

## Collection of Specimens for Laboratory and Point of Care Testing

### PRINCIPLE:

The correct identification of patients and specimens are two of the most important steps in the specimen collection procedure. Specimens for laboratory testing will be collected in a safe, timely and appropriate manner. See also, individual tests listed in the laboratory test catalog.

### PROCEDURE:

1. Identifying the patient:  
The person collecting the specimen must first verify the correct patient is being collected for the test requested. Two separate, unique identifiers are required to verify the correct patient is being collected. Acceptable identifiers are the patient's first and last name, the medical record number or the date of birth. At least two of these unique identifiers are checked with each of the laboratory labels and the patient's armband before the specimen is collected. The patient's identity should be verified by asking the patient to identify him or herself, when it is practical to do so. For example, verbal verification is not necessary if obtaining the services of a translator would delay the specimen or if the patient is unable to speak.
2. Labeling the specimen: All specimens must be properly legibly labeled in the presence of the patient with, at minimum, the Patient's First and Last Name (or Trauma identifier) and Medical Record Number (or Date of Birth). See also *Specimen Labeling & Acceptance/Rejection Criteria*.
3. Specimen Collection Supplies:  
Specimen collection supplies such as blood collection tubes and collection devices (e.g. heel lancets, culture swabs, and transport media) are used within their expiration date. All supplies are used and stored per manufacturer's instructions.
4. Unclear Test Order:  
All specimens should be submitted with a paper or electronic order. Any unclear order will be confirmed with lab and requesting unit personnel.
5. Capillary Tubes:  
Samples collected in capillary tubes for microhematocrits or capillary/dilution systems are obtained in duplicate whenever possible.
6. Needle Removal  
The collecting unit is responsible for removing the needle from any collection device prior to submitting the specimen to the laboratory for testing.

## LABORATORY RECOMMENDED SPECIMEN COLLECTION PROCEDURES:

### 1. Venipuncture

- ❖ The concentration of intravenous (IV) fluid and additives in IV therapy can contribute to unreliable values in certain tests. Therefore it is important to follow the guidelines below when a patient is receiving any kind of IV fluids.
  - Draw from the opposite arm of the IV
  - If only the arm with the IV line is available or if both arms have IV's, select a site distal to (BELOW) the IV line by at least 3 inches. Do not use the same vein. Do not use an edematous area. (You can usually identify edema when you palpate the skin and your finger pressure leaves a slight indentation).
  - If neither of the sites listed above are possible to obtain blood from, and the phlebotomist has to draw above an IV site, the phlebotomist has the doctor or nurse turn off the IV for 2-5 minutes. This is only done in extreme situations. Turning off the IV will allow the body's circulation to transport and mix the IV fluid with the blood. Dispose of the first few cubic centimeters of blood, which may be diluted and contaminated with IV fluids.
    - Note: Laboratory Staff is NEVER allowed to shut an IV off, this must be done by an RN or the Physician,
      - Always footnote any draw that has been done from the same arm as the IV is running in.
  - If you are drawing a Coagulation Specimen (ie: pt, ptt, not including Heparin Unfractionated) please do the following:
    - If drawing above the IV site you will have the RN shut the IV pump off for 5 minutes. Draw the patient promptly at the 5 minute mark.
    - If you are drawing below the IV site you will need to shut the IV pump off for 2 minutes. Draw the patient at the 2 minute mark discarding the first tube, then draw the additional tubes that need to be collected.
    - If the RN is drawing through the line that has been flushed with heparin or an anticoagulant is running in the line, 20ml must be wasted. This is to ensure the line is not contaminated with an anticoagulant.
  - If you are drawing a Heparin Unfractionated:
    - If drawing from the same arm that the IV is in the IV must be turned off for 10 minutes.
    - Waste an extra blue top tube before drawing the tube to be used for testing.
    - If drawing from the arm opposite the IV there is no need to turn off the IV.
- ❖ When the specimen is obtained, the phlebotomist lets the doctor or nurse know the task is complete so IV therapy can continue.

### Equipment

1. Clean Gloves
2. Alcohol swabs or Chlorhexidine swabs
3. Sterile 2x2 gauze pads
4. Appropriate size butterfly or needle and syringe
5. Vacutainer
6. Blood transfer device
7. Tourniquet (optional)
8. Blood culture bottle/appropriate lab collection containers
9. Patient Lab label
10. Bandage

<i>Venipuncture Steps</i>	
A.	Verify order and ID patient to determine type of lab test to be drawn.
B.	Gather equipment, wash hands and don gloves.
C.	Explain procedure to patient and family in developmentally appropriate terms.
D.	<p>Properly position the patient. Make sure there is nothing in the patient's mouth.  <b>Never</b> do a venipuncture on a patient who is standing.</p> <ul style="list-style-type: none"> <li>❖ <b>Inpatient:</b> Have patients in a supine position. If they are sitting in a chair it is permissible to let them stay in the chair. Add support under the arm with a pillow if needed. Extend the arm so as to form a straight line from the shoulder to the wrist.</li> <li>❖ <b>Outpatient:</b> The patient should be comfortably seated in a venipuncture chair or recliner. The arm will be positioned on a slanting armrest in a straight line from the shoulder to the wrist. Make sure the arm is not bent at the elbow.</li> </ul>
E.	<p>Prepare your equipment. Assemble your evacuated tube(s), barrel and needle or syringe and needle, gauze, paper adhesive pressure strips, and 70% alcohol prep before you apply the tourniquet.</p> <ol style="list-style-type: none"> <li>a. Recheck the label(s) or requisition for tube and specimen verification requirements.</li> <li>b. Select the proper size needle based on the size of the vein.</li> </ol>
F.	<p>Select appropriate site for venipuncture. <b>Do not draw blood above an intravenous infusion, on the same side as a mastectomy or when a purple armband is present unless there is a written order by the physician.</b></p> <p><b>Appropriate site locations include:</b></p> <ul style="list-style-type: none"> <li>• Medial cubital, cephalic, and basilic veins</li> <li>• Wrist (lateral side)</li> <li>• Hand (dorsal side)</li> <li>• Ankle/foot veins are used in extreme situations and only with a written Physician order.</li> </ul> <p>Note: The first choice is typically the one that passes through the center of the antecubital area – the Medial vein. Even if you see the vein palpate it so you can be certain of location and direction. A vein feels much like an elastic tube and</p>

### ***Venipuncture Steps***

“gives” under pressure. Veins also do not pulsate as arteries do. If you have difficulties finding a vein do the following:

- The medial veins will be assessed before another vein is considered.
- In the absence of a visible or palpable medial vein, the cephalic vein which passes through the outer or later aspect of the antecubital area will be considered.
- Punctures to the basilic vein which transverses the inside or medial aspect of the antecubital area will be considered only if the vein is visible or palpable and the phlebotomist has a high degree of confidence in accessing the vein.

Note: Because of its close proximity to the brachial artery and tracts of the medial Antebrachial cutaneous nerve, poor technique and or blind probing to access this vein puts the patient at great risk for an injury.

**Factors that need to be considered include:**

- Extensive scarring or burns
- Mastectomy – It is acceptable to collect specimens from the arm on the same side as a mastectomy, unless there is edema of the arm and if collection from the contra lateral arm is not possible.
- Hematoma – avoid hematoma sites
- Fistulas – avoid the arm that has an active fistula in place for dialysis
- Purple armbands – Avoid any arm that has a purple armband on it. In the case that both arms have a purple armband – ask the patient’s nurse to contact the physician for instructions on specimen collection.
- Thrombosed veins
- Edematous arms

**G. Venipuncture procedure:**

- a. Wipe the skin with 70% alcohol. Allow the site to air-dry.
- b. Insert the appropriate needle onto the syringe or thread the needle into the vacutainer holder.
- c. If an evacuated tube is used, insert the tube into the holder and onto the needle up to the recessed guide line. Do not push past this line because it will cause a loss of vacuum.
- d. The needle should be at approximately a 15 – 30 degree angle to the patient’s arm and in a direct line with the vein. Punctures at an angle greater than 30 degrees will possible allow the needle to pass through the other side of the vein.
- e. Turn the needle so that the bevel is in an upward position.
- f. Puncture the vein. The puncture of the skin and vein should be done in one motion.
- g. If a syringe is used care must be taken not to pull on the plunger too rapidly or forcefully. If an evacuated tube is used, as soon as the needle enters the vein push the tube as far as it will go.
- h. Steady the needle holder so that the needle is not inadvertently removed from the vein. If multiple samples are drawn remove the tube as soon as the blood flow stops and insert the next tube into the holder.

<i>Venipuncture Steps</i>	
<p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>❖ There is a two stick limit on all draws. If you are unable to obtain the sample in two sticks you will need to notify the patient's caregiver and assign another phlebotomist to complete the collection.</li> <li>❖ For heel sticks or venipuncture, Coban cannot be used on patient's under 18 years of age.</li> <li>❖ Most phlebotomy related injuries involve the nerves and the brachial artery. Nerve injury is the most common phlebotomy related injury that brings legal proceedings and is typically associated with one of two technical errors: Nerves provoked by poor technique or by the excessive pressure that builds up when the brachial artery is accidentally and unknowingly nicked. Phlebotomy experience and familiarity with the anatomy of the area is paramount.</li> <li>❖ If the patient has an adverse reaction to the phlebotomy contact the nurse for help by pressing the patient's nurse call button. If the adverse reaction is respiratory arrest, call a code blue.</li> </ul>	
H.	Mix Tubes with additive immediately but gently.
I.	Release the tourniquet and have the patient open his hand
J.	Remove needle from site and apply pressure with sterile 2x2. Apply bandage if needed to control bleeding.
K.	Dispose of all equipment in the appropriate designated disposal system.
L.	All specimens must be properly labeled at the patient's bedside.

## 2. Skin Puncture / Finger Stick

- Skin puncture may be used to collect blood on patients of all ages however the skin puncture technique is primarily used for adults on whom it is difficult to do a venipuncture on. There are many reasons for collecting blood by skin puncture:
  1. Some Point of Care Testing
  2. Micro volumes of blood are desirable to avoid anemia
  3. Patients whose veins must be reserved for therapy use
  4. Patients with severe burns
  5. Obese patients
  6. Those patients who have fragile veins

### **Equipment**

1. 70% alcohol prep pads
2. Dry gauze pads
3. Puncture device with tips 2.4 mm or less for newborns up to 5 mm. long
4. Heel warming device
5. Capillary tubes and/or microtainers
6. Gloves – must be worn throughout entire procedure
7. Laboratory request slips or labels
8. Bandaid

<b><i>Skin Puncture / Finger Stick Steps</i></b>	
A.	Verify order and ID patient to determine type of lab test to be drawn.
B.	Gather equipment, wash hands and don gloves.
C.	Explain procedure to patient and family in developmentally appropriate terms.
D.	<p>Select the puncture site:</p> <ul style="list-style-type: none"> <li>○ The fleshy surface of the distal portion of the second, third, or fourth finger can be used for puncture.</li> <li>○ The thumb or great toe can be used for a skin puncture in extreme circumstances.</li> <li>○ The heel of an infant should be used for a skin puncture – see related procedure.</li> </ul>
E.	Wipe the skin with 70% alcohol. Allow the site to air-dry.
F.	Using a heel warmer warm the puncture site if necessary to increase the blood flow. This warming of the site will help decrease clotting, hemolysis, and multiple skin punctures.
G.	The patient's finger should be held firmly, with the phlebotomist's thumb well away from the puncture site. The stick should be made into the pulp of the finger in one continuous motion. The finger puncture should involve a quick, deep puncture across the fingerprint, not parallel to the fingerprint.
H.	Wipe away the first drop of blood using a dry gauze pad. This will prevent contamination of the specimen with tissue fluids. Moderate pressure may be applied but do not vigorously massage the area. A gentle massage from the base to the tip of the finger is acceptable to obtain the proper blood sample.
I.	Collect the blood in the appropriate container and in the appropriate order. Take care not to make direct wound contact with the collection container or capillary tube, fill to the desired specimen volume.
J.	Gently press a dry sterile gauze pad to the incision site until bleeding has ceased. Apply a bandage after blood collection is complete.

### **3. Newborn Screening**

- Newborn screening is done to detect certain metabolic and genetic disorders. If diagnosed early, these disorders can often be treated to prevent mental retardation, physical disabilities and death. Colorado State Law requires that two Newborn Screening tests be performed on all newborns. Optimal timing for the test is 24-48 hours of life when the screening is most sensitive. The second test is collected at 8-14 days of age.
- The five circle Newborn Screen Form is to be used for the first and second Newborn Screen. The first screen is to be collected at 24 hours of life on newborn infants and before transfer to another hospital, before a blood transfusion or exchange, and before discharge. Prematurity and transfusion status will be noted on the request form in the space provided.
- The second Newborn Screen will be collected between 8 and 14 days of age and no later than 30 days of age. If an infant is discharged prior to the second Newborn Screen being completed, parents will be provided with an *information teaching*

*pamphlet* and the date that the second Newborn Screen is to be obtained. This is to be documented on the patient's medical record under discharge education.

- If Newborn Screening is refused, the parents must sign a Refusal of Treatment Form.
- Newborn Screen Collection Procedure:

#### **Equipment**

1. Sterile automated lancet device with tip less than 2.4mm
2. Alcohol prep 70% or chlorhexidine
3. Gauze pads
4. Heel warmer
5. Newborn Screen Card
6. Gloves

<b><i>Newborn Screening Steps</i></b>	
A.	Check that all necessary information on Newborn Screen Card is complete. Do not contaminate filter paper circles by allowing the circles to come in contact with spillage or by touching before or after blood collection.
B.	Wash hands before proceeding. Gloves MUST be worn during entire procedure.
C.	Confirm the identity of the infant by medical record number, name, and/or date of birth and ensure that it matches the data on the Newborn Screen Card and the Lab Label.
D.	To increase the blood flow to the puncture site, warm the site with heel warmer for three to five minutes.
E.	Wipe the skin with 70% alcohol. Allow the site to air-dry.
F.	To obtain sufficient blood flow the infant's heel should be punctured with a sterile automated lancet device, at the plantar surface on either side of the heel. NEVER use a scalpel blade to puncture the skin.
G.	Puncture heel. Wipe away first blood drop with gauze pad. Allow another large blood drop to form.
H.	Light touch filter paper to large blood drop. Allow blood to soak through and completely fill circle with single application. Do not allow filter paper to touch the baby's skin. To enhance blood flow, very gently apply intermittent pressure to the area surrounding the puncture site. Apply blood to one side of the filter paper only. Check each circle for complete absorption on the front and back of the card.
I.	Fill remaining circles in same manner as Step 8, with successive blood drops. If blood flow is diminished, repeat steps 4 through 8.
J.	Apply a bandage after blood collection is complete.
K.	Dry blood spots on the Newborn Screen Card for a minimum of four hours on the newborn screen drying rack or on flat surface, making sure the spots are kept horizontal until dry.

#### 4. Heelstick on Infants

- Heelsticks are not to be performed on patients over the age of 6 months and coban cannot be used. Refer to newborn screen section for collection of newborn screens.

##### Equipment:

1. Heel warmer
2. Chlorhexidine swabs or 70% alcohol wipes
3. 2x2 gauze
4. Automated heel incision device (appropriate size)
5. Blood collection container or capillary tube depending on test to be done
6. Patient Lab Labels
7. Clean gloves
8. Spot bandaid

<i>Heelstick on Infant Steps</i>
A. Gather equipment necessary for ordered lab and ID patient.
B. Explain procedure to family if present.
C. Wash hands and glove.
D. Position patient using developmentally supportive care.
E. Secure a heel warmer to the foot.
F. Provide Sucrose Solution if appropriate
G. Remove heel warmer. Only the lateral and medial sides of the heel may be used.
H. Using an alcohol wipe or chlorhexidine swab, clean the areas selected. Let dry for about 30 seconds.
I. Grasp foot and hold securely to collect specimen.
J. Open the automated heel incision device and remove the safety clip.
K. Secure the automated heel incision device flush to the skin. Do not push the device into the heel.
L. Depress the trigger on the automated heel incision device. Using a clean, dry 2x2 gauze pad, wipe away the first drop of blood. Do not use alcohol.
M. Do not make direct puncture wound contact with the collection container. Fill the desired specimen containers. Observe the infant for any intolerance to the procedure. Should the infant begin to decompensate, stop the procedure and allow the infant to recover.
N. Clean foot and apply pressure until bleeding stops. A bandage may be applied.
O. Dispose of device in sharps container.
P. Re-wrap infant. Make sure the infant is comfortable and stable before leaving the bedside.
Q. Label specimen(s) appropriately and send to the lab.
R. Document on the patient's medical record the test performed, the amount of blood taken for the specimen, and how the infant tolerated the procedure.



## 5. Throat and Nasopharyngeal Cultures

### Equipment

1. Culturette system appropriate for test being performed
2. Clean Gloves
3. Requisition
4. Patient Lab Labels

<i>Throat and Nasopharyngeal Cultures Steps</i>	
A.	Verify orders and ID patient. Explain procedure to patient and family in developmentally appropriate terms.
B.	Gather equipment, wash hands and don gloves.
C.	Throat Culture <ol style="list-style-type: none"> <li>a. Remove swab from tube.</li> <li>b. Take sample by rubbing the swab over the tonsil area and back of throat and return to Culturette.</li> </ol>
D.	Nasopharyngeal Culture <ol style="list-style-type: none"> <li>a. Non-intubated patient: <ol style="list-style-type: none"> <li>i. Bend appropriate swab (bacterial or viral) to conform to nasal passage. Take sample from the posterior aspect of the nasopharynx.</li> <li>ii. For bacterial, return to Culturette. For viral, place in viral transport media.</li> </ol> </li> </ol>

## 6. Stool Specimen Collection

### Equipment

1. Specimen cup
2. Wooden specimen sticks
3. Gloves
4. Plastic bag
5. Patient Lab Label

<i>Stool Specimen Collection Steps</i>	
A.	Gather equipment. ID patient. Wash hands and don gloves.
B.	Bacterial culture, viral culture, ova and parasite testing, and hemocult testing: Using wooden specimen sticks, transfer stool specimen into specimen cup.
C.	Label each specimen, double-bag and send to lab.
D.	Document specimen type and time sent to lab on patient's medical record.

## 7. Urine Specimens

- Urine specimen is obtained in order to evaluate renal function, hydration status and/or to check for infection.

### Equipment

1. Protective barrier wipe
2. Sterile Specimen Cup or sterile syringe with cap
3. Patient Lab Labels

<i>Urine Specimen Collection Steps for Female Clean Catch</i>
A. Wash hands with soap and warm water.
B. Spread the labia (folds of the skin) apart with one hand and wipe with the cleansing towelette provided. Wipe from front to back.
C. Continue holding the labia apart. As you start to urinate, allow a small amount of urine to fall into the toilet bowl. This helps to give the cleanest sample. Do not touch the inside of the cup.
D. Void into the specimen cup after they have a good stream of urine. Once the cup is at least half full, remove the cup from the urine stream and pass the remaining urine into the toilet.
E. Screw lid on tightly while not touching the inside of the cup or lid. Return the sample to a staff member, or as instructed.

<i>Urine Specimen Collection Steps for Male Clean Catch</i>
A. Wash hands with soap and warm water.
B. If uncircumcised, pull back the foreskin from the tip of the penis.
C. Wipe the end of the penis with cleansing towelette provided. As you start to urinate, allow a small amount of urine to fall into the toilet bowl. This helps to give the cleanest sample. Do not touch the inside of the cup.
D. Void into the specimen cup after they have a good stream of urine. Once the cup is at least half full, remove the cup from the urine stream and pass the remaining urine into the toilet.
E. Screw lid on tightly while not touching the inside of the cup or lid. Return the sample to a staff member, or as instructed.

## 8. Capillary Blood Gas Collection

### Equipment

1. Heparinized capillary tubes
2. Capillary caps
3. Metal insert
4. Automated heel incision device
5. Alcohol wipes/chlorhexidine
6. Sterile saline wipe
7. Plastic bag
8. Heel warmer
9. Band-Aid (optional)
10. Test tube
11. Gloves
12. Cotton balls
13. 2 x 2 gauze
14. Patient Lab Labels
15. Magnet
16. Sucrose solution

<i>Capillary Blood Gas Collection Steps</i>
A. Determine appropriate timing for procedure. Obtain and assemble equipment. ID patient.
B. Explain procedure to patient and family in developmentally supportive terms.
C. Warm the patient's foot for 5-10 minutes prior to collection using a heel warmer. In pediatric areas, fingers may be used to obtain specimen if the child is walking.
D. Wash hands and don gloves.
E. Provide comfort measures. Medicate for pain as needed or provide sucrose solution if appropriate.
F. Position extremity so that puncture site is dependent relative to the extremity.
G. Using chlorhexidine, swab clean the area selected. Let dry for 30 seconds.
H. Grasp the foot and hold securely to collect specimen.
I. Open the automated heel incision device and remove the safety clip.
J. Secure the automated heel incision device flush to the skin. Do not push the device into the heel.
K. Depress the trigger on the automated heel incision device. Using a clean, dry 2x2 gauze pad, wipe away the first drop of blood. Do not use alcohol.
L. Do not make direct puncture wound contact with the collection container. Fill two capillary tubes assuring that no air bubbles are present. After the tubes are full, seal both ends with capillary cap after inserting metal insert/FLEA. Mix the sample by using the magnet to move the metal insert up and down inside the tube.
M. Using Sharpie marker, label cap gas tubes with patient name. Test immediately at point of care or attach lab label and write time and date drawn, patient O2 flow, patient temperature. Place extra label inside pouch of lab specimen bag.
N. Observe the patient for any intolerance to the procedure. Should the patient begin to decompensate, stop the procedure and allow the patient to recover.
O. Place specimen in plastic tube, place plastic tube on ice in small bag, and send to lab. Double bag specimen per pneumatic tube policy.

P. For neonates, clean foot with a sterile saline wipe and apply pressure until bleeding stops. A bandaid may be applied.
Q. Dispose of device in sharps container. <i>The collecting unit is responsible for removing the needle from any collection device prior to submitting the specimen to the laboratory for testing.</i>
R. As appropriate, re-wrap infant. Make sure the infant is comfortable and stable before leaving the bedside. Note the vital signs and ventilator/oxygen settings as applicable.
S. Document procedure, monitor readings, results when received, patient's tolerance and amount of blood drawn.

### **Point of Care**

#### **9. Invasive Cardiology Arterial and Venous Blood Sampling for IStat and AVOX Testing Procedures to Include ACT, ABG, BMP, PT and Right Heart Catheterization Saturation Runs.**

Steps
A. Patient's identity will be confirmed using at least 2 patient identifiers prior to procedure and again during the time-out with all procedural staff to include the physician in the procedure room.
B. Either the physician will perform the blood sampling, or the Cath Lab technologist will serve as an extension of the physician during the catheterization procedures and draw samples from the sheath port and or the balloon catheter port as directed by the physician.
C. Gather any additional equipment needed for the blood sampling not already included in the standard Cath Lab pack.
D. Confirm steady state conditions to <i>ensure accurate test results</i> for <b>ABG analysis</b> and for <b>saturation runs</b> during Right Heart Catheterization procedures. Ensure the proper dosages of medication to include nitric oxide, oxygen and vasodilators are given at the appropriate times for the appropriate duration during the saturation runs
E. Maintain sterility throughout catheterization procedure and, as needed, apply additional personal protective equipment <i>to comply with standard precautions</i> .
F. Assess the status of the extremity containing the arterial or venous catheter for signs of reduced perfusion, such as blanching, mottling, and coolness. If present, immediately stop the procedure and notify the practitioner.
G. Turn the stopcock off to the patient and attach a needleless syringe to the empty port.
H. Turn the stopcock off to the distal port to allow blood to flow from the patient side port into the syringe.
I. Holding the syringe upright, slowly and gently pull back on the syringe plunger until the syringe fills with blood; this blood serves as the discard blood. If you feel resistance, reposition the affected extremity and reattempt aspiration. If you still meet resistance, stop and notify the practitioner.

J. Turn the valve or stopcock so it's perpendicular to the tubing to <i>ensure that the dead space volume remains in the reservoir.</i>
K. Withdraw the appropriate volume of blood needed for the ordered samples.
L. When you've obtained the blood samples, remove the needleless syringe and turn stopcock off to the patient.
M. Hand off blood samples to Cath Lab personnel running the samples in the AVOX or iSTAT machines as per the practitioner's orders using Lab POC protocols. Samples are to be run in the same procedure room as the catheterization is taking place.
N. Attach a syringe with flush solution to the empty port and clear the line of blood to <i>prevent clot formation.</i>
O. Testing results will be verbally reported to the physician by the personnel running the samples using the iSTAT or AVOX machine during the procedure and will also be downloaded into the patient's EPIC chart as per data transfer protocols.

## 10. VENIPUNCTURE – GENERAL

### I.V. Line

- Avoid drawing from an arm with an I.V. line. I.V. solutions will dilute the sample and may interfere with the tests.

### Tourniquet

- Venous stasis (prolonged tourniquet application) and forearm exercise may increase ionized calcium due to a decrease in pH caused by localized production of lactic acid. If a tourniquet is applied for more than one minute while looking for a vein, release and reapply after two to three minutes.
- Allow the tourniquet to remain in place until all blood is withdrawn to prevent changes in ionized calcium and pH results.

### Muscle Activity

- Avoid extra muscle activity, such as clenching and unclenching the fist, which may increase potassium results.

### Hemolysis

- Avoid hemolysis (bursting of red cells) by:
  - allowing residual alcohol to dry over the puncture site
  - discarding a sample from a traumatic draw.
- Hemolysis will cause an increase in potassium results and a decrease in calcium results. For cTnI, cartridges, gross hemolysis can also cause a decreased alkaline phosphatase activity and an increased proteolytic activity, resulting in decreased detection of cTnI.

## 11. VENIPUNCTURE - pH, PCO<sub>2</sub>, ELECTROLYTE, CHEMISTRY, AND HEMATOCRIT TESTS

### Anticoagulants

If the sample can be tested in a cartridge immediately, a plain syringe can be used. If a cartridge cannot be filled immediately the sample should be collected in a blood collection tube with sodium heparin or lithium heparin or a pre-heparinized syringe labeled for measurement of electrolytes and ionized calcium (such syringes contain balanced or low-level heparin).

### **i-STAT cTnI cartridges require the use of either:**

- heparinized whole blood collected in syringes or evacuated tubes containing lithium or sodium heparin, or
- non-heparinized whole blood samples tested within one minute of drawing from a patient into a plastic syringe or plastic evacuated tube containing no additives.

### **i-STAT CHEM8+ cartridges require the use of:**

- whole blood collected in non-heparinized capillary tubes, evacuated tubes, or syringes, as long as sample is tested immediately upon draw,
- heparinized whole blood collected in balanced heparin syringes or capillary tubes, or
- heparinized whole blood collected in evacuated tubes containin glithium or sodium heparin, as long as the tubes are filled to capacity.

### Fill Requirements

- Fill blood collection tubes with *and without* anticoagulant and syringes with anticoagulant to capacity. Incomplete filling of anticoagulated tubes and syringes will cause higher heparin-to-blood ratios, which will decrease ionized calcium results and may affect other results. Under filling blood collection tubes with *and without* anticoagulant may also cause decreased **PCO<sub>2</sub>**, HCO<sub>3</sub> and TCO<sub>2</sub> results.
- Partial-draw blood collection tubes (evacuated tubes that are adjusted to draw less than the tube volume, e.g. a 5 mL tube with enough vacuum to draw only 3 mL), with *or without* anticoagulant, are not recommended for blood gas or CHEM8+ cartridge analysis because of the potential for decreased **PCO<sub>2</sub>**, HCO<sub>3</sub> and TCO<sub>2</sub> results. Care must also be taken to eliminate “bubbling” of the sample with a pipette when filling a cartridge to avoid the loss of CO<sub>2</sub> in the blood.

### Mixing

- Gently mix blood (whether anticoagulated or not) immediately to avoid clotting. Invert a blood collection tube at least 10 times. Roll a syringe vigorously between the palms for at least 5 seconds each in two different directions, then invert the syringe repeatedly for at least 5 seconds, then discard the first two drops of blood. Note that it may be difficult to properly mix a sample in a 1.0 cc syringe.

### **Exposure to Air**

- Avoid exposing the sample to air when testing venous samples for ionized calcium, pH, **PCO<sub>2</sub>** and **TCO<sub>2</sub>**. Test immediately if the sample is drawn into a blood collection tube. Expel any air bubbles immediately if the sample is drawn into a syringe or leave an air bubble next to the plunger and do not allow it to move through the sample.

### **Time to Test**

- For the most accurate results, test samples immediately after drawing. Samples for lactate must be tested immediately. Samples for pH, **PCO<sub>2</sub>**, **PO<sub>2</sub>**, **TCO<sub>2</sub>**, and ionized calcium should be tested within 10 minutes. Other analytes should be tested within 30 minutes.
- If testing is not immediate, remix blood collection tubes by gentle inversion at least 10 times. Roll syringes between the palms for at least 5 seconds each in two different directions, then invert the syringe repeatedly for at least 5 seconds, and then discard the first two drops of blood. Blood in the tip of the syringe may have been exposed to air and may not be homogenous with the sample in the barrel of the syringe.

## **12. VENIPUNCTURE - COAGULATION TESTS**

### **Blood Flow**

- Collection technique resulting in good blood flow must be used. Inadequate blood flow may produce erroneous results.

### **Plastic**

- The sample for testing should be drawn into a **plastic** collection device (syringe or blood collection tube) containing **no anticoagulant, clot activators, or serum/plasma separators**. Any transfer device (dispenser, capillary tube, pipette or syringe) **must be plastic** and must **not contain anticoagulant**.

### **Time to Test**

- The sample must be immediately dispensed into the sample well of the cartridge and the cartridge must be inserted immediately into an analyzer. Repeat Test If a repeat measurement is needed, a fresh sample must be obtained.

## **13. SKIN PUNCTURE**

### **Device**

- Use a puncture device that provides free-flowing blood. Inadequate blood flow may produce erroneous results.

### **Time to Test**

- Test samples collected in capillary tubes immediately to avoid clotting.

#### **PT/INR Cartridges**

- i-STAT PT/INR cartridges should be filled directly from the puncture site by allowing blood to flow from the site into the cartridge - no transfer device should be used.

### **14. INDWELLING LINE**

#### **Blood Gas, Electrolyte, Chemistry**

- Back flush line with a sufficient amount of blood to remove intravenous solutions, heparin or medications that may contaminate the sample. Five to six times the volume of the catheter, connectors and needle is recommended.

#### **Coagulation Cartridges**

- If blood **must** be drawn from an indwelling line, possible heparin contamination and specimen dilution should be considered. The line should be flushed with 5mL of saline and the first 5mL of blood or six dead space volumes of the catheter should be discarded.

### **15. ARTERIAL PUNCTURE – GENERAL**

Overview Arterial punctures are performed to access gas exchange status. **PCO<sub>2</sub>**, **PO<sub>2</sub>**, and pH values change with changes in ventilator support at a rate dependent on underlying conditions. Sample should be drawn after these changes have stabilized.

### **16. ARTERIAL PUNCTURE - ACT TESTS**

#### **Blood Flow**

- Collection technique resulting in good blood flow must be used. Inadequate blood flow may produce erroneous results.

#### **Plastic**

- The sample for testing should be drawn into a **plastic** collection device (syringe or blood collection tube) containing **no anticoagulant**. Samples collected into glass tubes or syringes, or in tubes containing anticoagulants, cannot be used with the i-STAT coagulation cartridges.
- **Note:** CLSI guidelines recommend the sample for coagulation testing be the second or third tube drawn when using a blood collection system (use a discard tube if this is the only sample being drawn) or be taken from the second syringe if a double syringe technique is used for drawing blood.

#### **Time to Test**

- The sample must be immediately dispensed into the sample well of the cartridge and the cartridge must be inserted immediately into an analyzer.



## **17. ARTERIAL PUNCTURE - BLOOD GAS, ELECTROLYTE, CHEMISTRY, AND HEMATOCRIT TESTS**

### **Evacuated Tubes**

- Evacuated or other blood collection tubes are not recommended for blood gas analysis.

### **Syringes and Anticoagulant**

- If the sample can be tested in a cartridge immediately, a plain syringe can be used.
- If a cartridge cannot be filled immediately, the sample should be collected in a pre-heparinized syringe.
- Fill syringes to the recommended capacity or use the least amount of liquid heparin anticoagulant that will prevent clotting. Under filling syringes will cause higher heparin-to-blood ratios which will decrease ionized calcium results due to binding. Under filling syringes with liquid heparin will also dilute the sample causing results to be affected.

### **i-STAT cTnI cartridges require the use of either:**

- heparinized whole blood or plasma samples collected in syringes or evacuated tubes containing lithium or sodium heparin, or
- non-heparinized whole blood samples tested within one minute of drawing from a patient into a plastic syringe or plastic evacuated tube containing no additives.
- The use of whole blood or plasma samples containing other anticoagulants such as EDTA, oxalate, and citrate will cause deactivation of the alkaline phosphatase, resulting in decreased cTnI readings.

### **i-STAT CHEM8+ cartridges require the use of:**

- whole blood collected in non-heparinized capillary tubes, evacuated tubes, or syringes, as long as sample is tested immediately upon draw,
- heparinized whole blood collected in balanced heparin syringes or capillary tubes, or
- heparinized whole blood collected in evacuated tubes containing lithium or sodium heparin, as long as the tubes are filled to capacity.

### **Mix**

- Mix blood (whether anticoagulated or not) by rolling between the palms for at least 5 seconds, each in two different directions. Then invert the syringe repeatedly for at least 5 seconds. Discard the first 2 drops of blood.

### **Exposure to Air**

- Avoid or remove immediately any air drawn into the syringe and maintain anaerobic conditions.

### **Time to Test**

- For the most accurate results, test samples immediately after draw. Samples for lactate must be tested immediately. Samples for pH, **PCO<sub>2</sub>**, **PO<sub>2</sub>**, TCO<sub>2</sub>, and ionized calcium should be tested within 10 minutes. Other analytes should be tested within 30 minutes.
- If testing is not immediate, remix the syringe by rolling between the palms for 5 seconds each in two different directions, then invert the syringe repeatedly for at least 5 seconds, then discard the first two drops of blood. Blood in the tip of the syringe may have been exposed to air and may not be homogenous with the sample in the barrel of the syringe. Note that it may be difficult to properly remix a sample in a 1.0 cc syringe.

### **Criteria For Specimen Rejection**

- ❑ Evidence of clotting
- ❑ Specimens collected in vacuum tubes with anticoagulant other than lithium or sodium heparin (or EDTA for BNP or glucose cartridges).
- ❑ Specimens for ACT or PT/INR collected in glass syringes or tubes or with anticoagulant of any kind
- ❑ Syringe for pH, **PCO<sub>2</sub>**, **PO<sub>2</sub>** and TCO<sub>2</sub> with air bubbles in sample
- ❑ Incompletely filled vacuum tube for the measurement of ionized calcium, **PCO<sub>2</sub>**, HCO<sub>3</sub> or TCO<sub>2</sub>
- ❑ Other sample types such as urine, CSF, and pleural fluid

### **Precautions: Avoid the Following Circumstances**

- ❑ Drawing a specimen from an arm with an I.V.
- ❑ Stasis (tourniquet left on longer than one minute before venipuncture)
- ❑ Extra muscle activity (fist pumping)
- ❑ Hemolysis (alcohol left over puncture site, or a traumatic draw)
- ❑ Icing before filling cartridge
- ❑ Time delays before filling cartridge, especially lactate, ACT, and PT/INR
- ❑ Exposing the sample to air when measuring pH, **PCO<sub>2</sub>**, **PO<sub>2</sub>** and TCO<sub>2</sub>.

### **NOTES**

Blood flow can be stimulated by warming the puncture site. Follow the facility's policy and procedure for warming (arterializing) skin puncture area.

## REFERENCES:

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Laboratory Services

## LAB.QA.106 Collection of Specimens for Laboratory and Point of Care Testing

Copy of version 5.1 (approved and current)

Last Approval or  
Periodic Review Completed 5/10/2017

Next Periodic Review  
Needed On or Before 5/10/2019

Effective Date 10/19/2017

Controlled Copy ID 169906

Location Controlled PDF printed for lab  
test catalog.

Organization Memorial Health System

### Comments for version 5.0 (last major revision)

Added to Procedure

7. The collecting unit is responsible for removing the needle from any collection device prior to submitting the specimen to the laboratory for testing.

and

Wipe the skin with 70% alcohol. Allow the site to air-dry.

### Comments for version 5.1 (this revision)

clarified labeling requirements to refer to labeling procedure

### Approval and Periodic Review Signatures

Type	Description	Date	Version	Performed By	Notes
Approval	Lab Director	5/10/2017	5.0	Cory Dunn	
Approval	Manager Approval	5/10/2017	5.0	<i>Heather Bracken</i> Heather Bracken	
Approval	Lab Director	12/29/2016	4.0	Cory Dunn	
Approval	Manager Approval	12/28/2016	4.0	<i>Heather Bracken</i> Heather Bracken	
Approval	Lab Director	10/12/2016	3.0	Cory Dunn	
Approval	Manager Approval	10/12/2016	3.0	<i>Heather Bracken</i> Heather Bracken	

Approval	QA check	10/10/2016	3.0	Tianna McCormick
Approval	Lab Director	4/17/2016	2.0	Cory Dunn
Approval	Manager Approval	4/15/2016	2.0	Heather Bracken
Approval	QA check	4/15/2016	2.0	Tianna McCormick
Approval	Manager Approval	4/11/2016	2.0	Heather Bracken
Approval	QA check	4/6/2016	2.0	Tianna McCormick
Approval	Lab Director	2/19/2016	1.0	Cory Dunn
Approval	Manager Approval	2/18/2016	1.0	Heather Bracken
Approval	QA check	2/16/2016	1.0	Tianna McCormick
Approval	Manager Approval	2/16/2016	1.0	Heather Bracken
Approval	QA check	2/12/2016	1.0	Tianna McCormick

#### Version History

Version	Status	Type	Date Added	Date Effective	Date Retired
5.1	Approved and Current	Minor revision	10/19/2017	10/19/2017	Indefinite
5.0	Retired	Major revision	5/9/2017	5/10/2017	10/19/2017
4.0	Retired	Major revision	12/22/2016	12/29/2016	5/10/2017
3.0	Retired	Major revision	10/10/2016	10/12/2016	12/29/2016
2.0	Retired	Major revision	4/6/2016	4/17/2016	10/12/2016
1.1	Retired	Minor revision	3/15/2016	3/15/2016	4/17/2016
1.0	Retired	Initial version	2/12/2016	2/19/2016	3/15/2016

#### Linked Documents

- LAB.QA. 63 Specimen Labeling & Acceptance Criteria