8. Complications in Specimen Collection

A. Complications Associated with the Specimen Collection Procedure – A variety of adverse complications may be encountered. The following are the most commonly encountered:

1. Fainting (syncope)

   a. Patient becomes dizzy and faint at the site of blood or due to fasting
   
   b. Fainting is one of the reasons it is important to use a blood collection chair designed with a padded arm rest in front of the patient
   
   c. Follow your facilities’ policy on asking patients if they have fainted during previous blood draws.

   1) Some do not want phlebotomist to ask patients “Have you ever fainted from having your blood drawn?” as this can plant the idea in the patient’s mind.

   2) Instead, you may want to ask a more general question, such as “Have you ever had any problems with having your blood drawn in the past?”

   3) If they tell you they have fainted in the past during venipuncture, have them lie down.

   d. If during the procedure, the patient states they are faint or appear faint, immediately REMOVE THE NEEDLE, activate the needle safety device and have the patient lower their head and breathe slowly and deeply.

   e. Signs that patient is about to faint include: blood draining from their face (they become pale), rapid breathing, restless movement, a “chatty” patient becomes quiet and still, a silent patient becomes talkative.

   f. Ask for help to move the patient.

   g. Talk to the patient calmly; apply a wet towel to the back of the neck; offer juice or water.

   h. If the patient faints, remove needle and break the fall; request help.

   i. Do not allow the patient to leave until they have recovered.

   j. Fill out incident report as soon as possible while events are fresh in your mind. This is mandatory.
2. **Failure to draw blood** may be due to needle inserted incorrectly or vacuum lost in tube
   a. If you suspect the needle is not properly inserted, gently and carefully reposition. **DO NOT DIG FOR VEINS.** Withdraw slightly until you see top of bevel, reposition, reinsert.
   b. If you suspect vacuum in tube in lost, change tubes. Always have extra tubes within reach.
   c. Needle has come unscrewed from the hub during venipuncture; in this case, release the tourniquet and carefully remove the needle from the patient’s arm.

3. **Hematomas** occur when area around puncture site begins to swell indicating that blood is leaking into the tissues which **will result in a bruise.**
   a. May be due to:
      1) Partial insertion of the needle into the vein
      2) Insertion of needle through the vein
      3) Patient has fragile veins
   b. If swelling or discoloration at the puncture site happens **IMMEDIATELY** remove the tourniquet and needle, apply pressure for 2 minutes and recheck to ensure bleeding has stopped.
   c. Hematomas may also occur
      1) If the needle is removed before the tourniquet is released,
      2) If insufficient pressure was applied to a venipuncture site after the needle was withdrawn, or
      3) If the phlebotomist was “digging” for a vein
   d. Fill out an incident report as soon as possible while events are fresh in your mind. This is mandatory.

4. **Hemoconcentration**
   a. An increase in concentration of large molecules and formed elements in the blood with a decrease in volume of plasma
   b. Some causes are:
      1) Prolonged tourniquet application – longer than 1 minute
2) Massaging, squeezing or probing a site

3) Long-term IV therapy

4) Sclerosed or occluded veins

5) Dehydration

6) Certain diseases

c. Hemoconcentration may cause false increase in: potassium, magnesium, LDH, phosphorous, ammonia, and total protein.

5. Tourniquet Interference and Fist Pumping

a. Tourniquet that is too tight or left on too long can cause erroneous laboratory test results.

b. May cause false increase or decrease in certain analytes in the blood.

1) Some analytes leak from blood into the tissues causing false increase in: plasma cholesterol, iron, lipid, protein and potassium

2) Certain enzymes may be falsely increased or decreased

3) Tourniquets interference can occur within 3 minutes

c. If it takes longer than 1 minute to find vein, release tourniquet for 2 minutes before reapplying tourniquet.

d. Avoid having the patient excessively pump their fist as this may lead to a false increase in potassium, lactate, and phosphate.

6. Neurologic

a. Patient may feel sharp, electric tingling if nerve is hit

1) Immediately discontinue the venipuncture.

2) After bleeding has stopped, an ice pack may be applied to decrease inflammation.

3) Check your facilities’ policy for specific procedure.

4) Patient may need physical therapy.

5) Fill out an incident report as soon as possible while events are fresh in your mind. This is mandatory.
b. Seizures
   1) Rare complication; immediately stop the venipuncture
   2) Call for help.
   3) Do not place anything in the patient’s mouth

c. Fill out incident report as soon as possible.

7. Hemolysis
   a. When RBCs are ruptured, hemoglobin is released and serum appears pink to red.
   b. If grossly hemolyzed, will appear dark red.
   c. May be due to conditions such as: burns, snakebite or some diseases
   d. Usually caused by improper technique:
      1) Needle too small
      2) Pulling too hard on plunger of syringe
      3) Expelling blood vigorously into a tube
      4) Shaking or mixing specimen in tube too vigorously
      5) Not allowing alcohol to dry before drawing blood
   e. Hemolysis may cause false increase in: potassium, magnesium, iron, LDH, phosphorous, ammonia and total protein.
   f. Hemolyzed samples may show decreased red cell count and hematocrit.

8. Excessive bleeding after venipuncture
   a. May occur in patients
      1) On anticoagulant therapy
      2) Taking arthritis medication or aspirin containing medications or
      3) Who have decreased number of platelets
   b. Do not allow an outpatient to leave the draw chair or leave an in-patient until bleeding at the puncture site has stopped.
9. **Petechiae**
   a. Prior to blood collection, examine potential site. Small red spots on the patient’s skin may indicate rupture of tiny veins below the skin.
   b. May be due to coagulation problems or abnormalities.
   c. Phlebotomist must be aware of the fact that the patient may bleed excessively after blood collection.
   d. Make sure bleeding at the puncture site stops prior to leaving the patient. Notify nurse of excessive bleeding if it occurs.

10. **Intravenous (IV) Therapy** – *never* draw above an IV site. Consider the following:
   a. Try the opposite arm.
   b. When there is no other option, always draw from site 5 inches below IV site.
   c. Drawing from IV line: If IV in both hands, confer with nurse to determine if blood can be drawn from IV line according to following protocol. *This procedure can only be performed by nursing personnel:*
      1) The IV tubing is disconnected from IV needle; wait 2 minutes.
      2) Syringe is attached to the IV tubing.
      3) Critical that the first 6ccs of blood is discarded.
      4) Sufficient blood is drawn for testing.
      5) IV tubing replaced and IV line flushed by nurse.
   d. Drawing above an IV line: Proper protocol must be followed which involves:
      1) IV is turned off by the nurse.
      2) Waiting appropriate time limit – usually 2 minutes.
      3) Discard first tube drawn.
      4) Have nurse turn IV back on.
      5) *Must document that sample was drawn above IV.*
e. Evaluate feet or legs. However, if patient has been bedridden for extended periods of time, this may increase chances of phlebitis. A doctor’s written permission must be obtained to draw from ankles or feet.

f. Extended IV therapy may cause veins to be damaged or occluded.

11. Damaged, Sclerosed or Occluded veins

   a. Sclerosed or hardened veins due to inflammation or disease.

   b. Occluded veins are blocked due to extended IV therapy, chemotherapy or disease.

   c. Patients whose veins have been repeatedly punctured often become scarred and feel hard when palpated.

   d. Blood is not drawn easily; best to avoid these sites.

12. Collapsed Veins

   a. Usually caused by excessive pressure when collecting blood sample.

      1) May be caused by pulling syringe plunger back too quick or too hard. Pull plunger using gentle pressure.

      2) Using vacuum collection device on small veins. Use tubes with smaller volume (pedi tubes) and a smaller needle (butterfly needle).

   b. Carefully evaluate the patient’s veins before venipuncture and select the appropriate equipment for the vein selected.

B. Physical Disposition

   1. The basal state refers to the patient’s physical condition in the early morning hours approximately 12 hours after the last meal. Many factors can affect the basal state.

      a. Results of lab tests are more reliable because normal or reference values are most often determined from specimens collected during this time.

      b. It is recommended that specimens collected for determination of concentrations of the following analytes be collected during this time:

         1) Glucose

         2) Cholesterol

         3) Triglycerides
4) Electrolytes

5) Protein

2. Diet

a. To ensure a basal state, overnight fasting is necessary as blood composition is significantly altered after a meal.

b. **Fasting** refers to abstinence from food and beverages *except* water. Crucial that water is consumed to prevent dehydration which makes blood drawing difficult.

c. Fasting time will vary according to test ordered and it is critical to ask a patient when they last ate or drank something *other than water*.

d. If a patient has eaten and the doctor still wants the test drawn, write “non-fasting” on the lab requisition.

e. Phlebotomists may need to instruct patient. It is best to give oral and written instructions and emphasize the importance of following these directions.

1) Coffee and tea are not allowed; may cause fluctuation in blood glucose.

2) **Water is allowed and encouraged** to prevent dehydration which will also alter test results.

3) Specify the time when fasting must start.

f. Serum is normally clear, light yellow or straw colored; turbid specimens appear cloudy and milky and may be due to the following:

1) **Lipemia** is a condition where there are excess fats in the blood. Lipemia may be due to:

   a) Eating fatty substances such as non-lean meat, butter, cream, or cheese.

   b) May be caused by a hereditary condition.

   c) Lipemic specimens may indicate the patient is not in a basal state.

2) Rarely, cloudy specimens may indicate the presence of bacteria.
3. Exercise
   a. Affect on lab test depends on intensity, duration and frequency.
   b. Moderate or excessive exercise has a marked effect on the following lab results: lactic acid, creatinine, fatty acids and some amino acids, proteins and enzymes.
   c. Most analytes will return to normal shortly after exercise except enzymes such as creatinine kinase (CK), aspartate aminotransferase (AST) and lactate dehydrogenase (LDH), which will return to normal within 24 hours.
   d. Some research indicates exercise affects hemostasis.

4. Stress
   a. Patients are often frightened, nervous and over anxious prior to phlebotomy.
   b. Anxiety can cause a transient increase in white blood cells (WBC), albumin, fibrinogen, glucose, cholesterol and insulin or a transient decrease in serum iron and abnormal adrenal hormone values.
   c. Violent crying in newborns will have WBC counts 140% above the baseline counts. Even mild crying will cause 113% increase; but will return to normal after one hour.

5. Diurnal Rhythms and Posture
   a. Body fluids fluctuate during the day.
   b. Certain hormone levels are reduced in the afternoon, while eosinophils and serum iron are increased.
   c. Posture changes are well known to alter lab results
      1) Important to consider when comparing in-patient versus out-patient results.
      2) Changing from supine to sitting or standing causes water to shift from intravascular or interstitial compartments.
      3) Certain large molecules are not filterable to the tissues.
      4) Enzymes, proteins, lipids, iron and calcium significantly increase with position changes.
      5) Aldosterone and plasma rennin are affected by posture change.
6. **Obesity**
   a. Obese patients generally have veins that are very deep and thus, are difficult to visualize or palpate.
   b. Any puncture made may have to be based on phlebotomist’s knowledge of venous anatomy.
      1) This is essentially a “blind” stick
      2) This should only be made by the most experienced personnel
   c. If the vein is missed, take care not to probe excessively as this will cause rupture of red blood cells (RBCs), increase concentration of intracellular contents and release tissue clotting factors.
   d. Consider the possibility of a capillary puncture.

7. **Mastectomy**
   a. Ask patient about arm preference or problems as this will be an opportunity for the patient to let you know of a mastectomy.
   b. Women who have had a breast removed will also have had adjacent lymph nodes removed.
      1) This will greatly reduce lymph flow to the arm on the side of the mastectomy.
      2) May increase the possibilities of infection or it may result in lymphedema.
   c. Lymphedema is an accumulation of lymphatic fluid that causes swelling in the tissue of an arm or leg.
      1) Accumulation of this fluid can occur after lymph nodes or vessels are surgically removed or damaged.
      2) Lymphatic fluid is clear and collected from tissue in all parts of the body.
   d. If patient has had a double mastectomy confer with physician. May need to perform capillary puncture or perform venipuncture on legs or feet. *A doctor’s written permission must be obtained to draw from ankles or feet.*

8. **Edema**
   a. Abnormal accumulation of fluids in intercellular spaces of the body which may affect laboratory test results.
b. Can be localized or diffuse.

c. Avoid collecting blood from these sites. Usually hands and feet, but arms can be swollen and this will contaminate specimen with tissue fluids.

9. **Thrombosis**

a. Thrombi are solid masses derived from blood constituents in the vessels, i.e., a clot.

b. Thrombus may partially or fully occlude a vein or artery making venipuncture difficult.

10. **Burned or scarred areas** should be avoided.

a. Burned areas are very sensitive and susceptible to infection.

b. Veins under scarred areas are difficult to palpate and difficult to insert a needle.

11. **Allergies**

a. Patient may be allergic to iodine or other solutions used to clean the site.

b. Prior to using iodine or betadine, ask patient if they are allergic. If the answer is “yes”, use alternative method as directed by your site such as ChloroPrep or Chlorascrub.

c. Latex allergy are common. Use nitrile gloves if allergic to latex.

12. **Infections**

a. Patient may have transmissible disease, i.e., hepatitis, which may be transmitted to phlebotomist.

b. ALWAYS FOLLOW THE APPROPRIATE INFECTION CONTROL POLICIES.

c. Special infection control measures will be posted on the patient’s door.

C. **Other Factors Affecting the Patient and Laboratory Results**

1. **Age, gender and pregnancy** will influence lab results

a. Reference ranges (normal values) often listed according to age as there may be dramatic differences.

b. Gender – many normal values are different based on gender, especially hematology.
c. Pregnancy normal values established for obstetric clinics.

2. **Geographical location** – altitude, temperature, and humidity will affect normal baseline values
   
a. It is essential that each lab establish reference ranges for their particular patient population and location.

b. Protocols are in place to establish normal values on new equipment as well as periodically throughout the year to verify the machines are still in proper calibration.

3. **Travel**
   
a. Diurnal rhythm is affected by travel over several time zones.

b. Air travel can affect fluid retention

c. After long flights, may take up to two days for fluid and sodium levels to return to normal.

4. **Vomiting or Nausea**
   
a. May be due to patient’s condition.

b. Can be caused by the sight of blood or stress of venipuncture procedure.

c. Have a waste container available. Offer patient tissues or washcloth for possible clean up.

d. Sometimes occurs during Glucose Tolerance Testing. May need to discontinue test and reschedule for another day.

D. **Interferences of Drugs and Other Substances in Blood**

1. Very complex and depends on the type of analysis used.

2. Drug interference is decreasing due to the development of more sensitive and specific procedures.
   
a. Drugs may affect one or more of the following systems: hepatic, hematologic, hemostatic, muscular, pancreatic and renal; which may obscure the true clinical diagnosis.

b. Drugs can cause *falsely elevated or decreased* values in the analyte being measured.

3. IV medications and dyes used for certain x-ray procedures may affect results of lab tests.
4. The phlebotomist can aid the clinical laboratory by notating on the lab requisition whether the patient has had certain procedures or drugs which may affect lab tests.