MUSC Health
LABORATORY SERVICES

165 Ashley Ave., Room 318
Charleston, SC 29425 Phone
(843) 792-0707
Fax (843) 792-4896

Phlebotomy Guidelines and Order of Draw

Specimen Collection Procedures

The purpose of the document is to share the standard criteria for venous blood collection for medical laboratory testing.

Proper specimen collection and handling is a critical part of obtaining a valid laboratory result. Specimens must be collected in the appropriate collection container, kit or device, correctly labeled and transported promptly to the laboratory. Staff responsible for sample collection should follow essential safeguards to ensure accurate testing and to provide quality patient care.

1. Always check patient identification band and compare to the name on the requisition and the specimen labels. Label specimens immediately following collection. Labels must be rechecked before sending to the lab.
2. Deliver specimens to the laboratory as soon after collection as possible. Certain analytes are unstable and testing should occur as soon after collection as possible to insure valid measurements.
3. Special Collection Procedures: ○ When obtaining a blood specimen from a catheter, the components of the blood collection system (catheter, luer lock, syringe, needle, and collection device) should be checked to ensure compatibility to avoid air leaks which may cause hemolysis and incorrect draw volumes. ○ Collection of the blood through lines that have been previously flushed with heparin should be avoided, if possible.
    - ○ If the blood must be drawn through an indwelling catheter, possible heparin contamination and specimen dilution should be considered. The line should be flushed with 5 ml of saline and the first 5 ml of blood or six dead space volumes of the catheter discarded.

Order of Draw

The order of draw is recommended for both glass and plastic venous collections tubes when drawing multiple specimens for medical laboratory testing during a single venipuncture. The purpose is to avoid possible test result error due to additive carryover. All additive tubes should be filled to their stated volumes. Tubes with anticoagulant clot activator must be gently inverted 10 times end to end to prevent clotting.

****Note** Clot Activator Tubes** Plastic serum tubes containing clot activator may cause interference in coagulation testing. Only blood culture tubes, glass non-additive serum tubes, or plastic serum tubes without clot activator may be collected before the coagulation tube.

The order of draw is the same for specimens collected by syringe, tube holder, or into tubes preevacuated at the time of the collection.
Depending on the tube types to be collected, begin from the top of the list and work down in order that the tubes are listed.

- **SPS Blood Cultures** pediatric) - Blood Culture bottles (aerobic, anaerobic, and
- **Sodium Citrate Blue** - When using a winged blood collection set and the first tube to be drawn is a coagulation tube, a discard tube must be drawn first. The discard tube must be a non-additive, no clot activator, or a coagulation tube. **NO** clot activator or additive tubes should be drawn *before* coagulation studies.
- **Serum tubes** - With or without clot activator, with or without gel, (Red, Gold, Speckle-top, dark blue trace element
- **Sodium or Lithium Heparin** - Green (with or without gel plasma separator)
- **EDTA** - Lavender, Pink, Purple, Dark blue trace element w/EDTA, PPT (white)
- **Gray (Glycolytic inhibitor)** - Sodium Fluoride, Potassium Oxalate
- **Yellow Sodium Citrate** - Yellow ACD (acid citrate dextrose)
- **Quantiferon TB Gold Kit** - Collect the 3 tubes in the following order: Grey, Red, Purple. Follow collection instructions on kit label

Guidelines for Drawing Blood and Best Practices in Phlebotomy

Factors that increase the risk of hemolysis include:

- Use of a needle of too small a gauge (23 or under), or too large a gauge for the vessel; If the needle is too large for the vein for which it is intended, it will tear the vein and cause bleeding (hematoma); if the needle is too small, it will damage the blood cells during sampling, and laboratory tests that require whole blood cells, or hemoglobin and free plasma, will be invalid
- Jostling and jarring of tubes in transit can lyse or break open red cells
- Pressing the syringe plunger to force the blood into a tube, thus increasing the shear force on the red blood cells
- Drawing blood specimens from an intravenous or central line
- Under-filling a tube so that the ratio of anticoagulant to blood is greater than 1:9
- Reusing tubes that have been refilled by hand with inappropriate amounts of anticoagulants
- Mixing a tube too vigorously
- Failing to let alcohol or disinfectant dry
- Using too great a vacuum; for example, using too large a tube for a pediatric patient, or using too large a syringe (10–20 ml)
- Leaving tourniquet on for greater than one minute

Recommendation on blood-sampling equipment:
Safety-engineered evacuated tube systems or winged needle sets are safer than a hypodermic needle and syringe, but all are effective for blood sampling. Safety features (e.g. needle covers, needleless transfer systems or adaptors, and retractable lancets) can further reduce the risks associated with manual recapping, needle removal, disassembly and transfer of blood from syringes to tubes.

- A needle and syringe is the most common tool for withdrawing large quantities of blood.
- A sterile single-use needle and syringe should be used for each patient, and should be placed, as a single unit, into a sharps container immediately after use.
- Safety-engineered equipment offers better protection to the health worker, but should be appropriate for the specific task. Capillary punctures should be performed using a sterile device – preferably with safety features that automatically retract the lancet – to help prevent both reuse and sharps

Safety devices and best practice:
To avoid blood exposure, safety-engineered devices are available for the transfer of blood to reduce exposure to blood and injuries. Use of blood transfer devices is preferred.

Closed systems for blood sampling are preferable because and have been proven to be safer than open systems

- When obtaining multiple tubes of blood, use evacuated tubes with a needle and tube holder. This system allows the tubes to be filled directly. If this system is not available, use a syringe or winged needle set instead.
- If a syringe or winged needle set is used, use of transfer device is the preferred method to transfer blood from the winged needle or syringe into vacutainer(s).
- If the unlikely event that a transfer device is not available, best practice is to place the tube into a rack before filling the tube. To prevent needle-sticks, use one hand to fill the tube or use a needle shield between the needle and the hand holding the tube.
- Pierce the stopper on the tube with the needle directly above the tube using slow, steady pressure. Do not press the syringe plunger because additional pressure increases the risk of hemolysis.
- Where possible, keep the tubes in a rack and move the rack towards you. Inject downwards into the appropriate colored stopper. DO NOT remove the stopper because it will release the vacuum.
- If the sample tube does not have a rubber stopper, inject extremely slowly into the tube as minimizing the pressure and velocity used to transfer the specimen reduces the risk of hemolysis. DO NOT recap and remove the needle.
- Before dispatch, invert the tubes containing additives for the required number of times

References
CLSI. *Clinical and Laboratory Standards Institute*. 7th ed. CLSI standard GP 41. Wayne, PA: Clinical and Laboratory Standards Institute; 2017.

CLSI. *Clinical and Laboratory Standards Institute*. CLSI standard. Wayne, PA: Clinical and Laboratory Standards Institute; 2007.

World Health Organization. (2010). *WHO guidelines on drawing blood: best practices in phlebotomy.*Retrieved from http://whqlibdoc.who.int/publications/2010/9789241599221_eng.pdf
Rev. 9/2017