is a straw-like color.

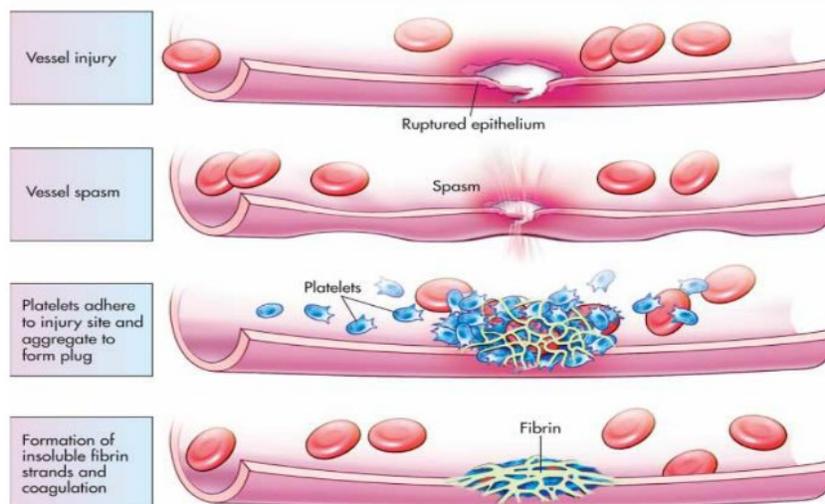
***Turbid-** some plasma and serum may appear cloudy or **lipemic** (milky) as a result of several conditions such as high lipids (fats) or bacterial contamination. A lipemic specimen may bring in to question whether the patient was fasting or not. (**Note: always document if the specimen doesn't look normal.*)



Coagulation of Blood

Hemostasis (*hemo-* blood / *stasis-* standing still) is the mechanism to prevent blood loss when a blood vessel is injured by an incision or puncture. This occurs after a venipuncture. Because damage was done to the vein during the procedure, the body starts to repair the vessel. This takes place in five different phases:

1. Vascular phase – the vessel is constricted to decrease blood flow to the area
2. Platelet phase – platelets clump together to form a plug
3. Coagulation phase – a fibrinogen mesh is formed over the platelets
4. Clot retraction – after bleeding has stopped, the clot retracts to heal the torn edges of the vessel
5. Fibrinolysis – the final repair is made. The injured vessel heals and the clot begins to dissolve or break up.



Normally slight pressure on a puncture site will stop bleeding. There are a lot of determining factors on bleed time and how long to pressure must sustain. Doctors will treat patients with medications known as “blood thinners.” These medications may prolong bleed time. Just always make sure never to leave, or let a patient leave, if the puncture site is still bleeding. Some common blood thinners are:

- coumadin (Warfarin)
- clopidogrel (Plavix)
- aspirin
- heparin

If a patient should tell you that they are on any of these medications, expect bleed time to be longer than normal. APPLY PRESSURE!

Arteries and Veins

What is the difference between arteries and veins? They both carry blood throughout the body, but not the same kind of blood. Arteries carry oxygenated blood to all areas of the body. Veins carry deoxygenated blood back to the heart to start the process all over again.

- **Arterial Blood**
 - *Bright red in color*
 - *Spurts out (making it harder to control)*
 - *Needs pressure for 3-5 minutes*

- **Venous Blood**
 - *Blood is darker in color*
 - *Occurs a steady flow*
 - *Normal bleeding stops by applying pressure*

- **Capillary Blood**
 - *Blood is a color in between*
 - *Occurs slowly*
 - *Easily controlled*

If an incident should occur that an artery is punctured during a procedure.... DO NOT panic! Remove the tourniquet, discontinue the draw, and apply pressure for 3-5 minutes. Make sure to report the incident to the patient's nurse.

How laboratory specimens are used

What is all the blood being used for? What other specimens can be tested?

As we discussed before about the body remaining in a steady state (homeostasis), laboratory testing can be the first to detect any abnormalities. Ordering a lab test could be done for a combination any of these four reasons:

- Diagnosis
- Monitoring
- Therapy
- Screening

The most common specimens that you will collect will be blood and urine, but those are not the only samples that are tested in the lab. Many specimens are collected by doctors and nurses.

These samples will have to be processed before testing begins.

Other specimen samples are:

- Cerebrospinal Fluid: from around the spinal cord
- Synovial Fluid: joint fluid
- Pleural Fluid: from around the lungs
- Biopsy tissue
- Stool
- Semen

CHAPTER 4. Safety and Infection Control

As medical professionals, we need to educate ourselves on how we can protect our patients and ourselves. There are many diseases out there that pose a threat to healthcare workers and their patients every day. It is important to take as many precautions as necessary to keep everyone safe. The **Occupational safety and health administration (OSHA)** and the **Center for Disease Control and Prevention (CDC)** have come up with many guidelines to ensure safety to employees and the public.

OSHA and NIOSH (National Institute for Occupational Safety and Health) oversees:

- Implementing the use of devices with safety features and evaluating their use to determine which are most effective and acceptable.
- Helping with prevention of needlestick injuries.
- Modifying work practices that pose a needlestick injury hazard to make them safer.
- Promoting safety awareness in the work environment
- Using devices with safety features provided by the employer.
- Do not recap needles.
- Planning for safety handling and disposal before beginning any procedure using needles.
- Reporting all needlestick and other sharps-related injuries promptly to ensure that employees receive appropriate follow-up care.

The Center for Disease Control (CDC)

The CDC is a government agency that helps identify and educate about infections, illnesses, and disease prevention. The CDC attempts to identify new diseases and work quickly to find ways to prevent their spread. It recommends standard precautions with any procedure that could result in exposure to body fluids. The CDC make suggestions and OSHA mandates the suggestions.

Personal Safety Involving Specimen Handling

Number one rule: ***Treat all patients and specimens as though they are infectious!***

You don't know if the blood specimen you handle might contain a **blood borne pathogen**. Blood borne pathogens are infectious organisms found in the blood and other body fluids. Some of the most common blood borne pathogens are Hepatitis A, B, C, D, & E, HIV, Syphilis, and Malaria.

Exposure Control

Let's talk a little bit about exposure control and how to protect yourself. If a needle-stick should occur the *absolute first thing* you should do is wash the area, cleanse it with alcohol, and then bandage it. Always take care of the site of the needle-stick first, and then report the incident immediately to your supervisor or charge nurse. It is your job to know who to contact during each shift. Be honest and accurate when reporting a needle stick. To prevent needle sticks, always use needles with safety shield devices, never recap needles, and always dispose of needles in a biohazard box (sharps container).

Exposure Control and Documenting (several questions regarding this on the NHA exam)

For the accidental exposure log, OSHA requires the following information.

- How the exposure happened

- By what means it occurred (splash into an eye, needlestick)
- Type of equipment involved
- Safety measure on the equipment
- Type of PPE the phlebotomist was using
- Where the incident occurred
- Situation surrounding, the exposure

If the incident involves an accidental needlestick or an injury from any other sharp instrument (lancet, broken capillary tube), make an entry in the Sharps Injury Log, including the following:

- Date the event happened
- Type of equipment involved and the brand name
- Where the exposure took place, such as the workplace's department

Safety Data Sheet

If you should be exposed to any chemical, refer to the SDS or the Safety Data Sheet. Chemical manufacturers supply Safety Data Sheets for their chemicals. Each SDS bears a hazard warning label and lists information about each chemical, including the chemical's name, trade names, and synonyms; the manufacturer's name, address and emergency telephone numbers; information about handling and storage, and actions to take in case of accidental exposure. This is under the chemical category.

Healthcare-Associated Infections

When a patient is being treated at a healthcare facility, **nosocomial infections** are a risk factor. Nosocomial infections are infections that patients obtain while being treated in the hospital, doctor office, nursing home, etc. In order to prevent the spread of infection, healthcare workers must abide by certain aseptic techniques:

- Use of PPE
- Frequent hand hygiene (hand washing)
- Waste management of contaminated materials
- Use of proper cleaning solutions
- Following standard precautions
- Using sterile procedures when necessary

Standard Precautions

In order to prevent the spread of blood-borne pathogens, OSHA has mandated a system of **Universal Precautions**, also known as **Standard Precautions**. As a part of these precautions, healthcare workers who are routinely exposed to infectious bodily fluids must wear **Personal Protective Equipment (PPE)**. Appropriate PPE will be determined by the types of exposure anticipated. As phlebotomists, the most common PPE will be our gloves. This is a list of Personal Protective Equipment commonly used:

- Gloves
- Gowns
- Face Shields and masks

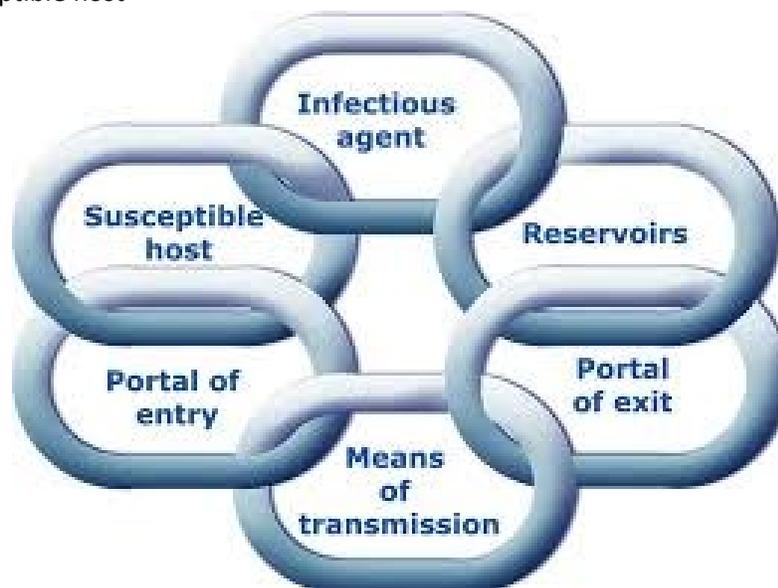
Remember Universal Precautions are used not only to protect you, but to protect our patients! The healthcare team should always use standard precautions when helping care for a patient.

Use of Standard Precautions

- Use PPE at all times; this will reduce the transmissions by **fomites**. Fomites are objects that could transmit infections. Some examples are countertops, door knobs, telephones, etc.
- Hand hygiene - this would include washing hands with soap and water for at least twenty seconds, or alcohol-based hand sanitizers. Make sure to keep nails trimmed to reduce the spread of bacteria.
- Take every precaution necessary to reduce the risk of a needle stick! Never recap a needle, always use needles with safety shields, and dispose all sharps in a plastic sharp container.

Following the precautions mandated by OSHA and the CDC, you, and you alone, can break the **Chain of Infection**. The Chain of Infection consists of six links. Transmitting a pathogen requires connecting the six links in the chain or cycle of infection.

- Infectious agent
- Reservoirs
- Portal of exit
- Means of transmission
- Portal of entry
- Susceptible host



The cycle begins with a pathogen or infectious agent that is capable of causing disease (*virus, bacterium, fungus, protozoon* delivery). An environment that supports the survival of these pathogens is a reservoir. In a clinical setting, the reservoir is often the patient, but it can also be an object such as a piece of medical equipment. The human body makes an ideal reservoir for microbial growth because of the presence of nutrients, moisture, and an ideal temperature and *pH*. The portal of exit is the passageway the pathogen uses to exit the reservoir. Portals of exit can occur through the respiratory, gastrointestinal, urinary tract, mucous membranes, or non-intact skin. Effective infection control means breaking this chain, thus preventing the continuation of the cycle.

These precautions protect you and the patient, but sometimes they are not enough. In order to help fight the spread of these diseases, the CDC has also mandated **transmission-based precautions**. Transmission-based precautions are used in addition to standard precautions for patients with known or suspected infections that are spread in one of three ways:

- **Airborne** - diseases that are spread through the air. This would include breathing, coughing, talking, etc.
- **Droplet** - diseases that can be transmitted through contact with eye, mouth, or nose secretions. This would include coughing or sneezing.
- **Contact** - diseases that are spread through direct or indirect contact with someone. You could obtain or spread disease through culture sample or dirty counters tops.

When healthcare workers come in contact with patients, their normal PPE is gloves and a lab jacket, but, if you ever see a sign on a patient’s hospital door, like the one shown below, you need to find out what special precautions need to be taken. This could be adding a gown, mask, or face shield. In more severe airborne cases, the patient would be secluded in a hepa-based room and you would wear a special mask to protect yourself.



Protective Environments:

We take extra steps to protect ourselves from infectious diseases, but we still can be harmful to our patients. Therefore, hospitals may place patients in reverse isolation. These patients have low immune systems and are susceptible to infections. The number of staff caring for the patient is limited. You might have to take extra steps when drawing blood for them. Some of these extra steps might include limiting which supplies go into the patient’s room with you, not bringing your supply tray into the room, or donning (putting on) and doffing (taking off) more PPE than normal. All healthcare facilities will have a policy and procedure for this situation.

Special Care Units in certain hospitals must take extra steps to protect their patients from contracting infections. This would include nursery units, burn units, and post-operative care units. If you are unsure of the steps that are needed to be taken to ensure you and your patient's safety, always ask and use the policies and procedures of the healthcare facility.

Correct Order of Donning PPE:

1. Wash your hands
2. Put on a new gown while only touching the inside surface
3. Put on mask
4. Wear face shield and goggles (if called for)
5. Put on gloves (pull over gown sleeve)

Correct Order of Doffing PPE:

1. Take off your gloves
2. Remove gown away from your body
3. Remove mask or any protective face shields
4. Wash your hands

Hand Washing Technique:

WASH YOUR HANDS! Washing your hands is the number one defense against the spread of diseases. It sounds so simple, so why make such a big deal of it? Well, when you are rushed or feel stressed, the smallest things can slip your mind. Having proper hand washing techniques is crucial when working with patients that may have highly contagious diseases. Remember this isn't just for your safety, it's also for the other patients with whom you may come in contact. Alcohol-based hand sanitizers are life savers for those moments when water and soap are not available, but the rule is three squirts and then it is time to wash your hands! You also need to wash your hand if they should become visibly soiled. Read through the technique below:

1. Take all rings, bracelet, and watches off.
2. Turn on the faucet, you will need warm water.
3. Dispense a small amount of hand soap into your palm.
4. Rub hands together for about 15-20 seconds, until you have covered all portions. Start with the palms, work in between the fingers, work outward to the back of the hands then the wrists.
5. Rinse your hand in a downward motion from the running water. Do NOT shake your hands; we are not dogs! It could contaminate the surrounding area. Dry your hands thoroughly with a disposable paper towel.
6. Shut the water off with the paper towel.

Donning and Removing Gloves:

1. Wash your hands.
2. Remove gloves from dispenser, trying to touch the outside as little as possible.
3. Slip your fingers into the opening of the glove as you hold on to the cuff with your other hand. Repeat process with your other hand.
4. For removal of the glove, grasp the wrist portion of the glove and pull off your hand turning it inside out.
5. Place the rolled-up glove in the other still gloved hand and repeat the process. The gloves should be inside out, one inside the other.
6. Discard the pair into a trashcan or bio-safety bag.

Disinfectants and Antiseptics:

The use of disinfectants and antiseptics are a must while working in healthcare settings! This helps contain the cause and spread of infections.

- **Disinfectants** are chemical compounds used to remove or kill pathogenic microorganisms. Disinfectants are used on fomites. Remember what fomites are? Fomites are surfaces such as door knobs, counter tops, computer keyboards, etc. Environmental Protection Agency (EPA) regulates all chemical disinfectants.
- **Antiseptics** are chemicals used to inhibit the growth and development of microorganisms, but they do not necessarily kill them. Antiseptics are used on the skin to prevent infections. It takes time for the antiseptic to take effect. This is why you have to let it dry!

CPR and First Aid

Every phlebotomist is responsible for safeguarding the well-being and welfare of the patients in their care. At times, this responsibility extends to performing basic first aid. It is important to be able to recognize potential problems with patients and know what to do in case of an emergency. In all situations, remain calm. Maintaining composure and remembering what to do in an emergency can be the most crucial step in keeping an emergency from becoming a disaster.

Syncope/Loss of Consciousness

If a patient loses consciousness during a blood collection or begins to show signs of syncope, immediately stop the procedure by removing the tourniquet and needle, place pressure on the venipuncture site, and protect them from injury by assisting them to the floor. With most cases of syncope, the patient recovers quickly. Nevertheless, note how long the patient was unconscious. Never leave the patient alone until they recover fully. Do not give the patient anything to eat or drink right away to reduce the risk of choking. You may place a cold cloth on the back of the patient's neck or on their wrists. If the patient is unresponsive for an extended period, call for medical help or emergency services. Stay with the patient until help has arrived.

When a patient in an inpatient setting is not breathing, note the exact time of collapse or when you found the patient in this condition. Immediately call for assistance from the nursing or medical staff. Do not leave the patient alone until help arrives. If the patient is not breathing and you are unaware of the patient's wishes for resuscitation, or the patient does not have a do-not-resuscitate (DNR) order, then you should initiate first aid, including cardiopulmonary resuscitation (CPR). For adults, the American Heart Association (AHA) recommends "CAB", meaning that chest Compressions are the priority, then **A**irway assessment, and then rescue **B**reathing.

Follow these steps to maintain Basic Life Support for an Adult:

- Activate the emergency response system by calling 911 or the local emergency number or have someone else do so.
- Check an adult for responsiveness by tapping their shoulders and loudly asking, "Are you alright?"

- Check the patient’s pulse while scanning the chest for signs of breathing.
- If the patient has no pulse and they are not breathing, start CPR immediately beginning with Chest Compressions.
- If an AED (Automated External Defibrillator) is available, use it immediately and follow the instructions given by the device.
- Place the heel of one hand on the patient’s sternum between the nipples and placing the other hand over the first, interlacing the fingers.
- Give chest compressions with the heel of your hand, at a rate of 100 to 120 per minute, at least 3.8 to 5 cm (1.5 to 2 in) in depth.
- Allow the chest to fully recoil between compressions.
- After 30 compressions, provide two rescue breaths by using the head tilt/chin lift method, pinch the nose and deliver two breaths, with each breath lasting one second. Continue 30 compressions to two breaths until the patient regains consciousness or EMS arrives.
- If the patient responds, place them in the recovery position (on their side), and monitor their breathing until a nursing, medical, or emergency medical services (EMS) professional arrives.

Follow these steps to maintain Basic Life Support for an Infant or Child:

When an infant or child is unresponsive, have someone call emergency services while beginning CPR. If there is no one else who can call for help, perform five sets of 30 compressions to two breaths before calling emergency services.

- Check a child for responsiveness by tapping their shoulders and loudly asking, “Are you alright?”
- Check an infant for responsiveness by tapping the bottom of their feet and loudly asking, “Are you alright?”
- Check the patient’s pulse while scanning the chest for signs of breathing.
- If the patient has no pulse and they are not breathing, start CPR immediately beginning with Chest Compressions.
 - For a child, place one hand on top of the other, interlacing the fingers and pressing down 5cm (2in) on the center of the child’s chest 30 times, aiming for rate of 100 to 120 compressions per minute.
 - For an infant, use two fingers to provide 30 quick compressions on the center of the chest, 3.8 cm (1.5 in) deep, aiming at 100 to 120 compressions per minute.
- Allow the chest to fully recoil between compressions.
- Provide rescue breaths:
 - For a child, provide two rescue breaths by using the head tilt/chin lift method, pinch the nose and deliver two breaths to make the chest rise, with each breath lasting one second.
 - For an infant, provide two rescue breaths by using the head tilt/chin lift method, cover the nose and mouth with your mouth and deliver two breaths, enough to

make the chest rise. ***Be careful not to over-ventilate***, which could cause damage to an infant’s lungs.

- Follow the same sequence of compressions-to-ventilations (30:2) until the patient recovers or EMS arrives.
- If an AED (Automated External Defibrillator) is available, use it immediately and follow the instructions given by the device.

Chest compressions provide adequate blood circulation to the brain. Faster compressions (of adequate depth) result in a higher survival rate than slower, shallower compressions.

Compressions create an increase in intrathoracic pressure, which then results in blood flow to the brain and other organs. The efficiency, speed, and proper application of CPR directly affect its success. For a patient who is unconscious, it is important to determine the state of ventilation and circulation quickly. Irreversible brain damage or death can result from a lack of oxygen that lasts for more than 4 to 6 minutes. Keep in mind that CPR instructions change, so it is important to keep up to date on current advances in providing this lifesaving procedure. It is important for all healthcare staff to keep certifications up to date when working in the health care field.

Seizures

Seizures can occur with epilepsy, medication reactions, fever, unconsciousness, or for unknown reasons. When a patient begins to seize, immediately stop the blood collection and take steps to ensure the patient’s safety. Call for assistance and stay with the patient in a safe place, such as in a bed, and leave the patient there. Do not lift or restrain the patient, because you could injure them or yourself. In addition, do not attempt to insert anything into the patient’s mouth during a seizure. As with any emergency, remain with the patient until they recover fully, or until help arrives.

Shock

Symptoms of shock often start with cold, clammy skin, blurry vision, and a rapid, weak pulse. For a victim of shock, call for help immediately. Remain with the patient until help arrives. Put the patient in the shock position, which involves the patient lying flat with the legs elevated approximately 12 inches. Keep the patient warm and loosen any tight clothing. If the patient is bleeding make sure to hold pressure to the site until help arrives.

Fire Safety

It is important to know all policies and procedures of your healthcare facility, including fire safety procedures. You need to be aware of where the fire extinguishers are located. Remember **P.A.S.S.** when operating a fire extinguisher:

- Pull Pin
- Aim Nozzle
- Squeeze Handle
- Sweep side to side

Electrical Safety

To avoid an “Albert Einstein” type hairdo, you should check cords, avoid using extension cords, unplug machines before maintenance, and avoid electrical equipment when drawing blood. If electrocution should happen to someone, please follow these steps:

- Do not touch the person
- Turn off electricity to the device
- Call for help

Radiation Safety

In some healthcare facilities it will be your job to collect specimens where elevated levels of radiation are present. To ensure everyone's safety, healthcare team members should wear a dosimeter badge. These badges measure the amount of radioactivity received. Remember the three cardinal principals of self-protection from radiation exposure are: time, shielding, and distance.

Chemical Safety

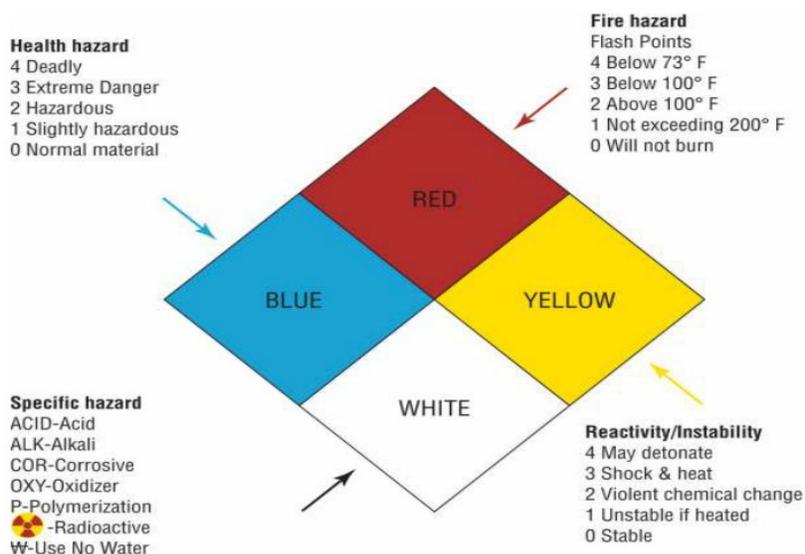
If you should come in contact with chemicals in the labs, wash the exposed skin for 15 minutes, then seek immediate first aid. All clinical labs have eye-washing stations in case any splashes of chemicals or bodily fluids should occur to the face and/or eyes. Wash your eyes for 15 to 20 minutes, then seek immediate first aid. Always check your Safety Data Sheets for exposure plans after flushing the area.

Safety in Patient's Rooms

The number one rule: ALWAYS leave a patient's room the way you found it. Do not leave the specimen tray unattended. If you put an arm rail down, always put it back up before leaving. Make sure to put all needles in the Sharps container. Discard any trash. Before leaving, always double check to make sure you are not leaving something behind. If a patient were to request anything, make sure to notify the nurse.

Disaster Emergency Plan

Make sure you know what procedures take place during disasters. If you are in a healthcare facility, patients come first. It's a silent oath we have all taken. Help patients to safety, then help co-workers to safety. It's part of being a healthcare worker. No running for the basement at the sound of a tornado siren; make sure all patients are secured!



CHAPTER 5. Laboratory Testing

We have gone over medical records and their importance. The government mandated that by 2014, all health care facilities use some form of electronic charting. This is in hopes that at some point they can all be linked together to curb healthcare costs. With electronic records, Doctors can see the entire medical history of a patient. They are also a key factor in preventing duplicate treatments or tests. Electronic records are more accurate than handwritten records. I always say, “in the healthcare field, if it hasn’t been documented then it didn’t happen.” Always ensure the privacy of a patient’s medical record. It can cost your health care facility huge fines if there is a breach in HIPPA!

Laboratory Test Requisition and Labels

You know it is against the law (and also just plain rude) to go stabbing and jabbing anyone for no reason. This is why you will have a **laboratory test requisition**.

Transmittal of the Laboratory Test Requisition:

1. A physician or nurse submits a request to the lab, either through a computer-based system or a written order.
2. Your Lab Order should have all the information requirements:
 - Patient ID
 - Patients Gender
 - Patients DOB
 - Doctor’s Name
 - Lab Tests to be done
 - Date of order and Date to be done

Make sure to clarify all test requisitions if any discrepancies should occur. Always double-check the drawing requirements before obtaining the specimen, such as: volume of blood required, temperature sensitive, light sensitive, collection tubes, etc. Refer back to your specimen-handling guide. Always check for duplicate orders! Most lab requisitions have an accession number (the unique number). Accession number help identify the specimen while it remains in the lab.

During the pre-analytical phase of laboratory testing, it is imperative that you **label** your specimens accurately. Label your tubes in front of the patient, right after the procedure! Never bring unlabeled specimens back to the lab. This could claim a life if you don't. A correctly labeled specimen should have at least two patient identifiers on the container itself. Your specimen label should include the following:

- Patient’s Name (First, Last, and Middle Initial)
- Patient’s Date of Birth
- Phlebotomist initials
- The date of collection
- The time of collection

Bar codes

Bar codes are often used in many different labs. Laboratory machines are designed to use bar codes to identify the specimen and what test needs to be run on it. This helps reduce **TAT** (turn-around-time). The bar codes should be placed on the upper left hand corner of the specimen tubes.

Radio Frequency identification (RFID)

RFID tags are tiny, silicon chips that transmit data to a wireless receiver. They are similar to bar codes, but better. This particular label can hold more information than a bar code. Handheld devices at various distances can also detect the label.

Many specimens are not left in the original collection containers. Plasma and serum will have to be removed from the red blood cells after centrifugation to help preserve the specimen, and/or preservatives will be added to urine for cultures. When this occurs, the specimens are relocated to a secondary container. All secondary containers and tubes should have the same information on them as the original.

Specimen Handling and Transport

Quality and completeness of blood samples can be affected by the method of transport, timing delays, temperature, humidity, agitation, exposure to light, and centrifugation methods. Clinical and Laboratory Standards Institute (CLSI) sets the standards of specimen collection and handling. Blood collection tubes have certain additives. To ensure the additives mix properly with the blood you need to invert your tubes 5-10 at patient's bedside. All lab specimens should be taken back to the lab within 45 minutes after collection. If you have any questions on drawing a specimen always refer to the specimen collection manual. When traveling to patient's homes or outside facilities, always transport blood samples in a plastic, leak-proof specimen bag.

Specimens that have a blood thinner or anticoagulant additive will require centrifugation right away; these specimens will never clot. These specimens turn into plasma.

Specimens that have no additives, or a clotting factor in them, need to be left to clot for 30 - 60 minutes. (Remember it takes about 30 minutes for blood to clot!)

Plasma or serum should be separated immediately after centrifuge. You will take a transfer pipet (similar to a dropper) and put into a transfer tube or sample cup.

Centrifuging

Some specimens require centrifuging or other additional processing prior to transporting them to the reference laboratory. Specimens that require separating the serum or plasma from the cells require centrifuging. To use the correct centrifuge be aware of the tube type, rotor, spin time, capacity, noise level, and proximity to other equipment. Some centrifuges accommodate only a few tube sizes, while others have adapter for various

sizes. The type of rotor can produce either a flat gel barrier (which is best for immunoassay and chemistry tests) or an angled gel barrier (which can be problematic for some chemistry tests).

The steps of centrifuging include the following:

- **Pre-centrifugation** is the handling and processing of specimens after collection and before centrifugation. It is important that the process begin as soon as possible after collection; the delay in separating plasma from cells should not exceed 2 hours. If a specimen for centrifugation does not have an anticoagulant additive, it should clot before going into the centrifuge. Clotting usually takes 30 to 60 minutes at room temperature. Do not chill these samples, because that will delay clotting. If the patient is taking an anticoagulant, that will also delay clotting. Be sure to protect any photosensitive specimens from light, either by wrapping them in foil or placing them in an amber specimen container. Shield photosensitive specimens from light as much as possible during the process.
- **Centrifugation** is the processing of specimens by spinning them in a centrifuge at high speeds, forcing the heavy elements of the specimen (blood cells) to move to the bottom of the tube and the lighter substances (serum, plasma) to remain at the top. The time and speed of centrifugation are critical elements the laboratory and centrifuge manufacturer establish. These procedures should be clear and available in every laboratory. If the time in the centrifuge is inadequate, portions of blood cells can remain in the serum or plasma and affect test results. It can also result in incomplete formation of the carrier gel. Place tubes in the centrifuge with their stoppers or caps on. Balance them so that tubes of the same size and that are holding the same volume of blood are opposite each other. Without that balance, they are at higher risk for breakage. Never open the lid of the centrifuge before it has completely stopped spinning. Do not centrifuge specimens more than once.
- **Post-centrifugation** is the handling and processing of specimens once the centrifugation process is complete and removal of the serum or plasma is necessary. Removal is best immediately after centrifugation and no longer than 2 hours later. Serum might require room temperature, refrigeration, freezing, or protection from light, depending on the test it will undergo. In general, serum and plasma should remain at room temperature no longer than 8 hours before testing. Otherwise, it needs refrigeration. If testing doesn't take place within 48 hours, then freezing is necessary.

Some specimens have time limits and temperature requirements after centrifuging such as room temperature, refrigeration, storage in the dark, or freezing depending on the testing requirements.

Chilled Specimens

Certain specimens must be chilled or drawn over ice. Examples:

- Ammonia
- Lactic Acid

- PTH

The way to draw a specimen over ice is to have a slurry bath close to the drawing area. Once you obtain the blood, simply put it into the ice bath. Another way of doing this is to have a frozen tube holder ready.

Light-Sensitive Specimens

Some specimens are sensitive to light; this is called **photosensitive**. Examples:

- Bilirubin
- Beta-carotene
- B6
- Semen

When drawing a specimen sensitive to light draw in an amber color tube. If these tubes are not available, draw the specimen, label the specimen, and then wrap in aluminum foil.

Warmed Specimens

Some blood samples are required to be at body temp. 37°C. You should be prepared with special heat packs to transport blood specimens. Examples:

- Semen (must be kept close to body temp.)
 - Should be transported at 36 to 38 degree Celsius
 - Should be transported back to lab within 2 hours
 - Protected from bright light
- Cryofibrinogen

Most blood samples are heat-sensitive; they should be kept at 2-8 °C if there is a delay in testing or testing is complete. Having blood samples at room temperature is common but only for up to 8 hours and depending on the requirements of the test.

Microbiology Specimens

Blood, sputum, and urine specimens for microbiological culture need to be transported back to the lab as soon as possible to prevent the growth of bacteria as this could contaminate your specimens. Make sure to identify the source of the specimen on the specimen container and not on the lid. (You would write urine for urine, sputum for sputum, etc). When collecting for microbiology you have must take extra steps as not to have a false positive result. Here are a few examples of instructions:

Urine analysis and cultures

12 ml of specimen is needed to perform the test

Instruct the patients to clean the genital area with a prepackaged cleansing wipe (provided by the lab) Women need to wipe from the front to back.

Void some into the toilet and catch urine midstream into the collection container

*This is what we refer to as a clean catch. Clean catch is required for a urine culture and sensitivity (C&S). This test is done if a patient shows signs and symptoms of a urinary tract infection.

Sputum Cultures

Have the patient collect mucus into a sterile cup with lid. The best specimen are collected early morning before the patient eats. Instruct the patient to cough deeply.

*When collecting for tuberculosis specimens, the patient and phlebotomist must be careful because the container contains poisonous additives.

Sputum cultures are ordered to determine if there is an infection in the lungs.

Blood Cultures

Venipuncture is always the method of choice for blood cultures.

- The health care work needs to explain the procedure in depth.
- The puncture site must be decontaminated, so that it is sterile.
- The type of collection tubes used must contain culture media that enable bacteria to grow under laboratory conditions.
- The timing and number of blood cultures obtained must be clearly indicated, as well as the location of the venipuncture.
- Anaerobic bottle must be collected first
- Aerobic bottle collected second

Possible interfering factors for blood cultures:

- If blood culture collections are ordered along with other lab tests, blood culture specimens must be collected first.
- When the needle enters the venipuncture site, it should not be scraped across the skin, as this can contaminate the needle.
- The anaerobic blood culture bottle must be first in all except the butterfly method.
- Some culture bottles contain resin beads that neutralize antibiotics already in the patient's blood. If these are not gently mixed, they can produce false positives.
- Sometimes two sets of blood cultures are ordered. The second set should be obtained in the same manner as the first, except the second set needs to be obtained at the second site or at a different time (about 60 minutes later).
- Recommendations are to use a butterfly system as this will help to prevent back flow into the vein. If you are using a vacutainer system, make sure to have the patient lower the rest of their body to prevent this from happening.

Blood cultures are often collected from patients who have fever of unknown origin (FUO).

Bacteremia (presence of bacteria in the blood) or *septicemia* (presence of pathogens in the circulating bloodstream), also sometimes called blood poisoning, can occur. When collecting blood cultures, extra steps must be taken to avoid contamination of the site.

*When handling specimens for culture and sensitivity, the tubes and containers may be kept at room temperature for up to 72 hours.

Specimen Delivery Methods

Normally it will be your job to deliver specimens back to the lab for processing. Some specimens will be brought over by nursing departments depending on what type and how collection was made. In bigger labs there could be a courier service that will bring specimens to be tested from smaller labs. These will normally be brought by a delivery service. In any case, you are responsible for helping with specimen handling as this is still part of the pre-analytical phase.

If a specimen needs to be processed immediately at an outside reference laboratory, you must contact the commercial courier service. This is only a delivery service and not laboratory personnel.

Specimen Rejection

Many factors are involved when a specimen is rejected. If there is not proper identification on the specimen, the lab will reject it immediately. It is too dangerous to run blood test on an unknown patient's blood. If your sample is short, the additive ratio and blood sample will affect the lab test. If the sample is hemolyzed (meaning the red blood cells are broken), this too will affect the test. If the tubes are too roughly handled. If the specimen is clotted, normally this is a time delay of the blood getting into the tube, or the tube was not properly inverted. You should keep specimen rejection to a minimum as it will result in re-sticking the patient. If a specimen is rejected for testing this should be documented and the doctor should be notified.

Reasons for sample rejection:

- The labels and the test request do not match
- Label is illegible
- Anticoagulated tube contains blood clots
- Excessive delays in processing the specimen
- Hemolyzed blood specimens
- Improper specimen transport or storage
- Incorrect blood volume (too little or too much)
- Lipemic (cloudy or milky) blood specimen
- Non-fasting blood specimen
- Use of outdated supplies to collect the specimen
- Timed specimens drawn at the wrong time
- Unlabeled specimens
- Contaminated urine specimens

How to avoid pre-examination errors while collecting blood specimens:

It is easy to miss errors in collection or handling unless they are obvious. These factors can cause inaccurate results. Do the following to avoid recollections and pre-examination errors:

- ✓ Allow alcohol to dry prior to venipuncture
- ✓ Use the appropriate gauge needle for the patient; nothing less than a 25-gauge needle to collect blood.
- ✓ Stop the draw if a hematoma forms.
- ✓ Avoid vigorous mixing of the collection tube.

- ✓ Avoid pushing the plunger during a syringe transfer procedure so blood is not forced out, this will cause hemolysis.
- ✓ Avoid forceful squeezing or “milking” during dermal punctures.
- ✓ Gently handle specimens during transport.
- ✓ Avoid freezing or thawing specimens in transit.
- ✓ Make sure that the order of draw is correct.
- ✓ Invert each tube properly after removing from the tube holder.
- ✓ Transfer blood properly from syringe to the tube.
- ✓ Do not use expired tubes.
- ✓ Use a discard tube when using the “butterfly” method.
- ✓ Always remove tube when the blood has reached the fill line.
- ✓ Use proper technique to minimize clotting in dermal puncture sites.
- ✓ Use correct tubes for collection.
- ✓ Understand and interpret lab orders.
- ✓ Properly protect light and temperature sensitive specimens.
- ✓ Avoid using alcohol as antiseptic if it will affect the test results.
- ✓ Centrifuge specimens correctly.
- ✓ Correctly and completely label all specimens.

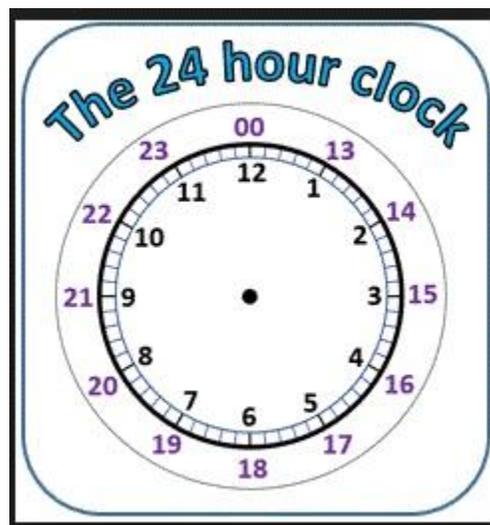
Military Time (24-hour clock)

As a healthcare worker it is important to be able to use military time when documenting. Military time uses a 24-hour time clock and eliminates the need for A.M. and P.M. The 24-hour clock is particularly useful in healthcare settings so that confusion is eliminated when documenting time for treatment procedures, specimen collections, tests, drug administration, surgical procedures, and so on. It is important that all healthcare workers understand and use it correctly.

Military time is expressed by four numerals; the first pair is hour (00 to 24) and the second pair is minutes (00 to 59). Each day begins at 0000 (midnight) and ends at 2359.

The first 12 hours are equivalent in military time; that is 3:00 a.m. is equivalent to 0300 in military time, but conversion of afternoon and evening times from a 12-hour clock to military time requires adding 12 to each hour (2:00 p.m. is 1400 in military time).

Normal Time	Military Time	Normal Time	Military Time
12:00 AM	0000	12:00 PM	1200
1:00 AM	0100	1:00 PM	1300
2:00 AM	0200	2:00 PM	1400
3:00 AM	0300	3:00 PM	1500
4:00 AM	0400	4:00 PM	1600
5:00 AM	0500	5:00 PM	1700
6:00 AM	0600	6:00 PM	1800
7:00 AM	0700	7:00 PM	1900
8:00 AM	0800	8:00 PM	2000
9:00 AM	0900	9:00 PM	2100
10:00 AM	1000	10:00 PM	2200
11:00 AM	1100	11:00 PM	2300



CHAPTER 6. Collection Methods of Phlebotomy

As I have stated before, there is a method to our madness. People come in all shape and sizes, and so do their veins. This is why we have different collection methods for different kinds of veins. There are three collection methods that phlebotomists use when obtaining a blood sample.

The safest method of blood collection is the **vacutainer**, also known as the vacuum (evacuated) tube. This method involves a tube, a double-sided needle, and a plastic holder. Blood flows directly into the tube which limits your contact with the blood. Each tube has a vacuum system that will allow the blood to stop on its own. All tubes are designed with a “fill line.” This is to ensure that the blood-to-additive ratio is accurate. Always check to make sure your tube is full before removing the needle.



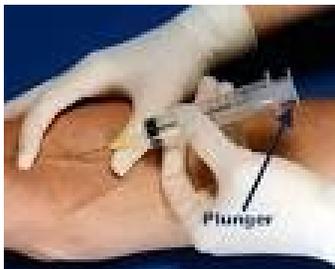
In some situations, the vacutainer will not benefit the patient. Strong healthy veins can withstand the vacuum of the tubes and the size of the needle. A **wing-infusion** set (butterfly) should be used when a patient has fragile veins, small veins, or if they request a butterfly. Butterflies consist of a small gauge, double-sided needle connected by a catheter. A phlebotomist should also use a butterfly when performing phlebotomy on the back of the hand or the top of the foot. Wing-infusion sets can be used one of two ways. The first and safest method is similar to the vacutainer, with a double-sided needle and tube holder. When insert into the vein correctly you will see a flash of blood in the tubing. As shown in the figures below:



Some patient's veins are too fragile for the vacuum of the tubes the veins will collapse. In these scenarios it may require you to use a butterfly with a syringe attached instead of the tube holder. This allows you to control the vacuum.



If a patient has veins that are known to collapse but bigger in size the next method is **syringe**. This method consists of a syringe and hypodermic needle. When using the syringe always break seal by pulling slightly back on the plunger. Make sure no air is in the syringe before inserting it into the vein. Once you are into the vein there should be a flash of blood where the needle and syringe are attached. Always use a transfer device to transfer the blood from the syringe to the tubes.



All three methods are recommended for phlebotomy procedure. It is up to the phlebotomist to determine which method is best for the patient's vein, unless a patient requests a specific method. Typically, the vacutainer and syringes have a 21 to 22-gauge needle, whereas a butterfly is a 23-gauge needle. Remember the higher the number of a gauge, the smaller the

needle. Always open all needles and syringes in front of the patient, this helps put them at ease knowing it is a clean needle.

Venipuncture Needle Insertion

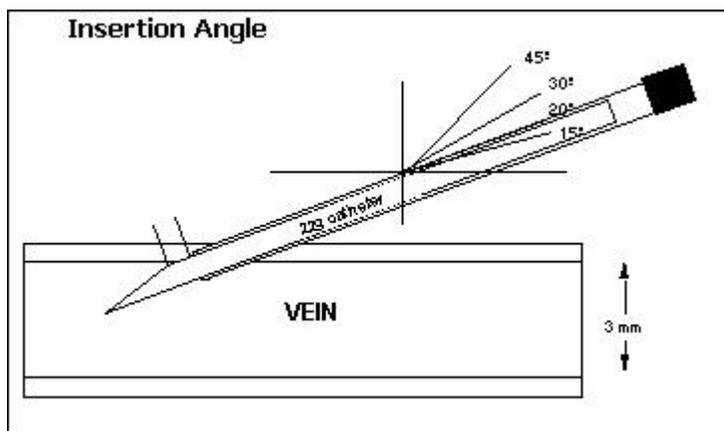
When performing a venipuncture in the antecubital region, the bevel should always be up (regardless of needle used.) Insert the needle at a 15 to 30-degree angle, depending on the depth of the vessel. The deeper the vein is in the arm, the greater the angle (not to exceed 30 degrees). A vein close to the surface of the skin should be collected at a shallower angle but no shallower than 15 degrees. An angle greater than 30 degrees runs the risk of going too far into the site and possibly hurting the patient or injuring a nerve. An angle that is too shallow runs a risk of forcing the bevel to adhere itself to the wall of the vessel (slowing or stopping the blood flow) or missing entirely (going between the vessel and the skin).

The proper angle for dorsal hand blood collection is 10 degrees. When performing a dorsal hand collection, the angle should be shallower due to the considerable number of nerves and tendons in the hand.

The insertion in all venipuncture locations should be performed with a quick, smooth movement to enter the skin. Swift entry helps reduce pain and prevents the vein from moving away from the needle which could result in an unsuccessful attempt.

Gaging the depth of the entry requires an understanding of where the needle will be inserted. When the needle is inserted, the skin and the wall of the vessel are both punctured. Insert the needle until you feel a change in resistance. At that point, stop the insertion and gently push the ETS tube in place. You can feel resistance when you puncture the skin, another resistance when you puncture the wall of the vein, and then a change in the resistance that indicates you are in the lumen (middle) of the vein. This location will help provide the best blood flow for the test required.

Inserting the needle to a point where it only partially penetrates the vein will result in blood leaking into the surrounding tissues and results in a hematoma. Inserting the needle too deeply can pierce through the vessel and transfix through the vein (going completely through the vein) and yield no blood. The insertion should also follow direction that the vein is located. Following the direction of the vein will help prevent missing the vessel or piercing through the side of the wall of the vessel.



Blood Collection Tube and Additives

Blood is tested in three different forms; **plasma**, **serum**, and **whole blood**. Each vacuum tube top is colored and has its own pressure that is designed to stop when the additive and blood ratio is met. Heparinized whole blood has become the specimen of choice for several clinical laboratory instruments used in STAT (immediate) situations. When performing tests on whole blood, the test can be run right away. If plasma is the specimen of choice, an anticoagulant tube must be centrifuged for about 10 to 15 minutes. When the test calls for serum, the tube must be placed in an upright position for about 30 minutes to let the blood clot. Once the blood is completely clotted the tube then can be centrifuged for 10-15 minutes to form serum. Depending on your lab's test tubes, the centrifuge times will vary.

Anticoagulants are added to blood to prevent the clotting process. They help preserve the life span of red blood cells and metabolism. Anticoagulants cannot be substituted for one another. The additive and tube needed will depend on which tests are to be performed. There are many anticoagulants: oxalates, citrates, EDTA, or heparin. Oxalates, citrates, and EDTA prevent the coagulation of blood by removing calcium and forming insoluble calcium salts. These three anticoagulants cannot be used in calcium determinations. However, citrates are frequently used in coagulation blood studies. EDTA is used for platelet counts and platelet function tests. Fresh EDTA-anticoagulant blood allows preparation of blood smears for differential (diff) counts because cell sizes are not affected. Heparin is used in assays such as ammonia and plasma hemoglobin, and it prevents blood clotting by inactivating the blood clotting chemicals thrombin and factor X.

Here some examples of what could happen if the wrong tube is used:

1. Timmy was diagnosed with a seizure disorder. The doctor prescribes him lithium to help control the seizures. When the phlebotomist obtains blood, she puts the specimen in a green top tube containing lithium heparin. What would happen if the lab technician (the one in the white coat) tests the lithium levels in that blood? You are right! It would have false elevation of lithium! Then the doctor would lower Timmy's dose, which could trigger a seizure.
2. Mr. Ribbit has a low sodium level. The doctor has prescribed him sodium tablets and would like him to recheck it in two weeks. When Mr. Ribbit has his blood drawn the phlebotomist uses a light blue tube containing sodium citrate. What do you think happened to the sodium levels in that specimen? Yes! The sodium levels in that tube would be falsely high! This is why you must learn the importance of what additive is in the tube!

Blood Collection Tube Inversions

In order to mix the additive and blood together the tube must be inverted several times. Some tubes require more inversions than other, but CLSI says the universal inversion is between 5 to 8 times when in doubt. This can be done simply by turning the tube upside down and right side up

or by doing a figure-eight motion. Blood collection tubes should be inverted as soon as possible after the procedure to prevent any blood clotting or hemolysis.

The Order of Draw

The order of draw can be very intimidating to some. While studying for the NHA exam you will need to know the order, a sample test, and additive, and for good reason! As we discussed before about false elevations in results, this can also happen if you do not follow the order of draw. Cross-contamination of the additives can occur.

There are several test tubes in clinical laboratory testing and we only cover a handful of them. The facility where you are working will determine what test tube is used. Every tube is designed with a fill-line; this could be as simple as a black mark. Make sure to fill all the tubes correctly.

Sterile blood cultures, media tubes, or **Yellow Topped Tubes** containing ACD or SPS. When a patient develops a fever of UNO the doctors might order blood culture on them. A major problem with collecting blood for cultures is not to contaminate the specimen with microorganisms from the skin. This is why it is important for the skin to be disinfected. It's best to use a vacuum system if possible to avoid contamination. This vial should be gently inverted eight times immediately after blood collections. Each blood culture tube requires 10 ml in each bottle.

Light Blue Topped Tube

Second in the order of draw! **Light Blue** tubes are used for prothrombin time (PT). When patients are put on blood thinners we use this test to check to see how thick or thin their blood is. The additive for this tube is Sodium Citrate. Always make sure to adequately fill this tube. After spinning this tube down, plasma is formed. This tube should be inverted 3-4 times.

Serum Separator Tubes (SST)

The tube stopper can be gold, speckled red (tiger top) and gray, or red and black. Some serum tubes contain no additive, and some contain a clot activator. Serum tubes must be allowed to clot for 30 min. prior to centrifugation. Serum tubes are used to perform chemistry blood collections (CMP, BMP, Hepatic, Lipids, etc.)

Rapid Serum Tubes (RST)

The tube stopper is orange. When a stat blood collection is required, an orange serum tube may be used. RST tubes only need to clot 5 min.

Red Topped Tube

These tubes are often used for discard tubes and drug monitoring. There is no gel at the bottom, which can affect some drug related test. After blood has clotted these can be spun down to create serum.

Green Topped Tubes

These tubes have an anticoagulant in them called heparin. These green top tubes can be spun immediately after collections. These tubes can be used for troponin, chromosome testing and some chemistry tests. When centrifuged plasma is formed at the bottom. Some green top tubes have a gel barrier at the bottom to separate cells. This tube should be inverted 8 times.

Lavender Topped Tubes

Lavender top tubes have an anticoagulant called EDTA. Blood that is collected in these tubes will never clot. Lavender top tubes are use a lot for hematology. This tube should be inverted 8 to 10 times. Lavender tops that are used for complete blood counts should never be centrifuged. When a specimen is centrifuged it will cause the breakage of platelets.

Pink Topped Tubes

These tubes are used for blood banking and also contain EDTA. Blood banking can include cross match and type and screen. This tube should be invert 8-10 times.

Gray Topped Tubes

These tubes are for glucose studies; they have additives potassium oxalate and sodium Fluoride. The ant glycolytic agent and glycolytic inhibitor are the terms for this tubes additive because it slows the chemical process of glucose breakdown. This tube is also used for blood alcohol testing and lactic acids.

Light Yellow Topped Tubes

The light-yellow stopper tubes contain acid citrate dextrose (ACD) and are used for blood collections such a DNA.

Royal or Dark Blue Topped Tubes

The dark blue stoppers do not indicate the additive contained in the tube, but that the tube is as free of element contamination as possible (lead testing, trace element testing, etc.). Royal blue stopper tubes can contain EDTA, sodium citrate, or heparin, or be serum tubes. The label on the tube indicates which additive is contained in the tube.

Different manufacturers' ETS tubes can vary slightly in tint. When in doubt about what the tube contains, read the label to determine which additives are in the tube. When a serum tube contains a gel separator, it is called a serum separator tube (SST). When a plasma tube contains a gel separator, it is called a plasma separator tube (PST). Some facilities can routinely order special testing that requires additional (different additive tubes) to be used.

Sample Tests

Each test has individual tests that can be ran in them. These are a few sample tests that you need aware of:

A lipid panel measures: Chemistry Test; Performed on Tiger Top or Red Top

- **Total cholesterol**, which is the sum of the different types of cholesterol.
- **High-density lipoproteins (HDL) cholesterol**, commonly called "good" cholesterol. Lipoproteins can be thought of as your child's blood transportation system. High-density lipoproteins carry cholesterol to the liver to be eliminated.
- **Low-density lipoproteins (LDL) cholesterol**, commonly known as "bad" cholesterol. LDLs that build up in the bloodstream can clog blood vessels and increase the risk of heart disease.
- **Triglycerides**, which store energy until the body needs it. If the body holds on to too many triglycerides, blood vessels can get clogged and cause health problems.

Hemoglobin A1c (HgA1c): Hematology Test; Lavender top tube

- **A1c** is a test that shows the average level of sugar over the past 2 to 3 months. People who have diabetes need to have this test done regularly to see whether their blood sugar levels have been staying within a target range. This test is also used to diagnose diabetes

CBC evaluates: Hematology Test; Lavender Top

- **Red blood cells:** The CBC's measurements of red blood cell (RBC) count, hemoglobin (the oxygen-carrying protein in RBCs), and mean (red) cell volume (MCV) provides information about the RBCs, which carry oxygen from the lungs to the rest of the body. These measurements are usually done to test for anemia, a common condition that occurs when the body has insufficient red blood cells.
- **White blood cells:** The white blood cell (WBC) count measures the number of WBCs (also called leukocytes) in the blood. The WBC differential test measures the relative numbers of the different kinds of WBCs in the blood. WBCs, which help the body fight infection, are bigger than red blood cells and there are far fewer of them in the bloodstream. An abnormal WBC count may indicate an infection, inflammation, or other stress in the body. For example, a bacterial infection can cause the WBC count to increase, or decrease, dramatically.
- **Platelets:** The smallest blood cells, platelets play an important role in blood clotting and the prevention of bleeding. When a blood vessel is damaged or cut, platelets clump together and plug the hole until the blood clots. If the platelet count is too low, a person can be in danger of bleeding in any part of the body.

The CMP helps evaluate: Chemistry Test; Tiger Top, Red Top, Orange, or Gold

- **Glucose**, a type of sugar used by the body for energy. Abnormal levels can indicate diabetes or hypoglycemia (low blood sugar).
- **Calcium**, which plays an important role in muscle contraction, transmitting messages through the nerves, and the release of hormones. Elevated or decreased calcium levels may indicate a hormone imbalance or problems with the kidneys, bones, or pancreas.
- **Albumin and total blood protein**, which are needed to build and maintain muscles, bones, blood, and organ tissue. The CMP measures albumin specifically (the major blood

protein produced by the liver), as well as the amount of all proteins in the blood. Low levels may indicate liver or kidney disease or nutritional problems.

- **Sodium, potassium, carbon dioxide, and chloride (electrolytes)**, which help regulate the body's fluid levels and its acid-base balance. They also play a role in regulating heart rhythm, muscle contraction, and brain function. Abnormal levels also may occur with heart disease, kidney disease, or dehydration.
- **Blood urea nitrogen (BUN) and creatinine**, which are waste products filtered out of the blood by the kidneys. Increased concentrations in the blood may signal a decrease in kidney function.
- **Alkaline phosphatase (ALP), alanine amino transferase (ALT), aspartate amino transferase (AST), and bilirubin**; ALP, ALT, and AST are liver enzymes; bilirubin is produced by the liver. Elevated concentrations may indicate liver dysfunction.

The hepatic function panel evaluates: Chemistry Tests; Tiger Top, Orange, Gold or Red

- **Alanine aminotransferase (ALT)**. This enzyme, found in the liver, plays a role in metabolism, the process that converts food into energy. If the liver is injured, ALT is released into the bloodstream. Its levels are especially high with acute hepatitis.
- **Alkaline phosphatase (ALP)**. This enzyme is found in the liver, bones, intestines, kidneys, and other organs. Kids and teens normally have higher levels of ALP than adults, even when they're healthy, due to bone growth. But ALP levels can also increase when kids have viral infections, liver diseases, or blocked bile ducts.
- **Aspartate aminotransferase (AST)**. This enzyme, which plays a role in processing proteins, is found in the liver, heart, muscles, and kidneys. When the liver is injured or inflamed, levels of AST in the blood usually rise.
- **Total bilirubin and direct bilirubin**. Bilirubin is a byproduct of the normal breakdown of red blood cells. It usually passes through the liver and is excreted from the body. But if that doesn't happen due to a liver disease, bilirubin levels in the blood can rise and the skin can take on the yellow discoloration known as jaundice. Tests for bilirubin may be total (measuring the level of all of the bilirubin in the blood) or direct (measuring only bilirubin that has been processed by the liver and attached to other chemicals).
- **Albumin and total protein**. Protein is needed to build and maintain muscles, bones, blood, and organ tissue. Sometimes when there's a problem with the liver, it can't make proteins as well, so protein levels decrease. Liver function tests measure albumin specifically (the major blood protein produced by the liver), as well as the total amount of all proteins in the blood.

Troponin: Chemistry test; Green Top Tube

Troponins are protein molecules that are part of cardiac and skeletal muscle (the heart).

Sed Rate: Hematology Test; Lavender Top tube

An erythrocyte sedimentation rate test, also called an ESR or Sed Rate test, measures the speed at which red blood cells settle to the bottom of an upright glass test tube. This measurement is

important because when abnormal proteins are present in the blood, typically due to inflammation or infection, they cause red blood cells to clump together and sink more quickly, which results in a high ESR value.

The ESR is useful in detecting inflammation in the body that may be caused by infection, some cancers, and certain autoimmune diseases and lupus. The ESR alone can't be used to diagnose any one specific disease, however.

A partial thromboplastin time (PTT) and PT/INR: Coagulation studies; Light Blue Top Tube

This test measures how long it takes for a clot to form in a blood sample. A clot is a thick lump of blood that the body produces to seal leaks, wounds, cuts, and scratches and prevent excessive bleeding.

The blood's ability to clot involves platelets (also called thrombocytes) and proteins called clotting factors. Platelets are oval-shaped cells made in the bone marrow. Most clotting factors are made in the liver.

When a blood vessel breaks, platelets are first to the area to help seal off the leak and temporarily stop or slow the bleeding. But for the clot to become strong and stable, the action of clotting factors is required.

The body's clotting factors are numbered using the Roman numerals I through XII. They work together in a specialized sequence, almost like pieces of a puzzle. When the last piece is in place, the clot develops — but if even one piece is missing or defective, the clot can't form.

The PTT test is used to evaluate the ability of a person's blood to clot. If it takes an abnormally long time for the blood to clot, it can indicate a problem with one or more of several different clotting factors. This may be a sign of:

- a missing, deficient, or defective clotting factor or factors
- liver disease (because many clotting factors are made in the liver)
- treatment with heparin, a blood-thinning medication

The PT test can be used to evaluate the action of five different clotting factors (I, II, V, VII, and X). If any factor is missing, deficient, or defective, clotting time may be delayed. Blood that takes too long to clot in a PT test may be a sign of:

- a hereditary deficiency in clotting factors (such as in the bleeding disorders hemophilia and von Willebrand disease)
- liver disease (because most clotting factors are made in the liver)
- vitamin K deficiency (because vitamin K is a necessary component of several clotting factors)
- therapy using warfarin, a blood-thinning medication

- certain medical conditions in which the body uses up or destroys clotting factors too rapidly

Vitamin B6: Chemistry test; SST

This blood test is used to evaluate Vitamin B6 levels. Vitamin B6 is involved in the process of making serotonin and norepinephrine, chemicals that transmit signals in the brain. It is also involved in the formation of myelin, a fatty protein layer that forms around nerve cells.

- Protect from light

Thyroid testing: Chemistry test; SST

The thyroid is a gland located in the neck. Its job is to take iodine from the blood and combine it with an amino acid (one of the building blocks of protein) to form thyroid hormones. One of the hormones, thyroxine, is responsible for your metabolism. Thyroid function tests help to determine if your thyroid is not working correctly:

- hyperthyroid – an over-working thyroid
- hypothyroid – poor thyroid function

Chromosome analysis: Green Top tube

Chromosome analysis or karyotyping is a test that evaluates the number and structure of a person's chromosomes to detect abnormalities. Chromosomes are thread-like structures within each cell nucleus and contain the body's genetic blueprint. Each chromosome contains thousands of genes in specific locations.

Peak levels and trough levels

The peak level is the highest concentration of a drug in the patient's bloodstream. Peak levels should be drawn 1 to 2 hours after patient has received a dose of medication. Could be longer depending on the medication.

Trough level is the lowest concentration of a drug in the patient's bloodstream. Trough levels should be drawn 15 to 30 minutes before the next dose of medication is given.

Lithium is a drug used for many different conditions. Phlebotomists often must draw blood for therapeutic levels. The results on the test are affected by what time the drug was taken. You should always check with the patient on when they took their last dose and document. If it is an inpatient, check with the nurse. This is often referred to as a Valproic Acid or Depakote level.

Cortisol is often called the "stress hormone" because of its connection to the stress response, however, cortisol is much more than just a hormone released during stress. Cortisol is one of the steroid hormones and is made in the adrenal glands. Most cells within the body have cortisol receptors. Secretion of the hormone is controlled by the hypothalamus, the pituitary gland, and the adrenal gland, a combination gland often referred to as the HPA axis. Because most bodily cells have cortisol receptors, it affects many different functions in the body. Cortisol can help

control blood sugar levels, regulate metabolism, help reduce inflammation, and assist with memory formulation. It has a controlling effect on salt and water balance and helps control blood pressure. Peak level of Cortisol should be draw around 8 am. Trough level or low level should be drawn around 4:00 pm.

Reporting and Distributing Laboratory results

Point-of-Care (POC) tests are laboratory tests performed close to the site of patient care (such as the patient's bedside or the examination room of a provider's office.) Ehen performing POC testing, be aware of values that indicate a potentially life-threatening or health-endangering situation. A critical value is a test result that is significantly about or below the expected reference rage. It could indicate a potentially life-threatening situation for the patient and requires so immediate response.

When a critical value occurs, report this result promptly and directly to the ordering provider. Not all laboratory values have a critical level, but each laboratory or facility has a list tests that require monitory patients' results for critical values. Learning the difference between an elevated or decreased value and critical value is important. Depending on the nature of the test-form simple screening to complex profiles- a change in a patient's homeostasis will result in an abnormal test value in either a quantitative numeric value or a simple positive or negative outcome.

The specific critical values can differ by facility and can change over time. Become familiar with the general tests that providers monitor for critical values and learn the values for your organization. For example, if the laboratories expected reference range for fasting blood glucose level is 70 to 100 mg/dL. And a patient's result is 464 mg/dL that is a critical value that warrants immediate reparations to the provider.

When reporting STAT results and critical values make sure to have the provider or nurse repeat back the results values. Any time results or reports are given to a provider the phlebotomist should document this in that patient chart. Documentation should include the result, time, date and provider's name.

Laboratory Results should include:

- The date
- The date of the collection
- Patient's name and date of birth
- Result of the tests
- Reference Range
- Ordering Provider

Reference Ranges and Critical Values

A reference range is a set of values that includes upper and lower limits of a lab test based on a group of otherwise healthy people.

The following *test values*, defined when lab results fall outside an expected range, may pose an immediate health risk and require immediate attention.

References ranges examples:

- **Troponin T:** 0.00 to 0.02 ng (Nano grams)
- **Cholesterol:** 140-200 mg/dL
- **Glucose:** 70 to 110 (this reference range can be broad and vary depending on person)
- **White blood cell count (WBC):** 4.3 - 10.8 x 10⁹ cells per liter
- **Platelet count:** 150,000 to 450,000
- **Sodium levels:** 135 to 145
- **Potassium normal:** 3.5-5.0

In a hospital or a large laboratory facility, you will handle specimen and perform testing on-site. Whether you are performing tests on-site, working in a reference laboratory, or performing POC testing, it is imperative to follow specimen-handling processes with accuracy. Prior to processing, important steps in handling and transporting include mixing the sample, creating **aliquots**, adding **diluents**, centrifuging, packaging the labeled specimen in a biohazard bag, and following thermal and light sensitivity procedures.

When tubes contain an additive, invert them gently to mix the additive with the blood and to distribute the additive evenly throughout the sample. Mix it as soon as possible after the collection. Shaking the tube can result in a hemolyzed specimen. Not mixing it enough can result in the formation of clots, which can alter the test results.

- **Aliquot-** to divide specimens into smaller portions (pipetting)
- **Diluent-** a solution (such as water or saline) that reduces the concentration of a specimen.

Capillary Draws

When doing capillary draws, always use the two middle fingers of the non-dominant hand. Microtainer tubes are the tubes of choice when doing capillary draws or heel sticks. This requires a lot less blood. Never use a lancet that is more than 2.0 mm on a child or infant, as it could hit the bone. Always dispose of lancets in a sharps container box. When performing heel sticks, first warm the site for 3-5 minutes. Apply pressure to the site to gather blood then press in with lancet directly to the side of the heel.



Always use retractable lancets for you and your patient's safety. When collecting microtainer tubes, the order of draw will be backwards. This is to ensure no clotting will happen when collecting into EDTA tubes. The order of draw for microtainer tubes:

- EDTA
- Heparin
- Serum

Tourniquets

In most cases, to locate a vein and to have good blood flow, a tourniquet will be necessary. This pools the blood to a central location making the vein easier to feel. When using a tourniquet to palpate (feel) the vein, never leave it on for more than 60 seconds. Tourniquets left on longer than 60 seconds run the risk of red blood clotting at the venipuncture site. As a new phlebotomist, always apply the tourniquet, locate the vein, and then remove the tourniquet while putting your needle together.

Tourniquets can come in various colors and materials. There are buckles, Velcro, blood pressure cuffs, and rubber bands. For most phlebotomy procedures, you will use a non-latex rubber band. This type is disposable and reduces the risk of blood borne pathogens. The tourniquet should be located at least four finger-widths above the venipuncture site. Avoid tying your tourniquet on too tight, as this can damage the specimen, create discomfort to the patient, and cause all blood flow to cease. It's hard to get blood when you've made it stop flowing! Once the tourniquet is on, DO NOT have the patient pump their hand. It is better for your specimen if they just open and close gently up to three times for you to feel the vein. If you have difficulties feeling the vein, even with the tourniquet on, try rotating the patient's wrist slightly.

Gloves

Gloves should fit like a second skin! Avoid using gloves that are too big, this will make locating a vein more challenging. Try palpating for the vein first; then put on your gloves while putting your supplies together. If using latex gloves, make sure the patient is not allergic to latex. Do not use any gloves that are ripped, torn, or have holes.

Cleansing the Site

Once you have located an area and found a vein, the site must be cleansed to prevent infection, and/or disease. The standard method for cleansing the skin prior to a venipuncture is to scrub the area with a 70% isopropyl alcohol, using back and forth strokes. Make sure to allow the antiseptic to dry and take effect. Phlebotomists almost always use isopropyl alcohol swabs. These are pieces of sterile gauze or paper saturated with alcohol and come in individual packages. There are many micro-organisms on the skin. When the skin is intact they cannot enter the body. When the skin is broken, such as a venipuncture, then an infection can occur if the skin was not properly cleansed. Isopropyl alcohol can reduce the number of micro-organisms on the skin. There are many germicides such as chlorhexidine, ethyl alcohol, and povidone-iodine. Any one of these are capable substitutes to cleanse the venipuncture site.

However, isopropyl alcohol dries quickly, does not leave a large amount of residue, and is not highly irritating.

To cleanse the area, open the alcohol swab package, remove the swab, and scrub the venipuncture site in a circular motion working from the inside out, covering a 3 to 4-inch area. Allow the area to air-dry for at least 30 seconds. Avoid blowing on the site, wiping, or fanning in attempt to have it dry faster. Dispose of all alcohol swabs after one use.

For most venipunctures, isopropyl alcohol is the antiseptic of choice, there are however some tests that will be affected by this cleansing agent. Here are some examples:

If a physician should order blood cultures, extra steps must be taken to avoid contamination of the specimen. Cleanse the area with 70% isopropyl alcohol to rid the skin of any loose dirt. Then, in the same circular motion, use povidone iodine swabs. Allow iodine to dry. This is to ensure a clean specimen. Neither isopropyl nor ethyl alcohol should be used to obtain a blood alcohol specimen. This can alter the test results. If a patient is allergic to alcohol, the next cleanser of choice is Chlorhexidine.

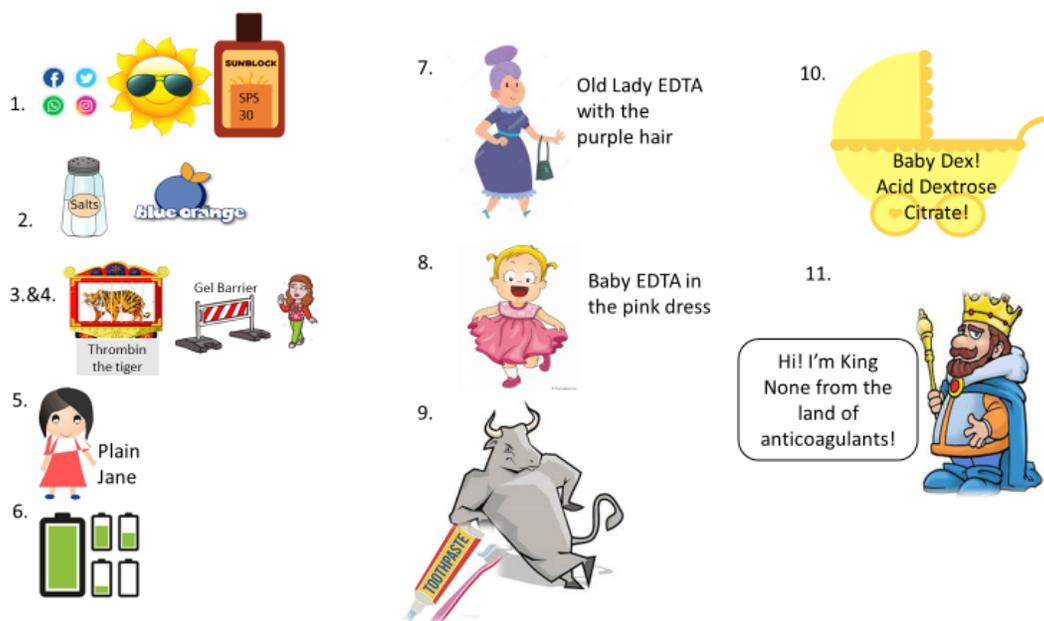
Specimen Trays

When doing phlebotomy procedures in a hospital or in traveling situations, returning to the lab for supplies may delay testing. It is important to have a variety of supplies on your specimen tray. All supplies should be checked weekly for any outdated tubes, needles, and syringes. All supply trays should be cleaned and restocked each shift. Make sure any open needles are disposed of properly, regardless of whether they have been used.

Your specimen tray should include:

- Marking pen
- Vacuum tubes and holders
- Safety holder for specimen tubes
- Vacutainer needles
- Safety syringes
- Hypodermic Needles
- Disposable tourniquets
- Butterfly needles
- Sterile gauze or cotton balls
- Bandages
- Sharps container
- Safety lancets
- Capillary tubes
- Microtainer tubes
- Disposable gloves
- Alcohol base hand gel

CHAPTER SIX – COLLECTION METHODS OF PHLEBOTOMY



Explanation:

1. Social media/sun/sunblock = media culture vials (social media) yellow top tube/yellow (sun) SPS (sunblock SPS instead of SPF)
2. Blue salty orange = sodium (hints the salt) Citrate (citrus hints the orange) Light blue top tube
3. & 4. Thrombin the tiger in a red and gold cage barrier between the cage and person= Serum tube: red and gold (red and gold cage) orange top tube (orange tiger) Speckled/Tiger top (tiger top tube) Gel barrier (barrier between the tiger and me!)
5. Plain Jane Red= Red top tube (nothing is in it so that why it's plain)
6. Lithium green batteries = green top tube lithium/sodium heparin
7. Lady EDTA with the lavender colored hair (sometimes older lady's dye their hair and it ends up being a shade of purple) = Lavender top tube with EDTA
8. Baby EDTA with the pink dress = Pink top tube with EDTA
9. Grey Ox brushing his teeth = Grey top tube with potassium Oxalate or sodium FLOURIDE
10. Baby Dex = Light yellow top tube with Acid Citrate Dextrose (DNA testing hints baby Dex)
11. King of none in the land of anticoagulants = Royal Blue top tube, the additives could be anticoagulants, or it could be none

CHAPTER 7. Variables and Complications

There are several important variables during the pre-analytical phase of testing that could affect your job. These variables include:

- Patient assessment and physical deposition
- Test requests
- Specimen Collection
- Specimen Transport
- Specimen receipt

It is important to assess the patient during, and after, blood draw. Many key observations could help with determining true results versus false. Let's review an example:

Maple is wheeled into the lab by an aide. Maple is very lethargic and doesn't respond to the venipuncture. She is having a hard time holding up her head and her eyes are slightly opened. After the specimen is tested, the lab tech (the one in the white coat) starts to question the patient's state. His chemical analyzer is showing a critical value of potassium. Given your description of the patient's current state, the lab tech is now more confident about his result.

A lot of simple variables can affect the test results. Example being: A patient comes in sweaty and panting from taking a morning jog. You should instruct the patient to sit and rest for at least 15 minutes before collecting the blood. This allows chemistry levels to decrease so there will be no false elevations in the test results.

Other simple things that can affect the outcome could be over the counter medications.

Examples:

- Tylenol can affect liver panel tests.
- Ibuprofen can cause a false positive in occult blood due to the dye.
- Aspirin can cause excessive bleeding during venipuncture.

Test requests will come in all kinds of forms. Requests could be generated electronically, hand written script, test requisition forms, or by verbal order. As a phlebotomist, you can take a test request by any of the four ways, but it must come from the doctor or his nurse.

Specimen collection must be accurately done. This consists of correctly identifying the patient, using correct tubes, using correct method, and correctly labeling the specimen. If any one of these things are compromised, so is the test result.

You, as a phlebotomist, must transport the specimen correctly and timely. Always check the specimen requirements for temperature sensitivity, light sensitivity, and time sensitivity. When blood has been centrifuged, plasma and serum need to be pulled off the red blood cells as soon as possible as this could affect certain test results. It is always good practice to get all specimens back to the lab within 45 minutes.

When taking specimens back to the lab, make sure to know which department each sample should go to. Nothing is worse than a lost specimen, and the patient having to endure another stick!

Categories of Pre-Analytical Variables

Blood specimens used to determine the amount of the patient's glucose, cholesterol, triglycerides, electrolytes, proteins, and so on, should be collected when the patient is in a **basal state** - that is, in the early morning, approximately 12 hours after food intake. The results of laboratory tests on basal state specimens are most constant.

Diet - The term *fasting* refers to no intake of food or drink (except water). Always clarify whether the patient has had anything to eat or drink. If the patient has eaten or had anything other than water to drink recently, but the physician still needs the test, the word "non-fasting" must be written on the requisition, and/or directly on the specimen.

Medications

Patients should take their prescription medication as directed the day of a lab draw unless the physician has told them otherwise or the medication needs to be taken with food and the lab tests calls for fasting conditions. When drawing for a drug therapy level it is important to document when the last dose of the medication was taken. Some over the counter medication can interfere with lab tests results, organ function and bleed time. Here are a few examples:

- Ibuprofen can cause a false positive in a fecal occult blood test.
- Acetaminophen can cause an effect on a liver function panel test.
- Aspirin can thin the blood and prolong bleed time.

Obesity - The most prominent vein for obese patient will be the cephalic, located on the outer antecubital area. If the vein is not entered when first punctured, be careful not to probe excessively because that can damage red blood cells. There are longer needles available to collect from obese patients if needed.

Damaged, Sclerosed, or Obstructed Veins - Obstructed, or clogged veins, do not allow blood to flow through them. Sclerosed, or hardened veins, are a result of inflammation and disease. Patient's veins that have been repeatedly punctured often become scarred and feel hard while the arm is palpated to find a venipuncture site. This site should be avoided!

Allergies - Some patients are allergic to iodine, alcohol, and other solutions used to cleanse a puncture site. Check for any allergy warnings posted and, if possible, ask the patient if they have any allergies to an alcohol solution or latex. Chlorhexidine has been reportedly used as an alternative to cleanse the skin. After application, it can be wiped off with sterile water.

Mastectomy - Patients who have undergone a **mastectomy** (the removal of the breast) often have resulting lymphedema (increased lymph fluid) on the side of the surgery. The fluid in the

area may make the patient more prone to infections. Therefore, the arm and area around the arm on the side of the mastectomy should be protected from cuts, scratches, burns, and blood collections. This type of fluid can also cause contamination to your specimens. Anytime blood must be drawn on the side of mastectomy, the patient's provider must give permission and it must be documented.

Edema - Some patients develop edema (an abnormal accumulation of fluid in the tissues). Several medical reasons can cause this: heart failure, renal failure, inflammation, malnutrition, and bacterial toxins. Avoid swollen areas when considering location of a venipuncture. Consult with a doctor on choosing the best location. Again, this can contaminate your specimen.

Thrombosis - Thrombi are solid masses derived from blood constituents that reside in the blood vessels. A thrombus may partially, or fully, occlude (close) a vein or artery, and such occlusion will make venipuncture more difficult.

Vomiting - Sometimes the thought or sight of blood before or during blood collection leads to nausea and possible vomiting. If this reaction occurs, have the patients take deep breaths and use cold compresses on their heads or on the back of the neck.

Complications Associated with Test Requests

Identification

Improper identification is the most dangerous and costly error a healthcare worker can make, because it can be life-threatening. Identification should include a match between the patient's identification, their verbal consent, and the test requisition. At least two identifiers are necessary to avoid an identification error. Bed labels, water pitchers, or door charts should not be used as a patient identifier. Hospital are public places with several patients being discharged and admitted every day. Labels from previous patient can often be accidentally left behind. Never draw a patient until they are identified correctly. Make sure to label your tubes in front of the patient; do not leave sight of the patient until this is done.

Time of Collection

Timing factors can affect test results, in some cases, such as testing drug levels. The timing of the collection must coincide with when the dosage was given. Always record time accurately on your specimens. This can affect whether the doctor wants to recheck levels or not. This is also important in for their medical records.

Requisitions

Always check the requisitions to make sure you have appropriate tubes on hand. Make sure that the information matches with the patient's identification. If there is a discrepancy, do not draw patient until the discrepancy is cleared up. Requisitions should include the following:

- Patient's name
- Patient's date of birth
- Date of the order
- Date to be done
- Doctor's name
- Covering diagnosis
- Test that is to be done

Tourniquet Pressure and Fist Pumping

Test results can be falsely elevated or decreased if the tourniquet pressure is too tight, or is maintained for too long. For example: plasma, cholesterol, iron, lipid, protein, and potassium levels will be falsely elevated if the tourniquet pressure is too tight or prolonged. (*You should never leave a tourniquet on longer than **60 seconds***) Also, pumping of the fist before venipuncture should be avoided, because it leads to an increase in the plasma, potassium, lactate, and phosphate concentrations. When a patient pumps their fist, blood pools to the center location of the spot, and this can cause an unnecessary hematoma.

Reducing Recollections of Blood

Several factors may cause you to “miss the vein.” These factors include: not inserting the needle deep enough, inserting the needle all the way through the vein, holding the needle bevel against the vein wall, or losing the vacuum in the tube. When you first insert the needle, you will want to go in until you hit resistance. Make sure the bevel of the needle is all the way into the site. You can adjust your needle by slightly going forward and backwards. DO NOT move your needle side to side. When using the vacutainer method, try another tube to make sure you haven't lost vacuum in your tube. Always anchor the vein as you are inserting your needle. This helps the vein not roll away from your needle. You do this by pulling back on the skin. If any defect should occur with your needles, release the tourniquet and discontinue the draw. It is better to re-stick someone than to “dig.”

Syncope (Fainting)

Syncope is a sudden loss of consciousness caused by a lack of oxygen to the brain that results in an inability to stay in an upright position. If a patient should faint during a blood draw, lower them to the floor and elevate their feet. Call for help from a co-worker. Do not let them leave until a nurse has looked them over. Request that they do not drive for at least 30 minutes afterwards. Always have a patient stand up slowly after fainting.

Seizure

A rare but serious complication that may occur during blood collection is a seizure. Try to keep the patient from hitting things. IF a patient begins to have seizure, you should immediately release

the tourniquet, remove the needle, and lower them to ground. DO NOT attempt to put anything in the patient's mouth.

Hematomas

When the area around the puncture site starts to swell, this means blood is leaking into the tissues and is causing a hematoma. A hematoma can occur when the needle has gone completely through the vein. Patients on blood thinners are very prone to hematoma. If this should occur release the tourniquet and remove the needle immediately. Apply firm pressure to the site to help stop the bleeding.

Petechiae

Petechiae are small red spots appearing on a patient's skin, indicating that minute amounts of blood have escaped into outer skin layers. This can be caused by low platelet counts and be a sure warning that the site might bleed excessively. This may also can occur when a patient has a fever.

Excessive Bleeding

Most patients stop bleeding at the venipuncture site within a few minutes. Patients that are on anticoagulant or blood thinners may have longer bleeding times. It is always a good idea to ask a patient if they are on any blood thinners, so you can be prepared. PRESSURE! PRESSURE! Once the needle is removed apply pressure to the site with a cotton ball or gauze for at least 60 seconds. Never let a patient leave if the site is still bleeding. I always tell my patients to keep their elbow bent so they don't break the platelet clump. You can also use Coban wrap, which is similar to an ace bandage, but disposable. In rare occasions that the bleeding doesn't stop, enlist help from a nurse or physician.

Neurological Complications

When you insert the needle into the site and the patient feels a sudden sharp pain, you might have hit a nerve. If this should occur, release the tourniquet immediately, discontinue the draw, and hold pressure at the site. I ask the patient to wiggle their fingers to make sure no nerve damage has been done.

Hemoconcentration

Hemoconcentration, the increase in red blood cells and other cells and solids in the blood, is caused from loss of fluid in the surrounding tissues of the venipuncture site. Hemoconcentration can occur if the tourniquet is applied too tight, if the tube is not inverted properly, and/or blood was left in the syringe too long.

Intravenous Therapy

Every time an IV is used, vein damage occurs. This can cause hemoconcentration or scar tissue. The vein might be easily palpated but are hard and can damage the specimen. These sights should be avoided. You should avoid drawing from an arm with an IV. If you have no alternative, you may ask the nurse to turn the IV off and wait ten minutes. Use a discard tube before drawing for lab

tests. Always note that you drew from an arm with an IV site. If at all possible, draw below the IV site.

Hemolysis

Hemolysis is a result of red blood cells destroyed. This normally turns plasma and serum bright red or pink. This occurs when blood is obtained while the needle is up against a vein wall or the plunger is pulled back too hard. This can also happen if the tube was shaken vigorously. If you use a needle that is smaller than 25-gauge, it can cause hemolysis. Blood going through such a small size hole will break the red blood cells. Hemolysis can be an indication of a medical problem; it is important to have proper to technique.

Collapsed Veins

Veins collapse when blood is withdrawn too quickly or forcefully during venipuncture, especially when blood is being collected from smaller veins or the veins of elderly patients. You will notice that blood is flowing into a tube but will start slowing down. If this should occur do not readjust your needle. Instead, discontinue the draw, and redraw with a syringe.

Turbid and Lipemic Serum

Turbid serum or plasma appears cloudy or “milky,” and can be a result of material contamination or high lipid levels in the blood. Lipemia can occur after someone has eaten something that is high in fat. This will affect some chemistry tests. Because lipemic serum or plasma does not represent basal state, the specimen should not be used. It can cause false elevation in lab testing.

Improper Collection

Be familiar with which tubes are used for routine lab tests. Remember additives cannot be substituted for each other. Such as: A green top tube that has lithium heparin would not be suitable for a patient’s lithium studies because it would cause false elevation. If you ever question the right collection tube or method, refer to a specimen-handling guide.

CHAPTER 8. Blood Collection Process

There are essential steps that are part of every successful blood collection procedure. Healthcare facilities will have their own procedures and protocols for you to follow. They will train you on how their facility operates. However, the most basic and essential elements of all venipuncture procedures involve the following steps:

1. Prepare yourself by cleansing hands and reviewing laboratory test orders.
2. Approach, identify, and position the patient comfortably and safely.
3. Assess the patient's physical disposition, including diet, and/or whether the patient is sensitive to latex or skin cleansing products.
4. Select and prepare equipment and supplies.
5. Find a suitable puncture site.
6. Prepare/decontaminate the puncture site.
7. Choose a venipuncture method.
8. Collect the samples in the appropriate tubes, and in the correct order.
9. Discard contaminated supplies in designated containers.
10. Label the samples.
11. Assess the patient to ensure bleeding has stopped.
12. Decontaminate hands.
13. Manage and document any special circumstances that occurred during the phlebotomy procedure.

Remember, documentation is *very* important. Without accurate documentation, the source becomes unreliable over time.

Using Standard Precautions

Precautionary measures such as hand hygiene and the use of gloves should be considered routine procedures. These procedures are vital to the well-being of the patient and the healthcare worker, and they must be practiced continuously. Hand hygiene and gloving procedures are most commonly done as soon as the healthcare worker is in visual contact of each patient, but before beginning the actual procedure. (*We always swab in and out before touching or handling patients!*) Dressing in nicely pressed clothing promotes the appearance of good hygiene and helps put the patient at ease.

Test Requisitions

Laboratory test requests are usually transmitted electronically or as a paper requisition. Electronic (computer generated) requests contain the same required information as paper requisitions. In some cases, the medical record number may be used as verification for a test requisition; however, each facility should have specific instructions for healthcare workers and the level of

authority in making decisions about laboratory requests. If there are any discrepancies on the test requisition always make sure to check with your supervisor, ordering physician, or nurse.

Patient Identification Process

Positive patient identification is one of the most crucial responsibilities for which a healthcare worker is held accountable. In hospital settings, it begins with registration and admission, where the patient is typically issued an identification band, which is usually worn on the wrist. Whenever taking blood samples you should have “at least two ways to ID the patient.” The identifiers can include: name, DOB, or driver license. However, do not use hospital room numbers, bed tags, and charts in holders near a patient or on a table, or tags on IV equipment. These are NOT reliable identifiers. Never collect a specimen until all identification discrepancies are cleared up. Extra care needs to be taken with high-risk situations:

- A patient does not understand the language. In this case, all efforts to find an interpreter must be made
- Siblings or twins are being cared for at the same time
- Patients with similar sounding names are being treated
- Patients with common names (for example: Smith, Jones)
- Patients have similarly spelled names (for example: Cho, Chou, Chow)
- Patients with the same name (for example: Sr. and Jr.)

Emergency Room Patient Identification

Patients often come to the ER unconscious and/or unidentified. Most ER departments have similar identification methods, but all healthcare workers should be knowledgeable of the specific procedures at their own facility. When in the ER, it might be necessary for a phlebotomist to take what is known as a verbal order from a doctor. Always repeat the order back to the doctor.

Identification of Neonates and Babies

In a hospital pediatric setting, neonates and babies under the age of 2 may have an ID band placed on the ankle rather than on the wrist, or on both the ankle and the wrist. The name of the person who identified the baby, and his or her relationship to the patient, must be documented.

All the following elements should be confirmed:

- Name of baby (if designated)
- Date of Birth
- Baby’s gender
- Medical record number or unique identifier
- Mother’s last name, or the last name used at registration

Outpatient/Ambulatory Patient Identification

Ambulatory patients may be seen in hospital clinics or physicians’ offices or may be receiving services such as diagnostic radiology or laboratory testing. These patients will require positive ID but do not require arm banding. For positive ID, the ambulatory patient must be asked to state his

or her first and last name, birthdate, and spell the last name while the healthcare worker cross-checks this information with test requisitions. Then the patient should be asked to show some form of identification. Remember 3-way match: verbal, identification, and requisition. When a patient is undergoing surgery, receiving sedation, or blood is about to be given, they should have an armband!

Physical Clues for Assessment of the Patient

As mentioned previously, factors related to the physical or emotional disposition, or age of the patient, may affect the blood collection process.

Some of these factors include:

- In a hospital setting you might see an empty food tray, so questioning the patient on whether they have just eaten might affect any non-fasting requirements.
- If it is an ambulatory patient, you might want to check whether they have had any history of fainting or nausea during blood draws.
- If a patient seems unusually ill, confused or non-responsive, this information can help lab techs determine whether abnormal levels are patient's actual levels or if the specimen is no good.

Approaching the Patient

Several professional and courteous behaviors and phrases can make the patient/healthcare worker encounter a smooth interaction. Be pleasant when speaking to a patient. When entering a hospital room treat the patient with respect by knocking and stating your name and the department you are from. Always greet patients with a smile, your name, and department. Explain to your patient what is about to happen, and why. Treat patients with the same respect as you would want to be treated. Make sure to use proper hand hygiene in front of the patient. Always open your needles and syringes in front of them so they can see they are unused.

Venipuncture Supplies

Being prepared means having all supplies readily available. Make sure to have supplies for every procedure in phlebotomy. Always have your tray filled and prepared! This includes needles, syringes, and vacutainer holders. Other equipment consists of:

- Test requisitions or labels
- Marking pen
- Gloves
- Alcohol pads/skin disinfectants
- Disinfectant swab sticks for blood cultures
- Safety needles with single-use, evacuated tube holds and butterflies
- Safety syringes and syringe transfer devices
- Blood collection tubes
- Plastic capillary tubes with tube sealer
- Non-latex bandages and sterile gauze pads

- Glass microscope slides
- Puncture-proof sharps container

Positioning the Patient

It is important to make the patient comfortable, safe, and to choose the least hazardous site for blood collection by skin puncture or venipuncture. Healthcare workers should know about useful devices (like hand and arm immobilizers) and the positions and locations of veins. Position the arm so that blood flows downward. Example: When positioning the arm it should be distal portion of the arm in a downward position. Palpitate the most common venipuncture veins and choose veins with width to them. Thin veins are more likely to “blow” because the width of the needle is bigger than the vein.

Another tool that can be useful is a phlebotomy wedge. A phlebotomy arm wedge is comfortable and contoured to patients arm to help stabilize arm during patient blood draws. Keeps elbow straight and elevated to draw patient at the right height and angle on the first try. This can be helpful when positioning the patient and trying to locate veins.



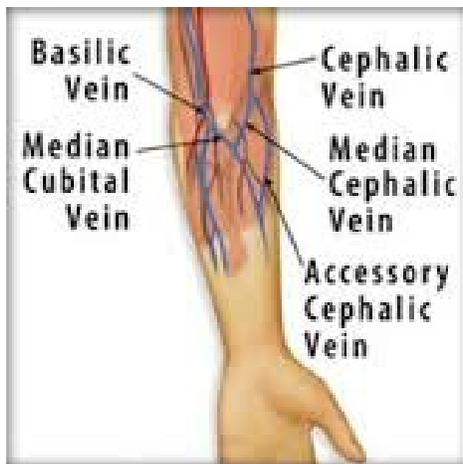
Anti-microbial coating seals against fluids encountered during blood draws.

Venipuncture Site Selection

The most common sites for venipunctures are in the antecubital area of the arm, just below the antecubital area of the arm, and just below the bend of the elbow, because this is where (*what are the three main phlebotomy veins?*) the median cubital, cephalic, and basilic veins lie close to the surface of the skin and are most prominent. The least hazardous site for venipuncture should be selected when possible.

1. **Median Cubital** (*sometimes called median vein*) – This is the most commonly used vein for venipunctures because it is the easiest from which to obtain blood. It is also less painful and less prone to injury. The median cubital vein is more anchored in the arm, so there is less chance of the vein rolling away from the needle.
2. **Cephalic vein** – This vein is on the outer edge (thumb side) of the arm. The Cephalic vein is generally considered to be the second choice in venipuncture sites, although this vein tends to be more prominent in obese patients.

3. **Basilic vein** – The Basilic vein is on the inside edge of the antecubital area (pinky side) of the arm. It is in close proximity to the median nerve and brachial artery, so the other choices are preferable.

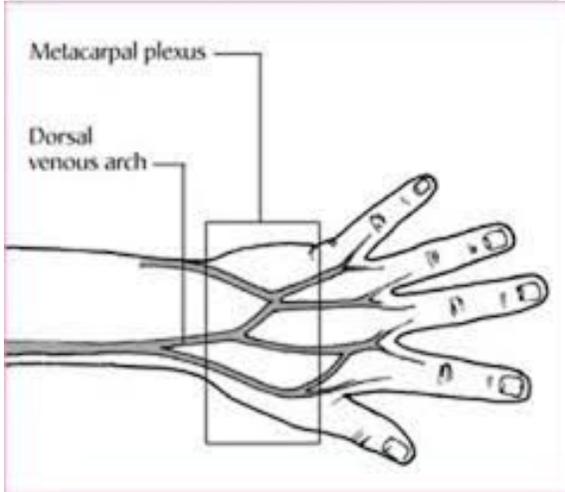


Palpating the entire antecubital area enables you to get an idea of size, angle, and depth of the vein. Always check both arms if you are uncertain. DO NOT have your patients “pump” their hand while palpating a vein. Have the patient close their fist and hold for a short time. Try not to let them open and close more than three times. You can always rotate the wrist to help in finding a vein as well. It is acceptable to have them make a fist and release once the needle is in.

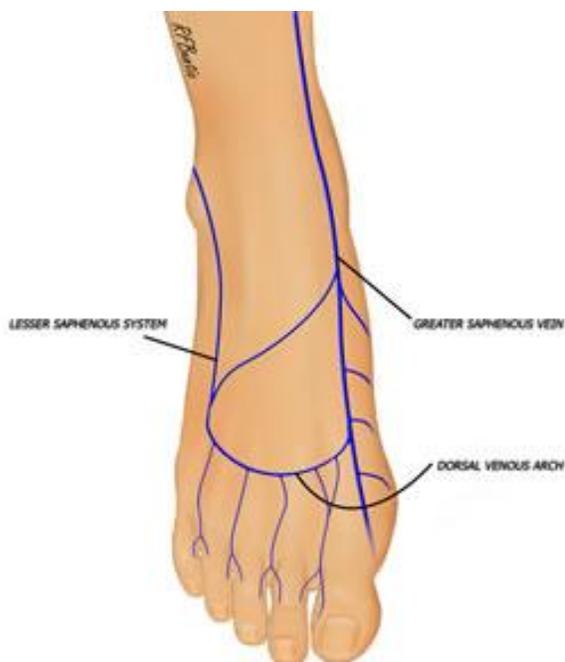
Alternative Puncture Sites

Hands - Alternative sites for blood collection, when the antecubital area cannot be used, are hand veins and in some cases, foot veins. Veins on the dorsal side (*back side*) of the hands or wrists are acceptable. These veins have a tendency to roll, therefore having them extend their wrist or foot helps to keep the veins flat. Always use a butterfly when doing a venipuncture on the hands, wrist, or feet.

***Important to Remember - arteries do not feel like veins. They are harder and have a pulse. Blood will look bright red and pulse into the tube or syringe. If you should enter an artery, discontinue the draw and hold pressure for up to 5 minutes. Always have a nurse look at the site and document it. Never use the front of the wrist to obtain blood. Probing with the needle could cause nerve damage!**



Ankles and Feet - Ankle and foot veins should be used only if arm veins have been determined to be unsuitable. You should only use these veins if the physician authorizes you to do so. Ankle and foot veins should not be used with a diabetic or cardiac patient, due to poor circulation.



Hard-to-find veins

Sometimes it is very difficult to feel a suitable vein. Warming the site helps by increasing the arterial blood flow. You can use several hand warming devices or a warm cloth, heated to 42[®] C for 3-5 minutes. Another way to help pump up a vein is to have the patient dangle their arm for 1-2 minutes.

Prioritizing Patients

During the course of a day's work at a busy hospital or clinic, you may have to make decisions about the order in which blood work is obtained. Priorities must be set and adhered to, whether they concern the order in which certain blood test are drawn on a patient, or which patients are to be drawn first from among a group. STAT patients should always come before routine patient draws.

Timed Specimens

If a test is ordered for blood sample collection at a particular time, it is your responsibility to draw the blood as close to the time as possible. Timed samples are important for various reason such as the timing of administering medications. Doctors will determine the dose of medicine depending on the levels the patient has in their system. For timed tests when patients are taking specific medication or drinking a liquid preparation (such as for a glucose tolerance test) make sure they have satisfied the testing requirements. Examples include a 2-hour postprandial blood glucose level, which requires a fasting blood glucose level plus is blood glucose test at exactly 2 hours after patients started eating their meal or consumed the liquid preparation.

Other timed tests include:

Peak Levels

A physician may order what's known as a peak level on a patient that is being administered a particular drug. This is to see how fast the body absorbs the medication and determine how much medication is the system at its "peak" level. It is important that as the phlebotomists you draw as close to the time being requested. This is typically 2 hours after the last dose but can be determined by the ordering physician as to when to draw it.

Example: If Timmy was to get a dose of antibiotics at 10:00 and the doctor has ordered a peak level 30 minutes after the last dose, it is the phlebotomist's job to draw the specimen as close to 10:00 as possible.

Trough Levels

Trough levels are drawn before the next dose of medication to determine how much is left in one's system at the lowest point of the medication dose. Trough levels are the opposite of peak levels. The time of when to draw a trough level is dependent upon the ordering physician and the medication.

CHAPTER 9. Indications for Skin Punctures (a.k.a. Dermal sticks, Capillary Draws)

Skin punctures are particularly useful for both adult and pediatric patients when small amounts of blood can be used for lab testing. For pediatric patients it is crucial to withdraw only the smallest amount of blood needed for lab testing to reduce the effect of blood-volume reduction. (*10 ml of blood could amount to being 5% to 10% of total blood volume in infants.*) While doing capillary draws on an infant of less than one year of age, a heel stick is performed. Capillary draws are most commonly used for those with fragile veins, such as elderly adults, or adults that are underweight. Here are some examples of why we would use skin punctures:

- Fragile veins, or veins that are small or roll easily
- When veins are being save for therapy
- Patient has already had multiple unsuccessful venipunctures
- Home testing
- Point-of-care testing
- Severe burns or scarring
- Obese patients
- Thrombotic tendencies
- Patient preference
- Small amount of blood need to perform the test

The following are not recommended for finger-sticks:

- Large amount of blood needed
- Coagulation studies
- Poor circulation
- Patient is dehydrated
- Swollen fingers

Lab tests commonly used performed by using finger-sticks:

- Blood smears
- PKU
- Complete Blood count
- Electrolytes
- Neonatal blood gases
- Point – of – Care testing
- Neonatal bilirubin
- Neonatal screening

Composition of Capillary Blood

Capillary blood acquired by skin puncture is different from that of venous or arterial blood samples by other methods. Capillary blood contains more arterial blood than venous. This can affect some values in lab tests such as glucose, potassium, total protein, and calcium. Capillary blood is more of a mixture, composed of blood from:

- Arterioles
- Venules
- Capillaries
- Tissue fluids

Supplies for Skin Puncture

Supplies for skin puncture are available from many manufacturers and, depending on the actual tests that are ordered, the supplies may differ. The basic list includes:

- Disposable gloves
- Commercially available warming pack, heating pad, towels, etc.
- Sterile, disposable, single-use puncture device with a permanently retractable blade or needle. These are typically called lancets.
- Disinfectant pads
- Sterile bandages
- Glass microscope slides
- Diluting fluids
- Plastic micro tubes
- Plastic-coated capillary tubes
- Capillary tube sealers or closures
- Lab requisition
- Marking pen
- Sharps box

Skin Puncture Sites

Skin puncture in adults and older children most often involve one of the fingers. The two middle fingers on the non-dominant hand is normally preferred. Why is this? The puncture should be made at the thickest part of the finger just off the center. Warm the fingers, makes sure there are no cuts, bruises, or calluses. I like to massage the finger before the finger-stick to help blood flow. For infants, the heel is the recommended site.

Warming the skin puncture site or lowering the arm

Although clinical practices are variable in health care facilities, warming the skin-puncture site helps. This increases the arterial blood flow to the area, thus “arterializing” the site. This can be use with hand warmers, or a washcloth heated with warm water up to 42[°] C. Sometimes having the patient wash their hand in warm water will help with this process, and sometimes it helps to have the patient simply lower their hand.

Cleansing the puncture site

The skin puncture site should be cleaned with an alcohol wipe and allowed to thoroughly dry before being punctured. If alcohol drops or pools at the site, it can cause hemolysis and contaminate the testing for glucose. Do not use iodine for cleansing the site as this can lead to inaccurate results in potassium, glucose, etc.

Skin Puncture Procedure

Skin puncture devices should be sterile, disposable, single-use, and have a permanently retractable safety blade or needle. Puncture devices are made to control for variable depth and length, depending on the patient’s age and weight. The average depth of a skin punctured should be 2 to 2.5 mm for adults, and less the 2.0 mm for small children and infants, to avoid hitting the bone. I like to warm the puncture site and massage the finger, then cleanse the area. Apply firm pressure to the tip of the finger; this helps with getting blood and also with the pain of the stick. Lancet should be perpendicular to the fingerprint grooves when doing a capillary draw. Then

apply the lancet to the site and release. Always wipe away the first drop of blood. The first drop is contaminated with fluid and possibly alcohol residue. *(If a lancet that is too long in depth is used you may cause **osteomyelitis**, which is inflammation of the bone caused by bacterial infection. **Osteochondritis** is inflammation of the bone and cartilage.)*



Dermal Order of Draw

The order of draw for a dermal puncture is different than the order of draw for venipuncture. When obtaining blood from a finger-stick or heel-stick, time plays against you. Blood can start to clot within a minute. This is why it is important to get any coagulation test tubes first.

1. Blood gases
2. Purple, lavender, pink, or pearl top tubes containing EDTA
3. Green: Containing heparin
4. Any other additive specimens
5. Serum tubes: Red or gold top tubes

Dermal Draw for Point of Care Testing

When performing a dermal puncture for other blood tests (glucose, cholesterol, hematocrit), follow the manufacturer's instructions for each test. The steps will remain the same except how the blood is collected and the method the blood is out in the cassette, cuvette, or strip. Follow the instructions for a dermal collection (including wiping away the first drop of blood) and avoid milking the finger, which can hemolyze the specimen or in other ways alter test results.

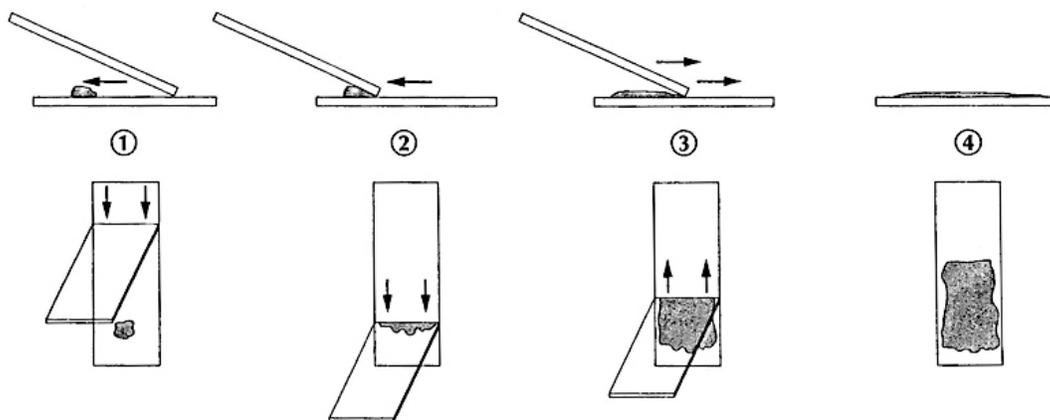
Blood Films for Microscopic Slides

Blood smears are not used in all laboratories because current technologies do not require them. Most hematology machines will do what is called a differential; this means it will count cells. Many doctors do not trust this and will ask what is known as a manual differential. A blood smear is a thin film of blood that is spread onto a glass slide. This is when microscopic slides come into play. They are counting red and white blood cells. They would also be looking for any abnormal cells. When looking through the microscope they will be looking for what is known as the feathered edge. This is the smear blood. In the feathered edge, the cells are more separate and easier to count.

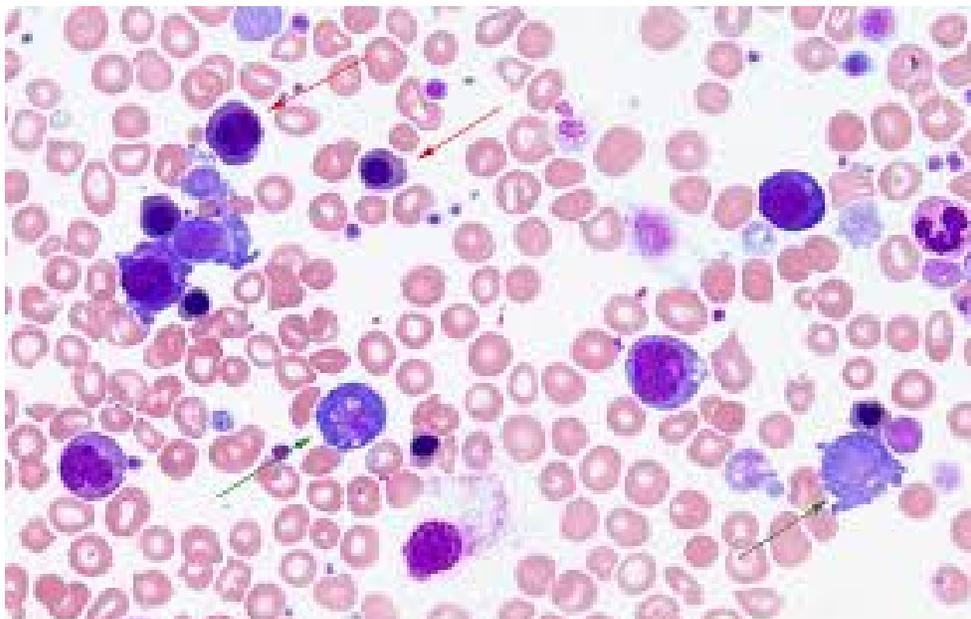
Making blood smears from fresh drops of blood:

1. Perform the finger puncture in the usual way, wiping the first drop of blood away.
2. Touch the slide to the second drop of blood approximately .5 to 1 inch from the end of the slide. Bloods smears may also be made using blood from a lavender top tube.

3. Place the second slide in front of the drop of blood and then pull it slowly into the drop, allowing blood to spread along the width of the slide.
4. When the blood spreads almost to the edges, quickly and evenly push the spreader slide forward at an angle of approximately 30 to 35 degrees.
5. Allow the slide to air dry. Blood films should have a feathered edge.



This is what blood looks like under the microscope:



Chapter 10. Pediatric and Geriatric Patients

Now we are going to give a little insight on how to collect blood from pediatric and geriatric patients. When in these situations you need to have some special knowledge and training. Both age groups require extra care when drawing blood.

Pediatric Patients

Children do not understand medical terminology or adult situations. You need to take time and have patience when talking to them. They will relate all needles to pain. It is vital that you practice techniques, such as the butterfly, to become more comfortable performing venipunctures on children. Be calm and confident when talking to children, meet them at eye level, explain the procedure in terms they would understand. Anytime when dealing with children ask for help from a co-worker; you will need it. Most children will not be cooperative in this situation. Don't ever lie and say, "this won't hurt," because let's face it, you will be sticking a needle in their arm! Of course, it will hurt a little. Most children relate needles to shots and expect that sort of pain, we like to call it more of a mosquito bite! (Get it? Mosquito bite... blood?) Here are some steps to follow:

- First be calm!
- Make sure to correctly identify the child
- Find out how the child has reacted to past blood (If it is the child first time try not to traumatize them)
- Ask the parents about what to expect and develop a plan of action!
- Put yourself at eye level of the child. Talk them and tell them what to expect. When placing the tourniquet on let them know it will only "hug" your arm.
- Always know when to stop! Tell the parents and the child you will try once and if that is not successful then you will find someone else.
Try to get the parents involved. The situation is scary enough they need that extra support.

Responses to the procedure

Once a child hears the word "needle" or sees a person in a white lab coat, chaos may follow!

- Children between the ages of 1 and 2 normally relate any procedure with pain and discomfort, even simple procedures, such as taking their blood pressure or temperature. Anything that is going to restrict movement for them can seem like the end of the world.
- Children 3 to 5 seem to think of these procedures like they are a punishment of some sort. They may react aggressively.
- Children 6 to 12 have gone through some relatable experience and, of course, remember only the bad (like shots, but never give us credit for the cute bandage and sucker they receive).
- Teenagers! Oh, we can't forget the teenagers; they seem to have one of two reactions. First one could be "Nope, not doing this!" or the second could be they are too embarrassed to show any kind of fear and act very chill throughout the whole thing.

Distractions

It's always a good idea to take off your lab jacket, this can help put them more at ease. Once a child reaches the toddler stage, around 3, they have more of an attention span and you can distract them from the procedure. Get creative! Fill your pockets with balloons, bubbles, or pinwheels! Of course, it is the digital age, so you could use a distracting cartoon on a cellphone. For older kids you try to relate to them about school subjects or sports, or you can even tease them about a boy/girl they might have a crush on. Nothing is more distracting than embarrassment!

Room Locations

When a child is admitted into the hospital we would like to consider their room a "safe" place to get better. If at all possible, try to do the procedure in a separate room and somewhere private. Places to avoid are playrooms and cafeterias, they are simply not appropriate.

Positioning for restraining

There will come a time when your best just won't be good enough and you will have to restrain the child in order to collect blood. Make sure you have a co-worker with you and the parent's permission to do so. Lay them in the supine position (lying on their backs). Include the parents during this process; you will need their help. Have one co-worker hold the arm at the wrist and the back of the elbow, have the parent hold the rest of the body. If the child cannot be restrained enough to perform the blood draw safely, then contact the nurse or physician.

Decreasing the needle pain

There are topical solutions that can be applied before the procedure. This gives the site a numbing sensation. ELMA is one in particular you can use to rub on the site, but the drawbacks are it can take anywhere between 45 to 60 minutes to come into effect. You will also have to predetermine the vein and it can be quite costly. This is a very good solution for children who have routine lab weekly or monthly with good veins. For infants up to 6 months there is an oral pain reducer known as **sucrose**. It takes only 2 minutes to become effective and can last up to 5 minutes.

Pediatric phlebotomy

Yes, we are talking little tiny babies! This sounds horrible and can make you feel like a horrible human being but remember you wouldn't be doing this if it weren't important! Two methods most commonly used to obtain blood from infants is capillary draws and venipunctures. When performing venipunctures on infants, always use the butterfly method.

Micro-capillary skin punctures

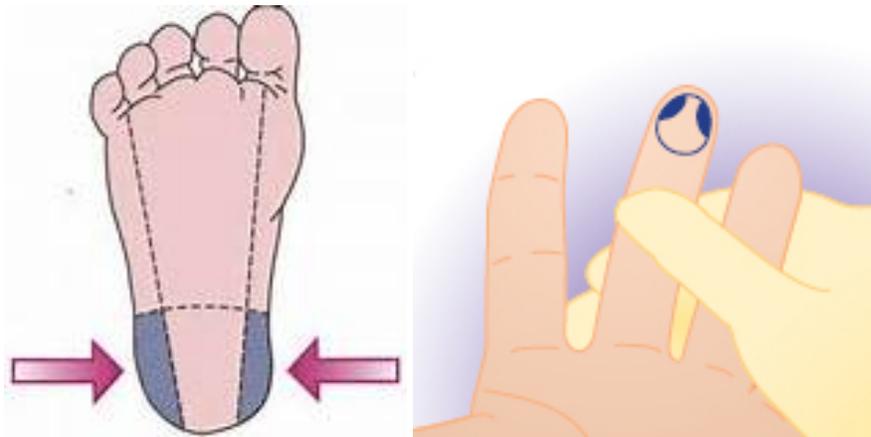
Skin punctures are used most often in pediatric phlebotomy when only a small amount of blood is needed. Always record each time blood is taken from newborns and infants to avoid iatrogenic anemia.

Skin puncture sites

The heel is the most desired spot for skin punctures in infants up to one-year old. The bottom surface of the heel is the best spot; this is to avoid hitting the bone. Finger-sticks are best for children one-year old or older; always use a lancet that is 2.00 mm or less when performing phlebotomy at either site. A serious condition known as osteomyelitis (inflammation of the bone)

can occur if hit repeatedly. Warming the heel will prevent hemolysis. Make sure to wipe the first drop of blood when performing skin punctures. Here are some steps to follow for heel sticks:

- Have parents lay the infant on their back side
- Wash your hands and put on gloves
- Locate which heel you will use
- Warm the site for 3 to 5 minutes to 42° C
- Gather your supplies
- Swab the heel with alcohol
- Allow the site to dry
- Hold the foot securely in your hand
- Place the retractable lancet to the site
- Push into the heel with the lancet then release the spring (a baby will probably cry now if they are not already)
- Wipe away first drop of blood
- Then apply the tube to the site and catch what blood you can!
- Once blood specimen is obtained hold pressure until the bleeding stops
*(it may be a bloody mess until you get the hang of it)



Capillary Blood Gases:

Arterial blood is always the specimen of choice for blood gases, but for infants, capillary blood can be used. The same steps are taken, but you will want to use a green heparinized safety plastic capillary tube.



Microtainer tubes (Remember the order of draw is backwards!)



Capillary tubes

Neonatal Screening (Inborn screenings)

Everyone hopes and prays their baby is healthy upon arrival! In the U.S. we do screen newborns for several different metabolic and genetic defects. Screening newborns assists in the early detection of genetic, metabolic, and infectious diseases and disorders. Blood-spot testing for newborn screenings are performed before the newborn is 72 hours old. If the specimen is obtained before the newborn is 24 hours old, a second specimen should be obtained for screening up to 2 weeks of age. We use a special filter paper to do lab test for early detection of these diseases:

- Cystic Fibrosis - mucous secretions that accumulate in various organs
- Hypothyroidism - decrease thyroid function
- PKU - a buildup of phenylketone caused by decreased metabolism of phenylalanine
- Galactosemia - the inability to break down galactose, a milk sugar
- Other genetic disorders (biotinidase deficiency, sickle cell disease)
- Infectious diseases (HIV, toxoplasmosis)

Here are steps to perform successful screening collections:

- Properly identify the newborn
- Wash hands and don gloves
- Warm heel, if necessary
- Cleanse the infant's foot and allow to dry
- Puncture the heel with 2mm or less of retractable lancet
- Wipe off the first drop of blood
- Allow a blood droplet to form
- Apply blood to only one side of the paper, saturating the circle completely
- Fill all circles completely

- Allow the filter paper to dry for at least 4 hours at room temperature (avoid heat or direct sunlight)

Reasons for rejected specimens

- The circle is too saturated
- Not all circles are filled completely
- Expired filter paper is used
- Contaminated with other substances
- Specimen was not allowed to dry thoroughly

Venipunctures on children

When a large amount of blood is needed for a testing it becomes necessary to perform a venipuncture versus a dermal stick on a child. The procedure is the same, only use a shallow vein and butterfly method when collecting. The proper sites are the antecubital area, middle of the wrists, top of the scalp (only when shown how to do so), and middle of the ankle. Venipunctures are needed when these tests are ordered:

- ESR
- Blood Cultures
- Cross-matching (blood banking for blood transfusions)
- Coagulation studies
- Drug studies
- Lead levels

Geriatric Patients

When dealing with elderly patients, treat them with respect. Address them with “sir” & “ma’am,” or “Mr.” & “Mrs.” Treat them like you would want your grandparents, parents, or yourself to be treated in this situation. As we get older our skin tends to get thinner. You will notice this often with elderly patients. You must take extra care so as not to cause a hematoma, which is common with geriatric patients. Their skin is fragile, their veins are fragile, and they are fragile. While performing phlebotomy on geriatrics the most common methods are syringe and butterfly. When dealing with Alzheimer patients don’t go it alone! They may agree to the procedure at first, but their minds change very quickly without notice. Have a distracting co-worker help through it. Normally they never mean what they say, and they may not understand, so this can be very frightening to them. Be calm! If the procedure cannot be done without risk to you or the patient, notify the nurse or doctor.

Make sure to properly identify geriatric patients. Some have limited hearing so it’s always a good idea to let them read their name. Never ask if this is their name, have them spell it out to you. Some patients eager to please and will agree to most anything. Also make sure a nurse or aide can properly identify nursing home patients.

Home-care blood collection

It has become increasingly common for phlebotomist to travel to the elderly. Many have limited mobility and are unable to travel. When collecting specimens in the home, make sure to properly identify the patients. Before doing any blood draw, make sure to locate the sink and trash can.

Make sure the site has stopped bleeding and all tubes are properly labeled before leaving the home! Here are some helpful hints:

- Have patient in a reclining position
- Gather all supplies (test tubes, needles, alcohol, sharp containers, etc.)
- Wash your hands
- Palpate for vein
- Don gloves
- Locate and swab the site; allow site to dry
- Get needles ready
- Apply tourniquet
- Anchor the vein
- Perform the procedure
- Release tourniquet when the last tube is half full
- Remove needle
- Apply pressure
- Discard needle in sharps container
- Label tubes

CHAPTER 11. Special Collections**Blood Cultures**

Blood cultures are often collected from patients who have a fever of unknown origin (FUO). Bacteremia (presence of bacteria in the blood) or septicemia (presence of pathogens in the circulating bloodstream) sometimes called blood poisoning can occur. While collecting blood cultures, extra steps must be taken to avoid contamination of the site. After the culture is obtained the blood is put on a specialized dish to see if any bacteria should grow, this is known as a culture. The lab will then identify what type of bacteria is growing so that the doctors know which antibiotics will treat their patients. Large amounts of blood are needed for a blood culture, so venipuncture is always the best method.

Blood Culture Procedure:

1. Properly identify the patient.
2. Wash hands and don gloves.
3. Assemble supplies, including a winged infusion set or syringe needle, adapter, and blood culture collection bottles.
4. Mark blood collection bottles with the level of blood required (typically 10 ml in each).
5. Remove protective cap and cleanse the top of the blood collection bottles.
6. Apply tourniquet.
7. Palpate to find the vein, then remove tourniquet while you prepare the skin.
8. Clean the site for 60 seconds with alcohol or chlorhexidine gluconate swabs. Cleanse the area in a back and forth motion. You will want to cleanse about a 2 to 2.5-inch diameter.
9. Allow the area to dry completely.
10. Cleanse the area again in the same manner covering the 2 to 2.5-inch diameter with povidone-iodine.
11. Do not touch the area; allow to dry completely.
12. Reapply the tourniquet after the area has dried.
13. Anchor the vein without touching the direct location of where the needle is to go in
14. Quickly insert the needle into the vein at a 15 to 30-degree angle. Pop the culture bottle into the double-sided needle. If filling anaerobic and aerobic bottles, fill the aerobic bottle first.
15. Remove the tourniquet before one minute has passed.
16. Monitor the patient's condition.
17. Make sure not to disturb the needle's position.
18. Quickly remove the needle using the same angle as insertion.
19. Apply gauze, using pressure, to the puncture site.
20. Activate the safety shield on the needle.
21. Dispose of the entire needle assembly into a sharps container.
22. Check to make sure the patient has stopped bleeding.
23. Apply a bandage or tape clean gauze over the puncture site.
24. Label all blood collection bottles, tubes, and the location (site) of the venipuncture.
Example: Blood culture #1 left arm.
25. Check the patient's status again.
26. Leave the room or dismiss the patient.

Possible Interfering Factors:

- If blood culture collections are ordered along with other lab tests, blood culture specimens must be collected first.
- When the needle enters the venipuncture site, it should not be scraped across the skin, as this can contaminate the needle.
- The aerobic blood culture bottle must be filled first in all except the butterfly method.
- Some culture bottles contain resin beads that neutralize antibiotics already in the patient's blood. If these are not gently mixed, they can cause false positives.
- Sometimes two sets of blood cultures are ordered. The second set should be obtained in the same manner as the first, except the second set needs to be obtained at either a second site or at a different time (about 60 minutes later)
- Recommendations are to use a butterfly system as this will help prevent back flow into the vein. If you are using a venipuncture system, make sure to have them lower the rest of their body to prevent this from happening.

Throat swab

A throat swab is a culture specimen usually obtained to test for strep throat. You will perform the test with a kit that has instructions for proper procedures. If there are no instructions, review facility requirements for the test. For throat swab collection: With the swab wipe both tonsils, the throat, and all areas that look inflamed or infected. Wash hands before and after performing the test. Wear gloves and change them between patients. Stand to the side of the patient when performing the test or wear a mask to protect yourself from airborne contamination. Label all specimens in front of the patient and test the collection or take the laboratory promptly.

Buccal swab

A buccal swab differs from a throat swab in where the specimen is collected. A buccal swab is collected from the inside of the cheek in the mouth to collect a patient's DNA. When performing a buccal test, introduce yourself, properly identify the patient with at least two patient identifiers, wash hands, and don gloves. Perform the specimen collection per the facility's instructions. Most commonly the collection is performed by gently rubbing sterile swab against the inside of the patient's cheek. Place the used swab in an appropriate container, labeled in front of the patient, and transport accordingly.

Semen (seminal fluid)

Semen specimens are used to perform sperm counts to help assess fertility. They can also be used to help prove identity in rape cases. Like with urine and blood specimen collections, introduce yourself and confirm patient identity with at least two patient identifiers. Wash hands and don gloves before handling semen specimens. Patients should be instructed on how long to refrain from ejaculation prior to specimen collection. Check with the facility for exact requirements. Handling instruction include collection into a sterile container. Do not use a condom; many condoms contain spermicides, which will adversely affect test results. Keep the specimen warm and protect it from light. To help ensure accurate test results, the specimen should be brought to the laboratory for testing within two hours and kept at body temperature. All specimens must be labeled.

Glucose Tolerance Test (GTT)

Glucose Tolerance Tests are for patients who suffer pre-diabetic symptoms. When a GTT, or sometimes referred to as an OGTT, is to be performed, the patient should be given complete information about the procedure so that his or her cooperation can ensure the best results.

Glucose Tolerance Test Procedure:

- Eat normal, balanced meals for at least 3 days
- Fast for 8-12 hours before the beginning of the test
- Drink water
- DO NOT drink unsweetened tea, coffee, or any other beverage before or during the test
- Do not smoke, chew tobacco, or gum while fasting or during the test

First, obtain a fasting blood sugar and urine sample. After testing the specimens, and the results are normal, proceed with having the patient drink the glucose, typically 75 grams, even for pregnant women. After the patient drinks the glucose, document the time. The patient should wait in the lab. After thirty minutes, obtain another blood sample and urine, making note of the time on the sample and mark thirty minutes. Then wait another 30 minutes, obtain another blood sample and urine and mark one hour. Then wait one hour, obtain the last blood sample and urine, and mark two hours. The patient's glucose level should start to return to normal within 1 to 2 hours.

Possible Interfering Factors:

If the patient becomes nauseated during the GTT, be prepared with cool towels and basins. If they are light-headed, then have them lie down. If the patient should vomit within 30 minutes of drinking the glucose, discontinue the test and reschedule.

Postprandial Glucose Test Procedure:

The 2-hour postprandial (after-meal) glucose test can be used to screen patients for diabetes, because glucose levels are rarely elevated in normal patients. In contrast, diabetic patients usually have increased values after two hours.

- Patient should eat a high-carb diet for 2 to 3 days
- Patient should eat a breakfast of orange juice, cereal with sugar, toast and milk (75 grams of glucose)
- Take a blood sample two hours after meal

Glucose Monitoring

Due to over demand and rapid turnaround time, "point-of-care" testing has become vital in most healthcare settings. During the past decade, small glucose testing instruments have become common.

Glucose Testing Procedure Steps:

- Gather equipment
- Identify the patient.
- Wash your hands.
- Put on gloves.
- Select the site and cleanse the area.
- Gently massage the finger from base to tip to promote blood flow.
- With the retractable lancet make a swift puncture to the tip of the finger.

- Wipe the first three drops of blood away with clean gauze.
- Place the test strip into the strip holder and insert it into photometer.
- The laboratory test results are displayed automatically.



Quality in POC Testing and Disinfection

When using POC monitoring instruments, it is your responsibility to ensure quality and control. Each day that you use your glucose monitor, you need to run controls before tests. Always record your results on a 30-day chart. Make sure the normal glucose range for the monitor is within two points of the target. You will receive small bottles of “controls” and these will be your “fake” blood to test the device. Whenever you run out of “controls” you will start with what is known as a “new lot.” You need to record that you started a new lot, along with the lot number that will be on the bottles. You also record anytime you clean the instrument and whenever you change batteries. Always look at the manufacturing instructions for all POC testing equipment.

Cannulas and Fistulas

A **cannula** is a tubular instrument that is used in patients with kidney disease to gain access to venous blood for dialysis or blood collection. This blood will be obtained through specially trained personal.

A **fistula** is an artificial shunt in which the vein and artery have been fused through surgery. It is a permanent connection tube located in the arm of the patients undergoing kidney dialysis. Only specialized personnel can collect blood from a fistula.

Donor Room

Blood donation is a wonderful thing, and thanks to several regional blood centers many lives have been saved. It only takes 500 milliliters to save up to three lives! Phlebotomists with experience and additional training may find work in a blood bank. These centers are responsible for collection, processing, and transfusing blood. Additional training would involve working with larger needles. Blood donation needles are typically 16 to 18-gauge sizes. Blood banks may also perform therapeutic phlebotomy, which is the intentional removing of blood to lower red blood cells (polycythemia vera: high red blood cell count) or iron levels (hemochromatosis: high iron levels). In blood collection from blood bank specimens, it is critical to avoid misidentification of the patient to prevent fatal transfusion errors. Donated blood can be processed into various blood products, including red blood cells, plasma, and platelets. When donating it is always encouraged to have the donor eat 4-6 hours before donating to help reduce the chance of

fainting, dizziness or other reactions to blood loss. Donors are encouraged to eat a light snack right before the phlebotomy procedure to help with this. A small physical examination is required to determine whether the donor is in generally good health. This includes:

- Weight (must weigh 110)
- Temp. (can't exceed 99)
- Pulse (must be between 50-100)
- Blood pressure (180-100)
- Skin lesions (no drug use/ 12 months after tats)
- General appearance (ill, drugs, nervous, drunk)
- Hematocrit and Hemoglobin (no less than 12.5)
- Medical history

Autologous Blood Donation

If a patient is having surgery with a high risk of bleeding, he or she can donate blood to themselves. This reduces the risk of acquiring any blood borne pathogens during a transfusion from a donor. The patient must be in good health (at least an 11 hemoglobin) and the surgery must be scheduled at least 72 hours before the donation.

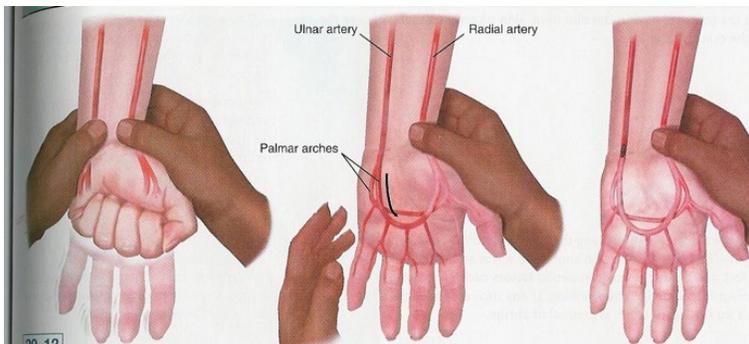
Arterial Blood Gases

ABG's provide useful information about the respiratory status and acid base balance of patients with pulmonary (lung) disease or disorders. Arterial blood rather than venous blood is used because arterial blood has the same composition throughout the body tissues, whereas venous blood has various compositions. Capillary blood gases are done on infants.

Radial Artery Puncture Site:

Radial artery is located on the thumb side of the wrist. Experienced health care workers should palpitate the artery. No tourniquet should be applied. The radial is most prominent artery to locate. It is less likely to cause a hematoma during the procedure. This is why it is the artery of choice, though it is small in size.

Brachial and Femoral arteries can be used for ABG's as well. They are hard to find. The brachial is located on the pinky side at the bend of the elbow. The femoral artery is located in the thigh by groin. When attempting to obtain an ABG in the radial artery, perform the modified Allen test to make sure circulation is good enough for the ABG. This is when you apply pressure to both the radial and ulnar artery. Have the patient open and close his or her fist several times. The palm of the hand should turn slightly white. When pressure is released from the arteries the color of the palm should return back to normal within 2 minutes. If there is any delay, there is not enough circulation to obtain an ABG.



Cleanse the site with iodine or chlorhexidine (do not touch after cleansing). Have the patients bend their hand back as much as possible to expose the wrist. With a syringe and needle you will enter the site at a 45-degree angle. Blood should start to flow into the syringe on its own. The blood should be brighter in color, and fill the syringe without pulling on the plunger. This is how you know you are in the artery. You will need approximately 1 ml of blood. Apply pressure to the sight for at 5 minutes. (** Arterial blood levels can vary from venous blood. If arterial blood is ever use for testing on chemistries or hematology, make sure to document it.)

Urine Collections

When collecting urine samples direct the patient to cleanse the genital area from front to back first, tell them to void a little and catch in midstream. This specimen is what we call clean catch. The sample should be tested within 30 minutes. If testing is going to be delayed the urine needs to be refrigerated. Make sure to always label the bottle not the lid. Once the lid is removed the urine is no longer labeled. Urine analysis can be done on random urine but this also needs to document. The preferred urine for testing is first morning. It is the most concentrate, this specimen is also best for pregnancy testing. When urine is tested and comes back positive for bacteria, we do what is called a culture and sensitivity. This is when the lab will see if the urine grows bacteria, then what kind, and what antibiotics can kill it. Some clinics require that an additional clean catch be submitted. The patient should drink a full glass of water 20 minutes before the collection and void into a sterile container.

Timed Collections

For some lab tests, 24-hour urine specimens must be obtained. This is where the patient collects their own urine for a full 24 hours. They will start in the morning by discarding the first urine, then after that they will collect it in a wide mouth jug. This needs to be refrigerated during the whole process. After a 24-hour period the patient should bring the jug back to the lab for processing.

Chain of Custody Forms

When collecting specimens for court orders or job requirements you might need additional paperwork known as “Chain of Custody.” This paperwork is often filled out by the “collector,” which will be you. You will come across this during urine drug screens (for work or probation), DNA testing, Blood or Breath Alcohol, and military blood screenings. The process maintains control of, and accountability for, the specimen from the time of collection to the time of disposal. The identity of every individual who has handled a specimen, and each time that the specimen transfers, must be documented by the chain-of-custody form. Chain-of-custody is required to have the following:

- The name and identifying information of the subject from whom the specimen was collected.
- The name of the person who obtained and processed the specimen.
- The date, location, and signature of the person attesting that the specimen is the correct one and matches its documentation.
- The signature and date from every person that had possession of the specimen for any amount of time, even for transport.

Examples of test requiring chain of custody forms:

Workplace drug testing

Drug testing of professional athletes

Neonatal drug testing

Blood alcohol testing

DNA analysis
 Rape test kits
 Parentage testing

Drug Testing

The Department of Health and Human Services initiates federal drug testing, which is mandatory for some government employees and many private-sector employees. Workplace drug testing often follows U.S. Department of Transportation’s mandated testing regulations, which have become an industry standard. Many employers require urine drug testing and use the Federal Drug Testing Custody and Control Form (CCF) for the process. This form documents the handling and storage information for specimens from the time they are obtained to their final disposal. Phlebotomist must undergo training and evaluation in the correct use of the CCF per federal guidelines. The process for collection has extremely specific guidelines to ensure that employees providing the specimen cannot tamper with it, such as adding water to dilute it or replacing it with urine they previously collected from someone else and concealed in clothing or handbags. Urine drug tests can usually detect marijuana use within the past week and the use of cocaine, heroin, and other illegal drugs within the past 2 days. However, they do not measure the degree of impairment or the frequency of use.

Workplace Drug Testing

- Ensures compliance with federal regulations, customer contracts, and insurance carrier requirements
- Reinforces a company’s no-use-policy
- Minimizes the risk of hiring an employee who uses drugs illicitly
- Identifies employees who use drugs illicitly so employers can enforce disciplinary action
- Improves the safety and health of employees

Sports-related drug testing

- Detects use of stimulants (amphetamines, anabolic steroids, alcohol, diuretics, street drugs, peptide hormones, anti-estrogens, beta, agonists) to enhance athletic performance
- Encourage regulation of nutritional and dietary supplements
- Analyzes blood and urine to detect blood doping or the use of erythropoietin

Neonatal drug testing

- Detects the use of cocaine, opiates, amphetamines, methamphetamines, and phencyclidine, which cause prenatal drug exposure and neonatal abstinence syndrome (withdrawal)
- Requires obtaining specimens for analysis within 24 hours after childbirth to detect recent drug use
- Confirms maternal drug use 24 to 72 hours prior to childbirth if the newborn’s urine is positive for these substances

When collecting for drug testing, Employers might request a drug test on employees at random or before offering an employment opportunity. Drug testing can also be a requirement for people in safety sensitive situation, like truck drivers or heavy equipment operators. Instructions may vary depending on the facility’s policy, but these are the general steps to following when collecting for work related urine drug testing:

- Identify the patient
- Must have a chain of custody form
- Have the patient empty out their pockets
- Have the patient wash their hands prior to the collection
- Shut off the water or tape off any water access. Add bluing agent to the toilet water. Make sure to instruct the patient not flush or wash hands until after the whole collection process is done. (This is to help eliminate the possibility of the patient diluting the specimen. Yes, people do try to do this!)
- Have the patient urinate into a sterile container that has a fixed temperature strip located on the side (must have at least 45 ml of urine for a specimen)
- After receiving the urine check the temperature (temperature should be 90 to 100 degree)
- Check for any discolorations or contaminants
- Split the specimen into specimen vials
- Continue to fill out the chain of custody form and give patient their copy and seal the vials into a specimen bag in front of the patient
- Instruct the patient to wash their hands

Forensic Specimens

Anyone a fan of the television shows CSI or Forensic Files? Forensic laboratory analysis involves various types of specimens, for example vaginal swabs after rape, blood and body fluids from crime scenes, and postmortem specimens from autopsies. Special handling of specimens is crucial, because the specimens might be decomposing, available in only trace amounts, or require analysis by a forensic scientist in extreme environments. **Forensic specimens** also involve toxicology testing of substances after poisoning or substance abuse. Collecting these specimens can require special training or experience and supervision. Unlike specimens collected in a clinical setting, forensic specimens can be in any condition, clotted or in containers that would otherwise be unacceptable.

Blood Alcohol Collections

In the case of a driving under the influence charge (DUI), police may request a blood alcohol level. The person in question *must consent* to having the blood test performed and may refuse it. Written consent is required! If a phlebotomist attempts to collect without it, they could be charged with assault and battery. Additionally, without consent, the blood alcohol test will not be admissible in court. Because these specimens are often key evidence in legal cases, the phlebotomist must take great care during collection process. Cleanse the site with chlorhexidine or another antiseptic that does not contain alcohol, or simply use soap and water. Cleansing the site with alcohol could cause a false positive.

CASE STUDY 1: THERAPEUTIC COMMUNICATION TECHNIQUES

Mr. Bradley is meeting with Carolyn, a Phlebotomy Technician at a family practice, to check his cholesterol. Carolyn says, "Good morning, Mr. Bradley. It's good to see you today. It has been awhile since you came in to check your cholesterol levels. You know this is for your own good." Mr. Bradley grows defensive and says, "You have no idea what I'm going through." Carolyn responds, "You do seem a bit troubled today. Would you like to share what is going on with you?"

QUESTION 1 *The phlebotomist says, "You know this is for your own good."*

Which of the following ineffective communication techniques is she demonstrating?

- A. Disapproving
- B. Defending
- C. Making stereotypical comments
- D. Probing

Making stereotypical comments is correct. This technique involves using clichés and meaningless phrases that show no original or patient-specific thoughts. It discourages further communication and minimizes the patient's thoughts and feelings.

QUESTION 2 *The phlebotomist says, "You do seem a bit troubled today."*

What therapeutic communication technique is she demonstrating?

- A. Making observations
- B. Reflecting
- C. Verbalizing the implied
- D. Repeating

Making observations is correct. By using this technique, the phlebotomist shares her own perceptions of the patient to encourage further exploration of his feelings. Mr. Bradley explains that his wife is not doing well, and that she needs oxygen to help with her breathing. He grows visibly upset and says, "it breaks my heart." Carolyn says, "There, there now. Everything will be okay. I hope you find it comforting to talk about it a little. I'm here for you, Mr. Bradley."

QUESTION 3 *The phlebotomist says, "There, there now. Everything will be okay."*

Which of the following ineffective communication techniques is she demonstrating?

- A. Defending
- B. Blaming
- C. Reassuring
- D. Advising

Reassuring is correct. This technique involves giving false hope and devaluing the patient's feelings. It discourages further communication and makes patients feel that there is no basis for their concerns.

QUESTION 4 *The phlebotomist says, "I'm here for you, Mr. Bradley."*

What therapeutic communication technique is she demonstrating?

- A. Clarifying
- B. Offering self
- C. Mirroring
- D. Reflecting

Offering self is correct. This technique involves conveying the availability to listen and help. It encourages further communication.

CASE STUDY 2: INCONSISTENT TEST RESULTS

Michael, a phlebotomy technician, is checking the blood sugar of Mr. Bunch, an inpatient at Allied Memorial Hospital. The patient has type 2 diabetes and is hospitalized due to a severe kidney infection. Michael uses a glucometer to test Mr. Bunch's blood. Before conducting the test, Michael checks the code on the bottle containing the strips against the code coming up on the glucometer display. After checking to make certain that the codes match, Michael performs the test according to the directions that come with the unit. The glucometer displays a reading of 600 mg/dL. Michael checks the patient's test log to see the last few results. They have all been in the normal range. Michael asks Mr. Bunch if he could test his blood again, explaining that he is not confident that the initial reading is accurate. After Mr. Bunch gives his consent, Michael performs a second test. This time, the glucometer reads 35 mg/dL.

QUESTION 1 *Which of the following steps should the phlebotomist take after seeing two widely divergent test results?*

- A. Notify the provider of the need for a venipuncture
- B. Arrange for the patient to have dinner
- C. Perform liquid controls
- D. Send the glucometer of repair

Perform liquid controls is correct. Running controls will help to troubleshoot the problem. The method used to obtain the sample shouldn't result in such differing test results. Even though the testing equipment or supplies. We don't know there is a problem with the meter until we finish troubleshooting.

Michael explains that he believes the glucometer is malfunctioning. He apologizes for the inconvenience and tells Mr. Bunch that another phlebotomist will be in shortly to test again with a different meter. Michael performs a low, normal, and high control on the metered using the same strips that he used during testing. All the controls are out of the expected ranges listed on the box of strips. Michael opens a new bottle of strips with the same code and lot number as the defective strips and runs another set of controls using a different box of the new strips. Michael now knows that the problem isn't the metered but rather the strips from the batch number that was used during the original testing.

QUESTION 2 *Which of the following should the phlebotomist write in the equipment log after running liquid controls?*

- A. Name and room number of the patient
- B. Time and date of control results
- C. Time and date of glucose testing
- D. Patient's test results

Time and date of control results is correct.

QUESTION 3 *What should the phlebotomist do about the defective strips?*

- A. Throw away the all strips with the lot number of the defective strips.
- B. Throw away any strips from the boxes that were tested.
- C. Contact the manufacturer and follow instructions for sending back the strips.

Contact the manufacturer and follow instructions for sending back the strips is correct.

CASE STUDY 3: COLLECTION SITES

Chris, a phlebotomy technician, is attempting to find vein in Ms. Miller's hand for a venipuncture. He ties a tourniquet 3 inches about the wrist bone of her right hand. He cannot locate any visible veins on the patient's hand Chris palpates diligently with one finger but cannot locate a vein. Before 1-minute passes, he releases the tourniquet. Chris explains to Ms. Miller that he cannot find a vein in her right hand. Ms. Miller asks, "How about my wrist? Can you try there?" Chris explains that is not a good idea and asks for her permission to attempt to find a vein in her left hands. Ms. Miller gives consent, and Chris ties a tourniquet about her left hand and begins to palpate. Before 1-minute passes, Chris releases the tourniquet and explains to Ms. Miller that he would like to apply a warm washcloth to her hand for a couple minutes. Ms. Miller says, "Why don't you just give it a good slap? That has worked before" Chris replies the would prefer not to slap her, and that a warm wash cloth applied to the site works just as will. After asking for permission again Chris reties the tourniquet and palpates for vein, He quickly finds one and begins the blood collection.

QUESTION 1 *Using the slap method of finding a vein could possibly lead to a charge of which of the following?*

- A. Assault
- B. Battery
- C. Malpractice
- D. Maleficence

Battery is correct.

QUESTION 2 *Why did the phlebotomist apply the warm cloth?*

- A. To clean the area to facilitate seeing veins
- B. To raise the skin temperature to bring more blood to the area
- C. TO comfort the patient in preparation for the puncture
- D. To allow the tourniquet to remain in place for longer period of time

To raise the skin temperature to bring more blood to the area is correct.

QUESTON 3 *Why should the phlebotomist avoid puncturing the inside of the patient's wrist?*

- A. There is a high risk for infection.
- B. It could damage the ulnar nerve.
- C. Use of a butterfly needle and syringe would be required.
- D. Punctures in the area are unlikely to yield an ample blood specimen.

It could damage the ulnar nerve is correct.

CASE STUDY 4: VEIN SELECTION

Molly, a phlebotomist technician, is preparing to perform a venipuncture for a client, Mr. Bennett. She has already performed the necessary preparations, including hand hygiene, patient identification, and patient preparation. As she prepares to look for a vein, she asks Mr. Bennett, "Have you ever had any problems in the past with blood collections, like the vein collapsing?" He states that he has never any problems. Molly then explains that she is going to look for the best vein, and Mr. Bennett indicates that he prefers using the right arm. Molly assesses Mr. Bennett's right arm for optimal veins to use for the venipuncture and then palpates any visible veins.

QUESTION 1 *Which of the following veins should the phlebotomist choose?*

- A. Cephalic vein
- B. Basilic vein
- C. Median cubital vein

The median cubital vein is the phlebotomist's first choice because it is a large vein that is less prone to injury and does not have tendency to roll away from the needle. Also, puncturing it is usually less painful for the patient than other veins are. The phlebotomist knows that the cephalic vein is a good second choice, but it is not usually visible and tends to roll away from the needle. She decides against the basilic vein because it lies close to the median nerve, so puncturing it poses a greater risk for nerve injury.

CASE STUDY 5: CAPILLARY BLOOD COLLECTION

The CPT, Chelsea, is collecting blood from Mr. Wheeler for an INR. The practice just purchased a new CLIA-waived INR unit that uses capillary blood for testing. Chelsea prepares the right third finger (middle finger) for testing by warming the finger first and then cleaning with alcohol wipe in a circular motion. She then punctures the skin at the tip of the finger, close to the nail bed, perpendicular to the finger print lines.

QUESTION 1 *Which of the following should the phlebotomist have done differently?*

- A. Punctured toward the side of the fingertip
- B. Selected a different finger
- C. Wiped the finger with a clean cotton ball after the cleaning with alcohol
- D. Punctured parallel to the finger print lines.

Punctured toward the side of the fingertip is correct. The phlebotomist should use the side of the finger for the puncture. The tip of the finger is more sensitive, has fewer capillaries, and might have calluses. There was nothing wrong with the finger the phlebotomist selected. The third (middle) and fourth (ring) fingers are best for a finger stick. The fifth or little finger is too thin, and the bone is too close to the surface. The first or index finger and the thumb are likely to be too sensitive or to have thick calluses. Wiping the finger with a clean cotton ball after application of the cotton ball decontaminates the skin. Puncturing perpendicular to the finger print lines is the correct method.

CASE STUDY 6: ALTERNATE COLLECTION SITES

Tom, a phlebotomy technician, is preparing to collect a blood sample from Ms. Coleman, who has an IV infusion in her right arm and scarring from a previous burn injury on her left forearm in the antecubital area and her upper forearm.

QUESTION 1 *Which of the following should the phlebotomist choose to perform venipuncture for this patient?*

- A. Dorsal side of the wrist
- B. Dorsal side of the hand
- C. Plantar surface of the foot
- D. Antecubital area of the left arm

The dorsal side of the hand is correct. Veins on the dorsal side of the hand are the next choice after the antecubital fossa. The phlebotomist should never collect blood from the wrist on the palm side because tendons and nerves are close to the surface in the area. Finally, the veins of the ankle or the foot should be last choice for a venipuncture. These veins are difficult to access and relatively easy to injure, and venipuncture of these veins is painful. In addition, scarred areas should be avoided due to increased pain and access difficult. The phlebotomist also knows he should not draw blood from an arm that has an IV infusion, so he must select a vein on the back of the patient's left hand.

QUESTION 2 *The patient tells the phlebotomist that she is nervous about him using a site that has not been used in the past. Which of the following responses should the phlebotomist provide?*

- A. "I'm going to use a different location that should lessen the discomfort for you."
- B. "I can guarantee this other site will be better for both of us."
- C. "It will be easier for me to use a different site due to all of your other complications."
- D. "If this change makes you nervous, I will use whichever location you prefer."

Selecting the dorsal side of the hand should be less painful than the antecubital area due to the patient's scarring. The left arm needs to be avoided due to IV infusion.

Chemistry Department

Clinical chemistry (also known as chemical pathology, clinical biochemistry or medical biochemistry) is the area of chemistry that is generally concerned with analysis of bodily fluids for diagnostic and therapeutic purposes. It is an applied form of biochemistry (not to be confused with medicinal chemistry, which involves basic research for drug development).

Hematology Department

Hematology examines whole blood specimens to perform full blood counts. Blood films are examined as well as many other specialized tests.

Blood Bank

Immunochemistry, or Blood bank determines blood groups, and performs compatibility testing on donor blood and recipients. It also prepares blood components, derivatives, and products for transfusion. This area determines a patient's blood type and Rh status, checks for antibodies to common antigens found on red blood cells, and cross matches units that are negative for the antigen.

Microbiology Department

Microbiology receives almost any clinical specimen, including swabs, feces, urine, blood, sputum, cerebrospinal fluid, synovial fluid, as well as possible infected tissue. The work here is mainly concerned with cultures, to look for suspected pathogens which, if found, are further identified based on biochemical tests. Also, sensitivity testing is carried out to determine whether the pathogen is sensitive or resistant to a suggested medicine. Results are reported with the identified organism(s) and the type and amount of drug(s) that should be prescribed for the patient.

COMMON LABORATORY TESTS

Chemistry Department

CMP (Comprehensive Metabolic Profile) - Routine laboratory test to treat, diagnosis, or monitor several different functions of the body.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

This is a panel of different chemistry tests:

Albumin	Creatinine with GFR Estimated
Albumin/Globulin Ratio (calculated)	Globulin (calculated)
Alkaline Phosphatase	Glucose
ALT	Potassium
AST	Sodium
BUN/Creatinine Ratio (calculated)	Total Bilirubin
Calcium	Total Protein
Carbon Dioxide	Urea Nitrogen
Chloride	

BMP (Basic Metabolic Profile) – Smaller version of a CMP.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

This a panel test that includes:

BUN/Creatinine Ratio (calculated)	Glucose
Calcium	Potassium
Carbon Dioxide	Sodium
Chloride	Urea Nitrogen (BUN)
Creatinine with GFR Estimated	

Lipid Panel (or Lipid Profile) - This group of tests can determine risk of coronary heart disease. May be a good indicator of whether someone is likely to have a heart attack or stroke, as caused by blockage of blood vessels.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference Range(s):

	Male (mg/dL)	Female (mg/dL)
Total Cholesterol		
<u><20 Years</u>	<u><170</u>	<u><170</u>
<u>≥20 Years</u>	<u><200</u>	<u><200</u>
HDL Cholesterol		
<u><20 Years</u>	<u>>45</u>	<u>>45</u>
<u>≥20 Years</u>	<u>>40</u>	<u>>50</u>

Triglycerides

COMMON LABORATORY TESTS

<u>≤9 Years</u>	<u><75</u>	<u><75</u>
<u>10-19 Years</u>	<u><90</u>	<u><90</u>
<u>≥20 Years</u>	<u><150</u>	<u><150</u>
LDL-Cholesterol (Calc)		
<u><20 Years</u>	<u><110</u>	<u><110</u>
<u>≥20 Years</u>	<u><100</u>	<u><100</u>
Cholesterol/HDL Ratio (Calc)		
	<u><5.0</u>	<u><5.0</u>
Non-HDL Cholesterol		
<u><20 Years</u>	<u><120</u>	<u><120</u>
<u>≥20 Years</u>	<u><130</u>	<u><130</u>

This a panel test that includes:

Total Cholesterol	LDL-Cholesterol (calculated)
HDL Cholesterol	Cholesterol/HDL Ratio (calculated)
Triglycerides	Non-HDL Cholesterol (calculated)

PSA (Prostate-Specific Antigen) - Monitors the prostate gland and is the first test in diagnosing prostate cancer.

- Test tube: Green, Gold, Tiger Top, Orange, or Gold and Red
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

ANA - This test helps to diagnose lupus and to rule out certain other autoimmune diseases.

- Test tube: Gold, Orange, Red and Gold, or Red
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

PTT (Partial Thromboplastin Time) - This test is most often ordered to help evaluate your risk of excessive bleeding prior to a surgical procedure, or to monitor heparin anticoagulant therapy.

- Test tube: Light Blue Top
- Keep at room temperature up to 6 hours, separate plasma from cells, and freeze

Glycohemoglobin (Hemoglobin A1C) - Used to monitor a person's diabetes and to aid in treatment decisions. This test is usually performed with the first diagnosis and then 2 to 4 times per year.

- Test tube: Lavender
- Keep at room temperature for up to 8 hours and then refrigerate at 2 degrees Celsius

Liver Function Panel (LFT) - Also known as liver (hepatic) function tests or LFT, can detect liver damage or disease. Multiple tests may be ordered at the same time, and may be used to detect hepatitis, or diagnose other liver-related conditions.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

TSH, High Sensitivity (Thyroid Stimulating Hormone) - This test is performed to screen for and diagnose thyroid disorders, or to monitor treatment of hypothyroidism.

- Test tube: Serum or Green

COMMON LABORATORY TESTS

- Keep at room temperature for up to 8 hours and then refrigerate at 2 degrees Celsius

Uric Acid - Used to detect high levels of uric acid, or to monitor certain chemotherapy or radiation cancer therapies. Serum uric acid measurements are useful in the diagnosis and treatment of numerous renal and metabolic disorders, including renal failure, gout, leukemia, psoriasis, starvation or other wasting conditions, and in patients receiving cytotoxic drugs.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours, and then refrigerate at 2 degrees Celsius
- Reference Range(s):

	Male (mg/dL)	Female (mg/dL)
<1 Month	1.5-3.9	1.5-4.6
1-11 Months	1.5-5.6	1.5-5.4
1-3 Years	2.1-5.6	1.8-5.0
4-6 Years	1.8-5.5	2.0-5.1
7-9 Years	1.8-5.4	1.8-5.5
10-12 Years	2.2-5.8	2.5-5.9
13-15 Years	3.1-7.0	2.2-6.4
16-18 Years	2.1-7.6	2.4-6.6
≥19 Years	4.0-8.0	2.5-7.0

Cardiac Profile - To help treat and diagnosis heart conditions such as a heart attack

- Test tube: Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

Troponin T - Troponin T (TnT) is an independent prognostic marker which can predict the near-, mid-, or even long-term outcome of patients with acute coronary syndrome (ACS/heart attack).

**There is different variations of this test: Troponin T or I

- Test tube: Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference range: 0.00-0.02 ng

Bilirubin - Measurement of the levels of bilirubin is used in the diagnosis and treatment of liver, hemolytic, hematologic, and metabolic disorders, including hepatitis and gall bladder obstruction. (There are various versions of this test such as direct bilirubin, total, or both.)

- Test tube: Serum (amber vial or aluminum foil)
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Must be protected from light

B-Type Natriuretic Peptide (BNP) - BNP is increased in congestive heart failure, left ventricular hypertrophy, acute myocardial infarction, coronary angioplasty, and hypertension. Elevations are also observed in pulmonary hypertension (indicating right ventricular dysfunction), acute lung injury, hypervolemic states, chronic renal failure and cirrhosis. Decreasing levels indicate therapeutic response to anti-hypertensive therapy.

- Test tube: Lavender
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

Sodium - Sodium measurements are useful in the diagnosis and treatment of aldosteronism, diabetes insipidus, adrenal hypertension, Addison's Disease, dehydration, inappropriate antidiuretic hormone secretion, or other diseases involving electrolyte imbalance.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference range: 135-146 mmol/L

Potassium - Potassium measurements are useful in monitoring electrolyte balance in the diagnosis and treatment of disease conditions characterized by low or high blood potassium levels. Potassium is elevated in adrenal cortical insufficiency, acute renal failure and in some cases of diabetic acidosis. False elevations of potassium may be due to hemolysis or rupture of platelets during coagulation process.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference range(s): 3.5-5.0 mmol/L (Age of the patient can change its range)

Creatinine - Serum creatinine is useful in the evaluation of kidney function and in monitoring renal dialysis. A serum creatinine result within the reference range does not rule out renal function impairment: serum creatinine is not sensitive to early renal damage since it varies with age, gender and ethnic background. The impact of these variables can be reduced by an estimation of the glomerular filtration rate using an equation that includes serum creatinine, age and gender.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference ranges depends on age, gender, and race

Magnesium - Magnesium measurements are used in the diagnosis and treatment of hypomagnesemia (abnormally low plasma levels of magnesium) and hypermagnesemia (abnormally high plasma levels of magnesium). Magnesium is decreased in chronic nephritis, acute pancreatitis, and alcoholic cirrhosis. It is increased in acute or chronic renal failure and Addison's Disease.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference Range(s): 1.5-2.5 mg/dL

Phosphorus - Serum phosphorus (Phosphate) levels alone are of limited diagnostic value and should be correlated with serum calcium levels. An increased phosphorus with decreased calcium suggests either hypoparathyroidism or renal disease. A decreased phosphorus and an increased

calcium suggest hyperparathyroidism or sarcoidosis. When both calcium and phosphorus are decreased diagnostic considerations include malabsorption, vitamin D deficiency and renal tubular acidosis. Increased phosphorus and normal or increased calcium suggests Milk-alkali syndrome or hypervitaminosis D.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference range depends on gender and age of patient

Triglycerides - Serum triglyceride analysis has proven useful in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, and various endocrine disorders. In conjunction with high density lipoprotein and total serum cholesterol, a triglyceride determination provides valuable information for the assessment of coronary heart disease risk.

- Test tube: Serum or Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference Range(s):
 - ≤9 Years <75 mg/dL
 - 10-19 Years <90 mg/dL
 - ≥20 Years <150 mg/dL

Glucose

- Test tube: Green or Grey
- Fasting Reference Interval 65-99 mg/dL
- Non-fasting Reference Interval 65-139 mg/dL

Hepatic Panel aka Basic Liver Profile, LFT, Liver Function Profile - The ALT and AST tests measure enzymes that your liver releases in response to damage or disease. The albumin test measures how well the liver creates albumin, while the bilirubin test measures how well it disposes of bilirubin. ALP can be used to evaluate the bile duct system of the liver.

- Test tube: Serum or Green

FSH and LH - FSH and LH are secreted by the anterior pituitary in response to gonadotropin-releasing hormone (GNRH) secreted by the hypothalamus. In both males and females, FSH and LH secretion is regulated by a balance of positive and negative feedback mechanisms involving the hypothalamic-pituitary axis, the reproductive organs, and the pituitary and sex steroid hormones. FSH and LH play a critical role in maintaining the normal function of the male and female reproductive systems. Abnormal FSH levels with corresponding increased or decreased levels of LH, estrogens, progesterone, and testosterone are associated with a number of pathological conditions. Increased FSH levels are associated with menopause and primary ovarian hypofunction in females and primary hypogonadism in males. Decreased levels of FSH are associated with primary ovarian hyper-function in females and primary hyper-gonadism in males. Normal or decreased levels of FSH are associated with polycystic ovary disease in females. In males, LH is also called interstitial cell-stimulating hormone (ICSH). Abnormal LH levels with corresponding increased or decreased levels of FSH, estrogens, progesterone, and testosterone are associated with a number of pathological conditions. Increased LH levels are associated with menopause, primary ovarian hypofunction, and polycystic ovary disease in females and primary

COMMON LABORATORY TESTS

hypo-gonadism in males. Decreased LH levels are associated with primary ovarian hyperfunction in females and primary hyper-gonadism in males.

- Test tube: Serum
- Reference Range:

FSH			LH		
Male	1.6-8.0	mIU/mL	Male		
Female			18-59 Years	1.5-9.3	mIU/mL
Follicular Phase	2.5-10.2	mIU/mL	≥60 Years	1.6-15.2	mIU/mL
Mid-Cycle Peak	3.1-17.7	mIU/mL	Female		
Luteal Phase	1.5- 9.1	mIU/mL	Follicular Phase	1.9-12.5	mIU/mL
Postmenopausal	23.0-116.3	mIU/mL	Mid-Cycle Peak	8.7-76.3	mIU/mL
			Luteal Phase	0.5-16.9	mIU/mL
			Postmenopausal	10.0-54.7	mIU/mL

Cold Hemagglutinins - This test can be useful for the detection of cold agglutinins in association with cold agglutinin syndrome. Cold agglutinin disease (CAD) is a severe, chronic blood disorder. It is a form of autoimmune hemolytic anemia (AIHA), which means the immune system mistakenly attacks and destroys red blood cells.

- Test tube: Plasma from Pink or Lavender; Red acceptable
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

Chromosome Analysis - Chromosome analysis or karyotyping is a test that evaluates the number and structure of a person's chromosomes in order to detect abnormalities. Chromosomes are thread-like structures within each cell nucleus and contain the body's genetic blueprint. Each chromosome contains thousands of genes in specific locations. These genes are responsible for a person's inherited physical characteristics and they have a profound impact on growth, development, and function.

- Test tube: Green
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius

Hematology Department

CBC (Complete Blood Count) - A complete blood count is used as a screening test for various disease states including anemia, leukemia and inflammatory processes. This is a routine panel test that include: WBC, RBC, Hemoglobin, Hematocrit, MCV, MCH, MCHC, RDW, Platelet Count, MPV and Differential (Absolute and Percent - Neutrophils, Lymphocytes, Monocytes, Eosinophils, and Basophils)

- Test tube: Lavender
- Keep at room temp

WBC (White Blood Cell) - WBC and Differential (Absolute and Percent - Neutrophils, Lymphocytes, Monocytes, Eosinophils, and Basophils)

- Test tube: Lavender
- Keep at room temp

COMMON LABORATORY TESTS

Hemoglobin A1c (HGBA1c) - To assist with control of blood glucose levels, the American Diabetes Association (ADA) has recommended glyated hemoglobin testing (HbA1c) twice a year for patients with stable glycemia, and quarterly for patients with poor glucose control. Interpretative ranges are based on ADA guidelines.

- Test tube: Lavender
- Keep at room temp
- Reference Range(s): <6.0 % of total hemoglobin

Coagulation studies - Test can include prothrombin time (PT), Partial Prothrombin time (PTT). This is to determine the bleeding time of a patient. This test helps determine dosages for blood thinners and what if any precautions needing to be taken during surgery.

- Test tube: Light Blue
- Keep at room temp/ Freeze after 6 hours

CLSI Guidelines:

Calculation

X = Anticoagulant volume required per 1 mL of blood

H = Hematocrit

V = Total Volume of anticoagulated blood

$$X \text{ mL sodium citrate} = \frac{100 - H}{595 - H} \times V$$

Example:

Patient hematocrit = 60%, 5 mL blue-top tube to be drawn

$$X = \frac{100 - 60}{595 - 60} \times 5^* = 0.37 \text{ mL sodium citrate}$$

5* mL is the volume of the standard drawing tube

Blood Bank

Crossmatch / Type and Screen / RH factor - In transfusion medicine, cross-matching or cross matching (part of series of steps in blood compatibility tests) is testing before a blood transfusion to determine if the donor's blood is compatible with the blood of an intended recipient.

- Test tube: Plain Red and Pink
- Keep at room temp

Specialty Draws

Retic (Reticulocyte) - Use in evaluating erythropoietic (produces too much red blood cells) activity.

- Test tube: Lavender

Folate - Folic acid deficiency is common in pregnant women, alcoholics, in patients whose diets do not include raw fruits and vegetables, and in people with structural damage to the small intestine. The most reliable and direct method of diagnosing folate deficiency is the determination of folate levels in both erythrocytes and serum. Low folic acid levels, however, can also be the result of a

COMMON LABORATORY TESTS

primary vitamin B₁₂ deficiency that decreases the ability of cells to take up folic acid. Reference ranges are vary depending on age and sex.

- Test tube: Serum
- Keep at room temperature

Iron - Serum measurements are useful in the diagnosis of iron deficiency and hemochromatosis (too much iron).

- Test tubes: Serum
- Keep at room temp
- Reference Range(s):

	Male (mcg/dL)	Female (mcg/dL)
<1 Month	32-112	29-127
1-11 Months	27-109	25-126
1-3 Years	29-91	25-101
4-19 Years	27-164	27-164
20-29 Years	50-195	
≥30 Years	50-180	
20-49 Years		40-190
≥50 Years		45-160

Rheumatoid Factor - Elevated RF is found in collagen vascular diseases such as SLE, rheumatoid arthritis, scleroderma, Sjogren's syndrome, and in other conditions such as leprosy, tuberculosis, syphilis, malignancy, thyroid disease and in a significant percentage of otherwise normal elderly patients.

- Test tube: Serum
- Keep at room temperature up to 8 hours and then refrigerate at 2 degrees Celsius
- Reference Range(s): <14 IU/mL

Valproic Acid - Valproic acid is used as an anticonvulsant to treat certain types of seizures, to prevent migraine headaches and to treat various psychiatric illnesses such as bipolar disorder and aggression. Drugs that compete for protein-binding sites with valproic acid can increase the concentration of valproic acid. Therapeutic drug monitoring is useful to optimize dose. Measurement of the free concentration is useful if toxicity is suspected.

- Test tube: Red
- Reference Range(s): 50.0-100.0 mg/L

Vancomycin - Vancomycin is an antibiotic used in the treatment of bacterial infections, especially methicillin-resistant staphylococci. Vancomycin is also used in treatment for penicillin-allergic patients who cannot receive or have failed to respond to other drugs, including the penicillin's and/or cephalosporins and for other infections caused by vancomycin-susceptible organisms.

- Test tube: Red
- Reference Range(s)

Vancomycin, Peak	20.0-40.0 mg/L
Vancomycin, Trough	10.0-20.0 mg/L

Microbiology Department

Blood Cultures - Isolate and identify potentially pathogenic organisms causing bacteremia/septicemia. Antimicrobial susceptibility testing on significant pathogens will be performed at an additional charge.

- Test tube: Blood culture media vial set (anaerobic and aerobic)
- Can be stored at room temp up to 72 hours

Urine Culture - Isolate and identify potentially pathogenic organisms. Antimicrobial susceptibility testing on significant pathogens will be performed at additional charge.

- Sterile container (at least 12 ml of urine)
- Refrigerate if there is a delay in testing

Throat Culture - A throat culture or strep test is performed by using a throat swab to detect the presence of group A streptococcus bacteria, the most common cause of strep throat. These bacteria also can cause other infections, including scarlet fever, abscesses, and pneumonia.

- Test tube: Swab

Wound Culture - A bacterial wound culture is a test that detects and identifies bacteria that cause infections (pathogenic) in a wound. ... A culture helps to determine whether a wound has become infected, which type(s) of bacteria are causing the infection, and which antibiotic would best treat the infection and help heal the wound.

- Test tube: Swab

Stool Culture - The stool culture is a test that detects and identifies bacteria that cause infections of the lower digestive tract. The test distinguishes between the types of bacteria that cause disease (pathogenic) and the types that are normally found in the digestive tract (normal flora)

- Sterile container
- Refrigerate if there is a delay in testing

Fungal testing - Fungi are microbes that exist in nature as one-celled yeasts or as branching filamentous molds (also may be spelled "moulds"). Only about 20 to 25 species of fungi are common causes of infection. Fungal tests detect infections and sometimes identify the fungus and help guide treatment. Fungal infections range from superficial skin infections to serious deep tissue, blood, lung, or systemic diseases.

Sputum Culture - Viscous material that is derived from the lower air passages such as the lungs and bronchi that may contain substances such as mucus, blood, pus and/or bacteria; it is not the saliva that is produced by the glands in the mouth.

Terms and Definitions (alphabetically)

Aerobic blood culture bottle – Type of blood culture bottle used to collect specimens to test for microbes that thrive in air

Aliquot – To divide specimens into smaller portions

Amniotic fluid – Liquid that surrounds a fetus inside the sac in the uterus

Anaerobic blood culture bottle – Type of blood culture bottle used to collect specimens to test for microbes that thrive in an airless environment

Antecubital fossa – The areas of the arm at the inner side or bend of the elbow; antecubital space

Antibody – A type of protein the immune system produces to neutralize a threat of some kind

Antigen – Any substance capable of inducing a specific immune response and triggering to the production of an antibody specific to that substance

Apheresis – The removal of whole blood from a patient or donor; the components of whole blood are separated mechanically, one of the separated portions is withdrawn, and the remaining components are transfused back into the patient or donor

ASAP – As soon as possible

Assault – The intentional creation of apprehension leading to a fear of harm

Autologous – “Self;” in blood transfusion and transplantation, it means that the donor and recipient are the same person

Bacterium – A single-cell micro-organism that reproduces rapidly and causes many infections

Basal state – State of rest and fasting, normally for at least 12 hours

TERMS AND DEFINITIONS

Basilica vein – Vein that runs medially and located in the upper arm and forearm. Last choice for venipuncture because of proximity to nerves and arteries.

Bevel – Sharpened and slanted cut edge of a needle designed to ease in the process of puncturing tissue

Bilirubin – Yellow or orange product of the breakdown of hemoglobin

Blood bank – A place where blood is collected from donors, typed, separated into components, stored, and prepared for transfusion to recipients; a blood bank may be a separate free-standing facility, or part of a larger laboratory in a hospital

Blood doping – Injection of blood cells or blood substitutes to increase athletic endurance by boosting the blood stream's oxygen-carrying capacity

Blood-borne Pathogens Standard – An OSHA-mandated set of requirements concerning protection against pathogenic micro-organisms that are transmitted via human blood and cause diseases in humans; these pathogens include hepatitis B virus and human immunodeficiency virus

Blood culture – A laboratory test used to check for bacteria or other mic-organisms in a blood sample

Blood smear – A blood test performed on slides that gives information about the number and shape of blood cells

Biohazard – Anything that is a risk to organisms, such as ionizing radiation or harmful bacteria or viruses

Biologic hazards – Also called biohazards; any risks to organisms. Including ionizing radiation and harmful bacteria or viruses; any conditions or phenomena that increase the probability of harm

Biotinidase deficiency – Deficiency of the enzyme that breaks down biotin

Bone marrow – The soft tissue inside bones that produces blood- forming cells

TERMS AND DEFINITIONS

Capillary puncture – Also known as a dermal puncture or finger stick, used to collect small samples of blood composed collect small samples of blood comped of capillary, venous or arterial blood

Cardiopulmonary resuscitation (CPR) – The application of chest compressions and ventilations to patients in cardiac arrest, done in an effort to maintain viability until advanced help arrives

Catheter – A hollow, flexible tube that can be inserted into a vessel or cavity of the body to withdraw fluids

Centrifuge – A device that spins laboratory specimens at high speeds to separate the samples into their components for testing purposes

Cerebrospinal fluid – Liquid that surrounds the brain and spinal cord

Chain of custody – The paper trail showing the seizure, custody, control, transfer, analysis, and disposition of specimens that may be used

Chemical reagent strip testing – A method of urine collection that may be ordered to diagnose urinary tract infections or to evaluate the effectiveness of drug therapy

CLIA-waived – Tests of the least complexity to perform and with a low risk error

Coagulation – The process by which a clot forms in the blood

Continuity of care document – A document that conforms to a standard accepted format for electronically transmitting/sharing patient information securely and in a format that is easy to read and share among provider locations.

Critical value – A laboratory test result outside of the expected reference range that can be threatening

Culture and Sensitivity – A test performed to test for infections

Cystic fibrosis – Mucous secretions that accumulate in various organs

TERMS AND DEFINITIONS

Decontamination – The process of removing foreign material such as blood, body fluids, or radioactivity; it does not eliminate micro-organisms but is a necessary step by step preceding disinfections or sterilization

Defibrillator – A service that delivers an electrical shock at a preset voltage to the myocardium; used to restoring the normal cardiac rhythm and rate when the heart has stopped beating, or is fibrillating

Dermal puncture – Also known as a skin puncture; a procedure in which a finger or heel is lanced to obtain a small quantity of blood testing; also called capillary draw

Diffusion – The movement of a substance from an area of high concentration to an area of low concentration

Diluent – A solution (such as water or saline) that reduces the concentration of a specimen

Dorsal – Back

Edema – A collection of fluid under the skin

EDTA - Ethylenediaminetetraacetic acid; used as an anticoagulant to keep blood specimens from clotting

Electrolyte – A chemical substance that develops an electrical charge and can conduct an electrical current when placed in water

Empathy – Sensitivity to and identification with another person's problems, without expressing sorrow or sympathy

Enteric – Pertaining the intestines

Ergonomics – The designs and arrangement of objects so that people interact with them most efficiently and safely

Erythropoietin – A medication for patients who have had chemotherapy to treat cancer; also used illicitly by some athletes to boost production of red blood cells and thus increase endurance

TERMS AND DEFINITIONS

Exposure control plan – An OSHA-compliant plan that explains ways to minimize or eliminate exposure of humans to blood-borne pathogens; in general, it should include its date of development, scope of information, universal precautions, engineering and work practice controls, personal protective equipment, and cover housekeeping, waste disposal, laundry, vaccinations with follow-up evaluations, communications, training, and first aid

Fasting – Not eating or drinking (except water) for a period of time, generally at least 8 hours, and often 12 hours.

Fecal test – A collection of stool or feces to test for the presence of parasites, blood or an infection

Filtration – A process that separates substances by forcing them through a membrane

Fibrinogen – A plasma protein that converts into fibrin to form a clot during bleeding

Fomite – Any nonliving object or substance capable of carrying infectious organisms

Fungus – A micro-organism that grows on or in animals, plants, humans, and food, including yeast and molds

Galactosemia – An inherited disorder in which the body is unable to use (metabolize) the simple sugar *galactose*, causing the affected patient to be unable to tolerate any form of milk, as well as other foods containing galactose.

Glucose tolerance test (GTT) – A test performed to determine how well a patient's body metabolizes sugar

Hematocrit - The proportion of the blood that consists of packaged red blood cells, expressed as a percentage by volume; the hematocrit test measures the percentage of hematocrit in the blood

Hematoma – A collection of blood underneath the skin, also known as a bruise

Hemochromatosis – High iron count

TERMS AND DEFINITIONS

Hemoconcentration – Excessive accumulation of blood into an area of the body, usually caused by a tourniquet left on too long or patient pumping their fist

Hemodialysis – A process that uses a machine to remove waste and excess fluid from the blood of patient whose kidneys no longer perform these functions

Hemoglobin – The red, oxygen carrying protein of red blood cells

Hemolysis – Destruction of red blood cells

Hemostasis – Stopping of red blood cells

Herpes simplex – A virus that causes blisters either around the mouth and lips (cold sores) or genital area

Hypothyroidism – Decreased thyroid function

Iatrogenic anemia – A type of anemia that results from multiple phlebotomies; it is especially common in geriatric, pediatric, or underweight patients

Immune system – The organs and structures that regulate the body's resistance to disease

Immunocompromised – Having an impaired immune response, usually as a result of disease, medication therapy, or surgery

Infection – The invasion and proliferation of pathogens in body tissues

Isopropyl alcohol – An antiseptic agent that reduces the presence of micro-organisms on the skin

Ketones – Acids that form from the breakdown of fatty acids in the absence of insulin

Lateral – Toward the side, away from the center of the body

Lumen – Hollow cone of the vein, best place for needle position during venipuncture

Lymphadenopathy – Swollen lymph nodes

TERMS AND DEFINITIONS

Meaningful use – A federal incentive program sponsored by the Centers for Medicare and Medicaid services (CMS) that encourages physicians and hospitals to adopt health information technology solutions, such as electronic health

Means of transmission – How a pathogen moves to a host via direct or indirect contact with people

Mechanical ventilation – Treatment that involves a machine perform or assisting with breathing

Medial – Toward the middle, close to the center of the body

Median cubital vein – Vein located near the middle of the antecubital area. First choice for venipuncture collection

Medical asepsis – The practice designed to reduce the number and transfer of pathogens as well as break the chain of infection; clean technique

Medical Identification number – Unique number that is established for a patient upon entry to the medical facility

Meningitis – An infection of the membranes that surround and protect the brain and spinal cord

Micro-organism – Living things that are too small to see without magnification

Mucus membrane – The moist inner lining of tubular structures including the mouth, esophagus, stomach, and intestines.

N95 or N99 respirator – A mask that helps protect the wearer from airborne diseases

Oral candidiasis – A fungal infection of the mouth

Occult blood - Blood that comes from a source that cannot be immediately determined, such as a peptic ulcer

Osmosis – The diffusion of water through a semipermeable membrane

Oxygenation – The process of supplying the body with oxygen

Palpate – To feel with the fingers

Parasympathetic nervous system – A division of the nervous system that prepares the body for digestion and rest

Pathogen – Disease causing micro-organisms

Petechiae - Small hemorrhagic spots that appear under the surface of the skin

Percutaneous – Made, done, or effected through the skin

Peripheral blood smears – Also called blood films; they consist of a thin layer of blood smeared on a microscope slide and then stained to allow microscopic examination

Per mucosal – Denotes by way of, or through, a mucous membrane

pH – A measure of acid-base balance

Phenylketonuria – Abbreviated PPK; a metabolic genetic disorder characterized by a deficiency in the hepatic enzyme phenylalanine hydroxylase; the form known as classic PKU causes permanent intellectual disability seizures delayed development, behavioral problems, psychiatric disorders, a “mousy” odor, lightening of skin and hair, and eczema

Photosensitivity – An abnormal reaction to or a change resulting from exposure to light

Phlebitis – Inflammation of a blood vessel

Plasma – Liquid portion of the blood in which blood cells are suspended

Plasmapheresis – Removal of blood plasma from whole blood

Point of care – At or near the site of patient care

Polycythemia vera – High red blood cell count

TERMS AND DEFINITIONS

Protected health information – As defined by HIPPA, any information, whether oral or recorded in any form, that is created or received by a health care provider; also relates to past, present, or future physical or mental health or condition of any individual, the provision of healthcare to an individual, or the payment for the provision of healthcare to an individual.

Protozoon – A single-cell parasite that replicates rapidly once inside a living host.

Quality assurance – Laboratory standards the CDC established to help maintain the highest level of test accuracy possible

Quality control – A method of repeated assay of known standard materials and monitoring reaction parameters to ensure precision and accuracy

Random specimen – A single urine specimen taken at any time

Reagents – Chemical substances known to react in specific ways; reagents are used to detect or synthesize other substances in chemical reactions

Reference Laboratory - A laboratory that is outside a patient care facility; usually reference laboratories can perform many more types of testing than are available at the average hospital laboratory

Recovery position – One of series of variations on a lateral recumbent or three quarters prone position of the body, into which an unconscious, but breathing, casualty can be placed as part of first aid treatment

Rubella – A virus that causes fever and a rash and can cause serious harm to the fetus if a person develops this illness during pregnancy

Saliva test – A collection of the fluids from the patient's oral cavity to help monitor hormone, drug, and alcohol levels

Sclerotic – Hardened, or veins that are hardened from repeated blood draws

Semen - The thick, whitish secretion of the male reproductive organs discharged from the urethra during ejaculation

TERMS AND DEFINITIONS

Serum – Straw-colored liquid portion of the blood visible after the specimen has been allowed to clot and after centrifugation

Sickle cell disease – Abnormal hemoglobin

Specific gravity – A measure of concentration

Sputum – Material coughed up from the lungs and expectorated through the mouth

Stat – Immediately, often within 45 minutes to 1 hour of receipt in the laboratory

Stool – Also called feces; waste or excrement from the digestive tract that is formed in the intestine and expelled through the rectum

Suprapubic – Pertaining to a location above the symphysis pubis, which is the slightly movable inter-pubic joint of the pelvis, consisting of two pubic separated by a disk of fibrocartilage and connected by two ligaments

Surgical asepsis – Complete removal of micro-organisms and their spores from the surface of an object

Therapeutic phlebotomy – A form of phlebotomy prescribed as treatment for patients with polycythemia vera (high red blood cells) or hemochromatosis (high iron count)

Thrombotic – Containing blood clots

Thrombosed – Closed

Timed specimen – Collected over predetermined period to obtain more specific information; such specimens are sometimes collected 2hr after a meal to test for diabetes

Tortuous – Twisted

Urine – The fluid secreted by the kidneys, transported by the ureters, stored in the bladder, and voided through the urethra

Urinary catheter – A tube inserted into the bladder to drain urine from the body

Varicella – A viral infection that causes a bister-like rash, itching, fatigue, and fever (chickenpox)

Virus – A micro-organism that causes infections and diseases

ORDER OF DRAW

Blood Culture bottles or yellow tube stopper: blood culture bottles come in sets of aerobic and anaerobic. The aerobic tube is collected first when the blood collection is performed with a butterfly needle. The yellow stopper tube contains the additive SPS. Both are used to perform bacterial studies, but they are very rarely used together.

Light Blue: the light blue stopper tube contains the additive sodium citrate and is used to perform blood collection for coagulation tests (PT, PTT, PT/INR, or PROTINE). Light blue tubes must be filled 100%.

Serum tubes: The tube stopper can red (plain red top), gold, speckled red (tiger top) and gray, or red and black. Some serum tubes contain no additive, and some contain a clot activator. Serum tubes must be allowed to clot for 30 min. prior to centrifugation. Serum tubes are used to perform chemistry blood collections (CMP, BMP, Hepatic, Lipids, etc.)

Rapid serum tubes (RST): The tube stopper is orange. When a stat blood collection is required, an orange serum tube may be used. RST tubes only need to clot 5 min.

Green: Green stopper tubes contain the additive heparin: either lithium heparin or sodium heparin (both are anticoagulants that prevent clotting).

Lavender or purple: Lavender or purple stopper tubes contain the additive EDTA and are used for hematology tests. (CBC, Hemoglobin A1C, Platelet counts, Red Blood Cell, etc.)

Pink: Pink stopper tubes contain EDTA and are used for blood bank collections.

Gray: Gray stopper tubes contain the additives sodium fluoride and potassium oxalate and are used for glucose, lactic acid, and alcohol blood collections.

Light Yellow: The light-yellow stopper tubes contain acid citrate dextrose (ACD) and are used for blood collections such as DNA.

Royal or dark blue: The dark blue stoppers do not indicate the additive contained in the tube, but that the tube is as free of element contamination as possible (lead testing, trace element testing, etc.). Royal blue stopper tubes can contain EDTA, sodium citrate, or

heparin, or be serum tubes. The label on the tube indicates which additive is contained in the tube.

***Several questions over the order of draw, tube additives, and tests.**

****Silica helps promote clot formation and can be used in some serum tubes**

*****Different manufacturers' ETS tubes can vary slightly in tint. When in doubt about what the tube contains, read the label to determine which additives are in the tube. When a serum tube contains a gel separator, it is called a serum separator tube (SST). When a plasma tube contains a gel separator, it is called a plasma separator tube (PST). Some facilities can routinely order special testing that requires additional (different additive tubes) to be used.**

BLOOD COMPONENTS

Blood is a living tissue containing various cells and substances. It circulates through the heart, arteries, vein, and capillaries carrying nourishment, vitamins, electrolytes, hormones, antibodies, warmth, and oxygen to the body's tissues. Blood also transports wastes and carbon dioxide to organs that can excrete them from the body.

Electrolyte - a chemical substance that develops an electrical charge and can conduct an electrical current when placed in water.

Hormone - a chemical a cell produces that affects the functions of other cells.

Antibody - a type of protein the immune system produces to neutralize a threat of some kind.

Excrete - eliminate.

Fibrinogen - a plasma protein that converts into fibrin to form a clot during bleeding.

Blood Group Systems

Each person has one of four blood types in the ABO system- A, B, AB, or O- and one of two designations in the Rhesus (Rh) system- Rh positive or Rh-negative. The presence or absence of the A and antigens determines the type.

- Type A blood has the A antigen
- Type B has the B antigen
- Type AB has both antigens
- Type O has neither antigen

Furthermore, type A plasma contains anti-B antibodies, type B plasma contains anti-A antibodies, type AB contains no antibodies, and plasma contains no antibodies, and type O contains both antibodies. People who are Rh-positive have the antigen for the Rh factor; Rh-negative people do not. Rh-negative individuals may donate to Rh-positive recipients but should only receive Rh-negative blood.

In an emergency, anyone can receive type O blood, and type AB individuals can receive blood of any type. Therefore, people who have type O blood are universal donors, and those who have type AB blood are universal recipients. In addition, AB donors can give plasma for all blood types. Type P is the most common ABO type, with type A a little less common, type B a lot less common, and type A the rarest.

Blood Bank

Blood banking refers to the process of collecting, separating, and storing blood. Donor blood is stored for future use to patients that may need a blood transfusion. It is important for patients to receive the right blood type. Only in emergency situation should a patient receive universal blood.

BLOOD COLLECTING

Things to remember when collecting:

- When drawing from infants, 2.5 ml is the maximum volume at one time.
- If the patient has done any strenuous activity before getting blood drawn have the patient rest for 15 minutes before the venipuncture, because strenuous activity affects coagulation.
- When a patient has veins that are hard to palpate, lower the arm 1 to 2 minutes to increase blood flow.
- When warming the antecubital area encase the arm in a warm towel for 1 to 2 minutes.
- Warm the heel of an infant to avoid hemolysis
- When using a blood pressure cuff for a tourniquet, pump the cuff up to 40 mm/hg

- Tourniquet should be placed 3-4 inches above the venipuncture site (approx. 3-4 fingers width)
- Non-powdered nitrile presents the lowest allergy risk
- Microbiological blood specimen same as blood cultures
- When positioning the arm it should be distal portion of the arm in a downward position
- Use soap and water when collecting for blood alcohol
- Check both arms for access to the median cubital vein
- Chlorhexidine gluconate swab can be used for blood cultures
- Must document which arm or hand that blood cultures were collected from
- Seek physician's approval before collecting on the side of a mastectomy
- Evacuated tube system is the same as a vacutainer
- Figure eight motion is acceptable for inverting tubes

Things to remember during capillary draws

- Lancet should be perpendicular to the fingerprint grooves when doing a capillary draw
- Cleanse the site after selecting the appropriate finger

SPECIMEN HANDLING

Semen (seminal fluid) (will be referred to as seminal fluid on the NHA exam)

- Should be transported at 36 to 38 degree Celsius
- Should be transported back to lab within 2 hours
- Protected from bright light

Vitamin B6

- Protect from light

Blood Culture collections

- Anaerobic bottle must be collected first
- Aerobic bottle collected second

Glucose and Albumin specimens

- Fast for 8 to 12 hours before the collection

Thyroid testing

- Should be drawn in a SST (serum separator tube) this includes tiger top (referred to as speckled top).

Sedrate

- Can be drawn in a lavender top to although it will be transferred to a black sodium citrate tube

Fecal Occult Blood

- Have patient avoid taking Ibuprofen this could cause a false positive

Acetaminophen (Tylenol)

- Can affect the liver

Chromosome analysis

- Collect in a green top tube containing heparin

Peripheral Smears

- Review how to make peripheral smears. This will show up on the exam. Remember to hold glass at a 30-degree angle to make a feathered edge.

GGT (glucose tolerance test)

- Document the time the glucose load or solution was finished

Always document the source of a non-blood specimen. Example: Urine, semen, sputum or stool. These are all collected in the same type of non-sterile container (this may be on the NHA exam)

PEAK AND TROUGH LEVELS

The peak level is the highest concentration of a drug in the patient's bloodstream. Peak levels should be drawn 1 to 2 hours after patient has received a dose of medication. Could be longer depending on the medication.

Trough level is the lowest concentration of a drug in the patient's bloodstream. Trough levels should be drawn 15 to 30 minutes before the next dose of medication is given.

Lithium is a drug used for many different conditions. Phlebotomists often must draw blood for therapeutic levels. The results on the test are affected by what time the drug was taken. You should always check with the patient on when they took their last dose and document. If it is an inpatient check with the nurse.

Cortisol is often called the "stress hormone" because of its connection to the stress response, however, cortisol is much more than just a hormone released during stress.

Cortisol is one of the steroid hormones and is made in the adrenal glands. Most cells within the body have cortisol receptors. Secretion of the hormone is controlled by the hypothalamus, the pituitary gland, and the adrenal gland, a combination gland often referred to as the HPA axis.

*Peak level of Cortisol should be draw around 8:00 am. Trough level or low level should be drawn around 4:00 pm. ****NHA may question you on this!***

REFERENCE RANGES AND CRITICAL VALUES

A **reference range** is a set of **values** that includes upper and lower limits of a **lab test** based on a group of otherwise healthy people.

The following **test values**, defined when **lab** results fall outside an expected range, may pose an immediate health risk and require immediate attention.

References ranges examples:

Troponin T: 0.00 to 0.02 ng (Nano grams)

Cholesterol: 140-200 mg/dL

Glucose: 90 to 110

White blood cell count (WBC): 4.3 - 10.8 x 10⁹ cells per liter

Platelet count: 150,000 to 450,000

Sodium levels: 135 to 145

Potassium normal: 3.5-5.0

** Lab result reports include:

- Patient's name
- Patient's identification number
- Name of the person receiving the report
- Date and time
- Detailed result information
- Origination of the report or results

Urine reagent testing (urine dipstick)

In some settings, phlebotomists perform point-of-care urine testing using reagent strips.

Urine reagent testing is a CLIA-waived test. This involves placing a chemically treated strip into a urine sample.

Most reagent strips provide information about pH, specific gravity, white blood cells, hemoglobin, ketones, bilirubin, protein, nitrites, and glucose (depending on the type and strip used.)

- **pH** can range from 4.6 to 8.0 and the normal range for a urine specimen is between 5.5 and 8.0. This is important when examining urine for bacterial growth because bacteria grow more easily in an alkaline environment than in an acidic environment. (Samples left concentrates urine. Highly concentrated urine can be an indicator of dehydration.)
- **Specific gravity** is an indicator of the concentration of the urine. The expected range for urine specific gravity is 1.003 to 1.030, but it is usually 1.010 to 1.025. A specific gravity below 1.010 indicates diluted urine. A specific gravity above 1.010 indicates concentrated urine. Highly concentrated urine can be an indicator of dehydration.
- **White blood cells and nitrites** indicates infection.
- **Hemoglobin** can indicate bleeding, infection, cancer, kidney disease, chemical poisoning, and other pathology.
- **Ketones** are products of fat metabolism. Their presence in urine can result from diabetes mellitus, starvation, or vomiting.
- **Bilirubin** indicate liver disease or red blood cell destruction.
- **Protein** can indicate inflammation, infection, kidney disease, or chemical poisoning.
- **Glucose** can indicate diabetes mellitus.
- All other components of the urine reagent test strip should be negative in a random urine sample.

Urine reagent test strips are screening tools. Further laboratory analysis is usually necessary to confirm any unusual findings on a urine reagent test.

Urine Drug Screen Collection * (may be several questions about drug screen collections) *****

Urine drug screen collection must have a chain of custody form. This helps provide a chain of personnel that has handled the specimen. Things to be aware of when collecting urine drug screens:

- Urine should be collected in a sterilized specimen cup with a temperature strip. Temperature strips are located on the outside of the container.
- Specimen temperature range should be between 90- and 100-degrees Fahrenheit
- Must collect at 45 ml of urine for a drug screen
- Read the temperature strip within **four** minutes

OPERATIONAL STANDARDS

The Joint Commission

The Joint Commission accredits and certifies thousands of health care organizations in the U.S. As an independent, nongovernmental, nonprofit organization. Its operational standards focus on continual improvement of patient safety and quality of care. The Joint commission updates the continual improvement. The National Patient Safety Goals (NPSGs) program increases patient safety by setting requirements for issues including accurate identification, communication of test results, and necessary training of health care professions. The NPSGs require validating patient identification using a two-factor method. For example, confirm identification by matching the wristband to the medical record, and asking patients for their telephone number, home address, or date of birth. Always ask patients to state their name, then compare that the name on the wristband or laboratory requisition form. To ensure test results are reported as quickly as possible. NPSGs emphasize the need for active communication between the health care professional performing the test and the provider ordering it. Ongoing personnel training in safety and infection control through proper hand hygiene and use of disinfectants adds on additional layer of safety.

OSHA and NIOSH (National Institute for Occupational Safety and Health) this organization oversees:

- Implement the use of devices with safety features and evaluate their use to determine which are most effective and acceptable.
- Helps with prevention of needlestick injuries
- Modify work practices that pose a needlestick injury hazard to make them safer
- Promote safety awareness in the work environment
- Use devices with safety features provided by the employer
- Do not recap needles
- Plan for safety handling and disposal before beginning any procedure using needles.
- Report all needlestick and other sharps-related injuries promptly to ensure that employees receive appropriate follow-up care.

Exposure Control and Documenting (may be several questions regarding this on the NHA exam)

For the accidental exposure log, OSHA requires the following information.

- How the exposure happened

- By what means it occurred (splash into an eye, needlestick)
- Type of equipment involved
- Safety measure on the equipment
- Type of PPE the phlebotomist was using
- Where the incident occurred
- Situation surrounding, the exposure

If the incident involves an accidental needlestick or an injury from any other sharp instrument (lancet, broken capillary tube), make an entry in the Sharps Injury Log, including the following:

- Date the event happened
- Type of equipment involved and the brand name
- Where the exposure took place, such as the workplace's department
- Brief description of how the exposure occurred

If you should be exposed to any chemical refer to the SDS or the safety data sheet. Chemical manufacturers supply Safety Data Sheet for their chemicals. Each SDS bears a hazard warning label and vital information about each chemical, includes the chemical's name, trade names, and synonyms; the manufacturer's name, address and emergency telephone numbers; information about handling and storage; and actions to take in case of accidental exposure. This is under the **chemical category**.

Clinical and Laboratory Standards Institute (CLSI)

CLSI is committed to providing high-quality care for patients by developing standards and guidelines to help labs achieve accreditation. To help organizations achieve the standards the CLSI works in coordination with industry and health care professionals to ensure they have most up-to-date information and use the safest methods of performing blood tests.

Example of an NHA question: Which of the following should a phlebotomist recognize as being a component of CLSI? Quality efficiency measures

The Center for Disease Control (CDC)

The CDC is a government agency that helps identify and educate about infections, illnesses and disease prevention. The CDC attempts to identify new diseases and work quickly to find ways to prevent their spread. It recommends standard precautions with any procedure that could result in an exposure to body fluids. The CDC only makes suggestions and OSHA mandates the suggestion.

INFECTION CONTROL***Cycle of Infection***

Transmitting a pathogen requires connecting the six links in the chain or cycle of infection.

- Infectious agent
- Reservoir
- Portal of exit
- Mode of transmission
- Portal of entry
- Susceptible host

The cycle begins with a pathogen or infectious agent that is capable of causing disease (*virus, bacterium, fungus, protozoon* delivery). An environment that supports the survival of these pathogens is a reservoir. In a clinical setting, the reservoir is often the patient, but it can also be an object such as a piece of medical equipment. The human body makes an ideal reservoir for microbial growth because of the presence of nutrients, moisture, and an ideal temperature and *pH*. The portal of exit is the passageway the pathogen uses to exit the reservoir. Portals of exit can occur through the respiratory, gastrointestinal, or urinary tract; mucous membranes; or nonintact skin. Effective infection control means breaking this chain, thus preventing the continuation of the cycle.

We use Standard Precautions (**may be on the NHA exam**)

Virus - a micro-organism that causes infections and diseases.

Bacterium - a single-cell micro-organism that reproduces rapidly and causes many infections.

Fungus - a mirco-organism that grows on or in animals, plants, humans, and food, including yeasts and molds.

Protozoon- a single-cell parasite that replicates rapidly once inside a living host.

pH - a measure of the acidity or alkalinity of a substance, with a low pH indicating acidity and a high pH indicating alkalinity

Mucous membrane - The moist inner lining of tubular structures including the mouth, esophagus, stomach and intestines.

*Please note the changes of six links in the chain of infection instead of three.

** Please add to your list of infections **diphtheria**. Diphtheria is a serious infection of the nose and throat. When caring for a patient with diphtheria make sure to use contact precautions.

Per mucosal - a path of entry via the mucous membranes (Examples: Mucus membranes)

Vector - an organism (such as an insect) that transmits a pathogen (Example: Mosquito)

Percutaneous - made, done, or effected through the skin (Example: Needlestick)

**** Using face shields are preventing exposure of the permucosal (mucus membranes) transmission. This may be on the NHA exam!!!**

Medical and Surgical Asepsis

Medical asepsis consists of removing micro-organisms after they leave the body. The goal of medical asepsis is to reduce the number of micro-organisms, prohibit growth, and prevent transmission. Hand hygiene is an essential medical septic technique. This type of asepsis does not eliminate pathogens, but it greatly reduces their numbers and ability to multiply and cause infections.

- Apply antiseptic to the puncture sites prior to venipuncture and allow to dry 30-60 to let the antiseptic do its job!!!!

Surgical asepsis is mandatory for invasive procedures and when there is a penetration of the patient's skin or mucous membranes. The goal is to eliminate micro-organisms and prevent them from entering the body. Surgical asepsis involves sterile gloves, supplies, and equipment; gowns and drapes. Antiseptic skin preparation is mandatory with surgical aseptic technique prior to puncturing a patient's skin.

Safety precautions:

- To clean up a blood spill use 1:10 ratio of sodium hypochlorite (bleach)
- Post exposure prophylaxis (PEP) is the steps taken after an exposure
- National Fire protection Association (NFPA) 704 marketing system, a health hazard is signified by blue.

- When ID a patient check both the wrist and ankles for an ID band in a hospital setting

CPR AND FIRST AID

Every phlebotomist is responsible for safeguard the well-being and welfare of the patients in their care. At times, this responsibility extends to performing basic first aid. IT is important to be able to recognize potential problems with patients and know what to do in case of an emergency. In all situations, remain calm. Maintaining composure and remembering what to do in an emergency can be the most important step in keeping an emergency from becoming a disaster.

IF a patient loses consciousness during a blood collection or begins to show signs of syncope, the patient unresponsive patients can hear but are not able to respond. With most cases of syncope, the patient is recovers quickly. Nevertheless, note how long the patient was unconscious. Never leave the patient alone until they recover fully. Do not give the patient anything to eat or drink right away, to reduce the risk of choking. You may place a cold cloth on the back of the patient's neck o wrists. If the patient is unresponsive for an extended period, call for medical help or emergency services. Stay with the patient until help has arrived.

When a patient in an inpatient setting is not breathing, note the exact time of collapse or when you found the patient in this condition. Immediately call for assistance from the nursing or medical staff. Do not leave the patient alone until help arrives. If the patient is not breathing and you are unaware to the patient's wishes for resuscitation or the patient does not have do-not-resuscitate (DNR) order. Initiate first aid, including cardiopulmonary resuscitation (CPR). For adults, the American Heart Association (AHA) recommends "CAB", meaning that chest compressions are the priority, then airway assessment, and the rescue breathing.

For adults, follow these steps to maintain basic life support.

- Activate the emergency response system by calling 911 or the local emergency number or have someone else do so.
- Find of defibrillator and follow the instructions on the device. (Office defibrillators are portable and use either batteries or standard 110-volt current.)

- Begin CPR by placing the heel of one hand on the patient's sternum between the nipples and placing the other hand over the first, interlacing the fingers. Give chest compressions at a rate of 100 to 120 per minute, at least 3.8 to 5 cm (1.5 to 2 in) in depth. Allow the chest to fully recoil between compressions. After 30 compressions, provide two rescue breaths and continue until the patient regains consciousness or the EMS arrives.
- If the patient responds, place them in the recovery position (on their side), monitoring their breathing, until a nursing, medical, or emergency medical services (EMS) professional takes over.

Chest compressions provide adequate blood circulation to the brain. Faster compressions (of adequate depth) result in a higher survival rate than slower, shallower compressions. Compressions create an increase in intrathoracic pressure, which then results in blood flow to the brain and other organs.

The efficiency, speed, and proper application of CPR directly affect its success. For a patient who is unconscious, it is important to determine the state of ventilation and circulation quickly. Irreversible brain damage or death can result from a lack of oxygen that lasts for more than 4 to 6 min.

For children or infants, the AHA recommends checking the patient for unconsciousness by tapping the patient and loudly asking "Are you all right?" When an infant or child is unresponsive, have someone call emergency services while beginning CPR. If there is no one else who can call for help, perform five sets of 30 compressions to two breaths, and then call emergency services. Steps for infant and child CPR include the following.

- Provide compressions

For a child, place one hand on top of the other, interlacing the fingers and pressing down 5cm (2in) on the center of the child's chest 30 times, aiming for rate of 100 to 120 compressions per minute.

For an infant, use two fingers to provide 30 quick compressions on the center of the chest, 3.8 cm (1.5 in) deep, aiming at 100 to 120 compressions per minute.

- Provide rescue breaths

For a child, pinch the nose, cover the entire mouth with your mouth, and give two breaths.

For an infant, cover the nose and mouth, and give two breaths. Be careful not to overinflate.

- Follow the same sequence of compressions-to-ventilations until the patient recovers or the EMS arrives.
- When an AED arrives for a child, turn it on and follow the prompts.

Keep in mind that CPR instructions change, so it is important to keep up to date on current advances in providing this lifesaving procedure. It is important for all health care staff to keep certifications up to date when working in the health care field.

Symptoms of shock often start with cold, clammy skin; blurry vision; and a rapid, weak pulse. For shock, call for help immediately. Remain with the patient until help arrives. Put the patient in the shock position, which involves the patient lying flat with the legs elevated approximately 12in. Keep the patient warm and loosen any tight clothing. **(may be asked about symptoms of shock)**

*****If a patient is found motionless and cyanotic (blue): Look, listen, and feel for breathing movements (may be asked on the NHA exam)**

REFERENCES

Garza, D., and Becan-McBride, K. (2013) *Phlebotomy Simplified, 2nd Edition*. Houston, TX: Pearson

National Healthcareer Association (2012) *Certified Phlebotomy Technician (CPT) Study Guide*. Leawood, KS: Assessment Technologies Institute, LLC

