

EXERCISE 4: MICROCOLLECTION

Textbook: Chapter 9

Skills: 20 points

- Objectives:
1. State the types of patients who are candidates for microcollection.
 2. Identify potential sites for capillary puncture.
 3. List and select the types of equipment needed to collect blood by microcollection.
 4. Demonstrate concern for the safety and welfare of yourself and others by consistently using appropriate infection control techniques.
 5. Demonstrate appropriate concern for your classmate by explaining the procedure.
 6. Describe and demonstrate preparation of a microcollection site.
 7. Perform a competent/effective microcollection of capillary blood from the fingertip with no contamination from tissue fluid and with minimum trauma.
 8. Describe the correct procedure for the microcollection procedure on infants.
 9. List the steps necessary to perform a capillary puncture in chronological order.
 10. List 5 circumstances that would lead to re-collection or rejection of a patient microcollection sample.
 11. Identify 10 special precautions necessary during microcollection.
 12. State the order of the draw for samples collected by microcollection.
 13. Describe and state the appearance of additive and non-additive capillary tubes.

Discussion

Skin Puncture Site

There are many terms used for "microcollection" and they include: capillary puncture, microsampling, finger stick and heel stick. Microcollection is a blood collection technique using the finger, great toe or heel. In rare instances the earlobe may be used. The distal portion of the second, third or fourth finger can be used but the middle finger is usually the site of choice. Swollen or edematous areas should not be used because of possible contamination with body fluids which can contaminate the specimen. Fingers that are cyanotic (blue), swollen or inflamed should be avoided.

Patients Who are Candidates For Microcollection

Microcollection techniques may be the procedure of choice for the following patients:

1. **Neonates** - Newborns do not have a very large blood volume and it is very dangerous to remove too large a volume of blood, which would occur with a venipuncture. A 10 mL sample from a premature or newborn infant can represent 5 to 10 percent of the total blood volume in the entire body. The blood is generally obtained from the sides of the heel or, in older infants, the big toe since these two areas are larger and more accessible than the fingertip. **The bottoms and backs of the heels are NEVER used for microcollection due to the possibility of causing damage to the bone or nerves with subsequent infection or permanent physical damage.** Infants fingers should never be punctured due to the short distance to the bones and main nerves of the infant's fingers. More details of this procedure will be covered in a future lecture.

2. **Pediatric patients** - if only a small amount of blood is needed, the tip of the third or fourth finger is generally punctured. This is a less traumatic procedure for a young child.
3. **Adults** - microcollection may be the procedure of choice in the following adult patients: severely burned, obese, patients with thrombotic tendencies, oncology patients to save their veins for future chemotherapy, geriatric patients, patients with fragile or **very** poor veins, patients with I.V.s in both arms, and patients doing home testing such as glucose monitoring.

Microcollection Equipment

The types of equipment necessary for microcollection varies in how it is used but always makes either a puncture or cut into the skin and through the capillary bed. The equipment used to collect the blood depends on the type of patient and the particular test being performed.

The types of supplies available for skin puncture would include the following: gloves, lancets or automatic puncture devices, capillary tubes or micropipets, disinfectant pads, cotton balls, bandages or gauze pads, glass microscope slides, microcollection tubes or capillary tubes, capillary tube clay sealer, warming pads, laboratory request slips or labels, a marking pen and a sharps container.

Lancets

Lancets have a sharp metal point and are designed for a controlled depth of puncture ranging from 2.0 to 3.0 mm. Babies should **never** be stuck with a puncture device that exceeds 2.0 mm. The shoulders on either side of the metal point prevent the phlebotomist from puncturing too deeply. They are made of sterilized metal, some are surrounded by plastic. Lancets are disposable and can **be used only one time**. If an unsuccessful puncture is performed, a new lancet must be used. The metal lancets are hand held.

Skin Puncture Devices

Automated puncture devices such as the Autolet are commercially available. They are spring loaded and are designed to give a quicker, more uniform puncture of a specified depth. They are easy to use and are particularly helpful to patients who must do home glucose monitoring. Another advantage to the spring loaded puncture device is that the device hides the blade in a plastic holder so the patient cannot see it. This prevents apprehensive patients (especially children) from pulling their hand away just as the phlebotomist is ready to stick. In a case like this the phlebotomist may possibly stick themselves. These skin puncture devices are available for punctures of different depths.

Devices on the market for diabetic at home glucose monitoring **should not** be used for microcollection. These devices provide a blood flow of one to two drops, adequate for the glucose test, but this is not adequate blood flow for the sample size needed for most laboratory settings.

Collection Tubes

Micropipets, microtainers and capillary tubes for collecting skin puncture blood are manufactured in a variety of bore sizes, volume capacities and shapes. They may be heparinized (red ring), non-heparinized (blue ring) or may contain other additives (heparin-green ring). They may be conical, cylindrical, straight-walled with open ends and may be made from glass or plastic. There should be a means for proper filling, measuring, color coding for the proper anticoagulant, stoppering, centrifugation and storage.

The Unopette is a system composed of a micropipette and dilution system used to prepare dilutions of the blood sample to be used for platelet counts, white blood cell counts, red blood cell counts and hemoglobin determinations. This will be covered in a future laboratory.

Warming the Site

In order to ensure an adequate blood flow following a successful capillary puncture the site should feel warm to the touch. Cool skin indicates decreased blood flow to the area and the potential that, even though the puncture is performed properly, and adequate amount of blood will not be obtained. There are several methods available for warming the site and include the following:

1. If possible, have the patients run warm tap water over their hands for two to three minutes.
2. Gently massage the area for 1 to 2 minutes.
3. Obtain a wash cloth, wet it with warm water and wrap it around the site. When wrapped around the site for 3 to 10 minutes the skin temperature can increase several degrees. The wrap can be encased in a plastic bag to help retain heat and keep the patient's bed dry. If a blood collection is ordered on another patient, the phlebotomist can perform that draw then return and perform the capillary puncture.
4. Heel warmers are available commercially for use on neonates. It is a chemically activated source of heat. It prevents the possibility of burning the baby's skin with a too warm wash cloth.

Labeling the Samples

Samples must be labeled at the bedside. Computer generated adhesive labels can be wrapped around the sample. If these are not available put as much identifying information as possible on the microcontainer then place the micro container into a red stoppered vacutainer tube. Label the vacutainer tube in the proper manner.

Precautions in Microcollection Techniques

1. Puncture laterally across the print. If the puncture is performed along the print the blood will flow with the print making it very difficult to collect, causing unnecessary contamination of your gloves and work area.
2. The first drop of blood must be wiped off to prevent contamination of the specimen with tissue fluids. Tissue fluids contain coagulation factors that can accelerate coagulation (clumping of the blood) making it unacceptable for testing.
3. Collect hematology specimens *first*. When collecting blood for hematology tests the finger must be wiped dry after each test drawn. Platelets will begin to clump immediately in the blood at the puncture site. The values for the red blood cell count, hematocrit, hemoglobin and platelets are lower in capillary blood than in venous blood. therefore, whenever it is possible and the patient is old enough, venipuncture should be performed
4. Because of platelet adhesiveness and aggregation (clumping) at the site of the puncture it is advisable to collect the platelet count and blood smear first if multiple tests are ordered.

5. When filling the special collection tubes for other blood tests the blood must be mixed well after the addition of each drop if the tube contains an additive. Samples that are not well mixed will clot and will have to be recollected.
6. Capillary tubes with a blue ring do not have an anticoagulant and do not need to be mixed. Capillary tubes with a red ring contain the anticoagulant heparin, which prevents blood from clotting. The red ringed tubes must be inverted several times to allow the blood to mix with the heparin. If the blood does clot the specimen will have to be recollected.
7. Do not overfill the capillary tube. If the tube is completely full blood will leak out when the end is filled with clay. This will unnecessarily contaminate your gloves or work area with blood.
8. Be **very** careful when filling the end of the capillary tube with clay. If the tube is held in the middle or far from the end being filled with clay it may break when pressure is applied. The broken end will pierce the skin and allow a large inoculum of blood into your bloodstream. This is more dangerous than a needle stick injury due to the amount of blood present in the capillary tube. If this type of injury occurs notify your instructor or, if you are at the clinical site, clinical instructor **IMMEDIATELY**.
9. If you have attempted the procedure twice and are not successful do not stick the person a third time, except in very unusual circumstances.
10. Check puncture site before leaving to make sure bleeding has stopped.
11. Never put an adhesive Band-ad on the puncture site of an infant or very small child.

Rejection of Microcollection Samples

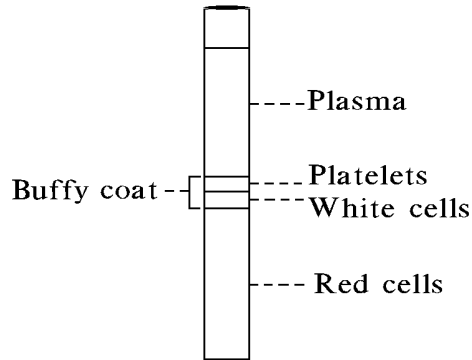
1. If the first drop of blood is not wiped away sample will be contaminated with tissue fluid.
2. Excessive squeezing of the finger to obtain the specimen will contaminate the specimen with excess tissue fluid.
3. Microcollection tubes with additives must be mixed frequently during collection to prevent the specimen from clotting.
4. The site must be completely dry prior to puncture, alcohol will cause hemolysis of the blood sample.
5. Certain tests (ie, Unopette) **must** be free of air bubbles, which will cause falsely decreased results in the test.

Microhematocrit

The microhematocrit test is done to determine if a patient is anemic. It is quick and easy to perform, requires

minimal equipment and is an excellent way to **screen** for anemia. After a skin puncture is performed the blood is collected in microhematocrit tubes and one end is sealed with clay. Then it is put in a special centrifuge (microhematocrit centrifuge) which spins the tubes around at a great rate of speed.

This causes the blood to separate into three layers: plasma, buffy coat (which contains platelets and white blood cells), and red blood cells.



Cell layers in centrifuged whole blood.

After spinning, the tube is placed on a special type of card or other device to determine the reading. The hematocrit is expressed as a per cent and determines what per cent of the whole blood is plasma and what per cent is red blood cells.

The normal values for people differ, women and children have lower values than men and newborn babies. The following chart lists the normal values:

Newborn	45 - 50%
One year	27 - 44%
Women	36 - 48%
Men	40 - 55%

Lower results than normal are due to a wide variety of causes including: poor diet, chemotherapy, drug therapy, gastrointestinal bleeding, or bleeding due to surgery or trauma.

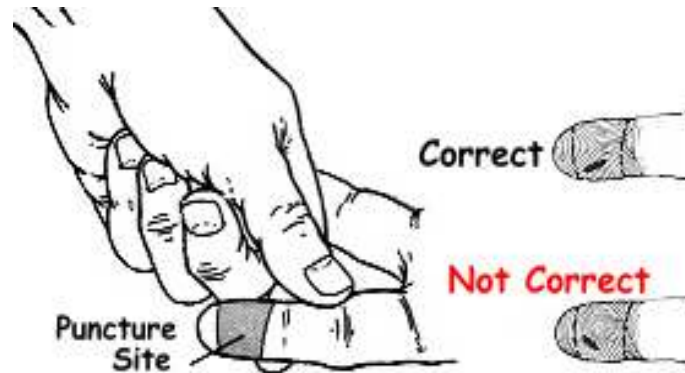
Procedure:

- Materials:**
1. Lancet
 2. Alcohol Pad
 3. Kimwipes
 4. Two microhematocrit tubes
 5. Clay tube sealer
 6. Gloves
 7. Band-Aid

Instructions:

1. Assemble all equipment.
2. Properly greet and identify the patient.
3. Select an appropriate site on the third or fourth finger of the hand.
4. The puncture site chosen should feel warm, if the site is cool warm by gently massaging the finger, have the patient run warm water over the site or wrap in a warm cloth for several minutes.
5. Rub the puncture site **vigorously** with an alcohol swab to cleanse the area and increase the circulation.
6. Wipe the area dry with a Kimwipe or gauze. Dry skin allows the blood to form a well rounded drop something it will not do on moist skin. Alcohol left on the site will contaminate the blood sample collected. Cotton balls should not be used to wipe the site as small pieces of cotton may stick to the finger and interfere with the collection of blood.
7. Remove the lancet from its protective paper without touching the tip.
8. The patient's hand and finger should be held **laterally** so that the puncture site is readily accessible. The skin near the chosen sites should be pulled taut. Using the sterile blood lancet, make a deep puncture on the fingertip **across** the fingerprints. A deep puncture is no more painful than a superficial one, will give a much better blood flow, and will make it unnecessary to **repeat** the procedure.
9. Squeeze the finger **firmly** to initiate the blood flow and **WIPE AWAY THE FIRST DROP OF BLOOD** with a Kimwipe. The first drop contains tissue fluid which will contaminate the blood sample collected.

10. Apply firm pressure, approximately 1 cm behind the site of the puncture, to obtain a drop of blood. Immediately release the pressure to allow recirculation of the blood. If the finger is squeezed continuously without release the finger will force tissue fluid into the sample, causing contamination of the sample. The squeeze/release technique must be used to obtain an acceptable sample. It may be necessary to massage the finger to increase blood flow. Pressure should not be applied near the puncture site.



11. Using the technique in step #9 will cause the formation of a well rounded drop of blood. Carefully touch the tip of the microhematocrit tube to the drop of blood. **DO NOT ALLOW THE COLLECTION DEVICE TO TOUCH THE PUNCTURE SITE.** The tube should be held at a downward angle. Blood will flow by capillary action into the tube. **Avoid air bubbles.** It is critical when using the Unopette blood dilution system. Bubbles will cause falsely decreased results.
12. The tube should be filled 2/3 to 3/4 full. **DO NOT OVERFILL.** Heparinized (red ring) should always be used when collecting capillary samples. The sample should be collected quickly and the tube carefully inverted to mix the blood with the heparin to prevent clotting.
13. After collecting the two microhematocrit tubes fill one end of each tube with clay. Hold the clay perpendicular to the counter. Grasp the microhematocrit tube as close to the end that will be filled with clay as possible. Gently push the end into the clay 2 to 3 times. Use great care, too much pressure will cause tube to break and puncture your skin, causing a blood exposure. **CAUTION:** Only the microhematocrit test requires the end of the tube to be filled with clay. For all other tests do not fill end with clay.
14. After collecting the specimen apply a cotton ball to the puncture site, using slight pressure until the bleeding has stopped. Apply a Band-Aid.
15. Dispose of the lancet in the sharps container and all other materials in regular trash.
16. Give the two microhematocrit tubes to the instructor for verification that the procedure was performed correctly. The instructor will spin the tubes down and aid you in reading the results.

EXERCISE 4: MICROCOLLECTION

Phlebotomist _____

Date _____

Patient Name _____

For each of the following select the letter which best describes the level of skill:

- A Performed**
- B Not Performed**
- C Needs Improvement**

- ____ 1. Washed hands properly and donned gloves.
- ____ 2. Role play: Properly approached and identified the patient.
- ____ 3. Role play: Explained the procedure.
- ____ 4. Selects appropriate equipment.
- ____ 5. Prepares and organizes equipment.
- ____ 6. Selects site for skin puncture.
- ____ 7. Warms the site as necessary.
- ____ 8. Cleanses skin puncture site with alcohol.
- ____ 9. Allows site to air dry or carefully dries site.
- ____ 10. Secures puncture site appropriately.
- ____ 11. Punctures site with lancet across the fingerprint.
- ____ 12. Wipes away the first drop of blood.
- ____ 13. Appropriately applies pressure then releases near the puncture site to collect an adequate blood sample.
- ____ 14. Upon completion of collection, applies pressure to the puncture site with a cotton ball until the bleeding has stopped.
- ____ 15. Disposes of lancet in the sharpskeeper.
- ____ 16. Discards materials into appropriate waste receptacles.
- ____ 17. Removes all equipment from the patient's vicinity.
- ____ 18. Inspects puncture site; applies bandage if needed.
- ____ 19. Removes gloves and washes hands.
- ____ 20. Leaves patient in a courteous manner.

	Tube 1	Tube 2	Results (use correct units)
Hematocrit			

Are these results within the normal range (circle one)? **YES** **NO**

EXERCISE 4: MICROCOLLECTION - STUDY QUESTIONS

Name _____

Date _____

Points: 30

1. List three types of patients who may be candidates for capillary puncture (1.5 points).
2. List the 3 most commonly used sites for capillary puncture (1.5 points).
3. When performing a capillary puncture on an infant's heel why should the bottoms and backs of the heels never be used (1 points).
4. Explain why capillary puncture should not be performed on an infants finger (1 point).
5. Briefly describe the appearance of a metal "lancet" (1 point).
6. Briefly describe the appearance of an automated skin puncture device. What is the advantage of this device over the lancet? (2 points).
7. List two types of collection tubes used to collect capillary puncture specimens (1 point).

One year old	
Women	
Men	

14. State why the site must be punctured laterally **across** the print (0.5 point).

15. State why the first drop of blood produced **must** be wiped away (0.5 points).

16. Discuss why the site must be completely dry prior to puncture (0.5 point).

17. Why must air bubbles be avoided when collecting blood in the Unopette blood dilution system (0.5 point)?

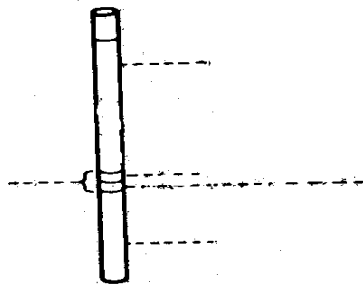
18. What additive are in the capillary tubes with a blue ring? a red ring? (1 point)

19. Why must special collection tubes with additives be well mixed during sample collection? (0.5 point)

20. State why great care must be taken when filling the end of the microhematocrit tube with clay (1 points).

21. State why it is important not to overfill the capillary tube (0.5 point).

22. Briefly list three precautions/sources of error during microcollection (1.5 points).
23. What is the maximum number of attempts which should be made using the capillary puncture technique (0.5 point).
24. State three circumstances that would lead to recollection or rejection of a patient microcollection sample (1.5 points).
25. Label the following diagram of a spun microhematocrit tube (2 points).



26. **Briefly** list in chronological order the steps for performing a capillary puncture (2 points).

