

10. Arterial, IV, and Special Collection Procedures

- A. *Blood gases* are used for the diagnosis and management of respiratory disease, provides valuable information about a patient's oxygenation, ventilation and acid-base balance and include the following laboratory tests: Ph, CO₂ and O₂.
1. Capillary blood gases:
 - a. Arterial blood collected by venipuncture is specimen of choice for pH, CO₂ and O₂.
 - b. Capillary blood has blood from capillaries, venules, arterioles and tissue fluids.
 - c. Requires collection in an "open system", allowing exchange of O₂ and CO₂ from air.
 - d. This method is performed on children or babies from whom arterial punctures are dangerous.
 - e. Procedure:
 - 1) Warm area.
 - 2) Collect quickly in anticoagulant (Natlson) tube, fill completely and seal **BOTH** ends of the tube **immediately**.
 - 3) NO air bubbles allowed.
 - 4) Special tube with metal filings available to aid in mixing specimen.
 - 5) **Put in ice water and deliver STAT.**
 2. Arterial blood gases:
 - a. Arterial punctures are not for the beginning phlebotomist. Extensive observation and training must be completed before an arterial puncture is attempted.
 - b. Patient should be calm, anxiety and excitement can alter the breathing and change composition of the blood gas.
 - c. Selection of site is determined by circulation, size and accessibility of artery and type of tissue surrounding the site.
 - 1) Radial artery is artery of choice, located on the thumb side of the wrist. Disadvantage is small size, requires considerable skill.
 - 2) Brachial artery is second choice, large and easy to palpate. Disadvantage its deeper and close to basilic vein and median nerve.
 - 3) Femoral artery is largest artery for arterial puncture, located superficially in groin, this puncture performed by physicians.
 - 4) Other sites includes scalp and umbilical arteries in infants.
 - d. Collateral circulation by the ulnar artery must be checked by use of the **Allen test** before puncture is made in the radial artery- **MEMORIZE THIS TEST**
 - 1) Have patient rest hand on bed or bedside table, wrist up, fist clenched.
 - 2) Phlebotomist uses middle and index finger of each hand to press on the radial and ulnar arteries simultaneously.
 - 3) While continuing to hold pressure, patient relaxes the fist.
 - 4) Obstructed blood flow causes blanching of the palm.
 - 5) Release pressure on the **ulnar** artery only, palm/fingers should turn pink in about 15 seconds, indicating ulnar artery is providing circulation to hand, if hand remains blanched, it indicates restricted blood flow of the ulnar artery

(*negative test*).

- 6) If a negative test is obtained that *wrist should not be used* and the opposite wrist should be checked.

e. Supplies

- 1) antiseptic such as povidone iodine (Betadine)
- 2) Gauze
- 3) heparin solution of 1000 I.U. per ml
- 4) Hypodermic needle
- 5) Syringe - glass or plastic (glass used to be preferred because of the limited exchange of gas through glass, but with advanced rapid sampling and resulting it has become less of a factor)
- 6) Ice water

f. Procedure

- 1) Draw 0.5 to 1 mL heparin into the syringe and coat entire barrel, expel air.
- 2) Cleanse area, no tourniquet necessary due to arterial blood pressure.
- 3) Pull skin taut and enter artery at a high angle, usually 45 degrees.
- 4) Syringe fills by itself due to arterial pressure.
- 5) After sufficient sample is collected remove needle and apply direct pressure with gauze on site for a minimum of 15 minutes.
- 6) Quickly remove needle and replace with plug, mix sample and *place in ice water immediately* to keep blood gases from escaping.
- 7) Specimen should be analyzed *within 10 minutes*, so arrange for immediate transport of the specimen.
- 8) Do not leave patient until bleeding has stopped and area is cleansed with a alcohol pad to remove Betadine.
- 9) Notify nurse that arterial puncture was performed so he/she can periodically check the site.

g. ABG Hazards:

- 1) Because of higher arterial pressure, a hematoma is more likely to occur, especially elderly patients and patients on anticoagulants.
- 2) Possibility of **arteriospasm**, a reflex condition of the artery in response to pain or to anxiety.

B. Bleeding Time

1. Used to assess platelet function and number and capillary integrity.
 - a. Use blood pressure cuff pumped up to 40 mm Hg.
 - b. Make puncture with automated incision making device.
 - c. Measure amount of time it takes for punctures to stop bleeding.
2. Aspirin and other medications (streptokinase, streptodornase, etc) may cause a falsely elevated bleeding time.

C. Blood Cultures

1. Indicated for patients with FUO
 - a. FUO may be the dominant clinical feature in bacteremia.
 - b. Usually drawn before and after fever spike, when bacteria are most likely to be

present.

2. Procedure:
 - a. Cleansing of venipuncture site is the most critical step.
 - b. Must cleanse tops of BC bottles with iodine and allow to air dry.
 - c. Draw 1 aerobic and 1 anaerobic, fill anaerobic bottle first if using a syringe.
3. Special precautions:
 - a. **Do not change needles**, repalpate area, wipe iodine off with alcohol.
 - b. Insufficient sample or injection of air into the anaerobic bottle may cause false negative.
 - c. *ISOSTAT* inactivates HIV, ARD inactivates antimicrobial agents.

D. Glucose tolerance test (GTT)

1. Used to aid in the diagnosis of diabetes mellitus or gestational diabetes. **NOTE:** The American Diabetes Association no longer recommends the GTT for diagnosis of diabetes mellitus, but it is still recommended to screen for gestation diabetes.
2. Instructing the patient.
 - a. Well balanced meals for three days.
 - b. NPO except water for 12 hours prior to test.
 - c. Encourage to drink water during the test.
3. Performing the test:
 - a. Draw fasting specimen.
 - b. Have patient drink “glucola”, usually contains 100mg of glucose, watch for signs of nausea.
 - c. Draw specimens at 30", 1 hour, 2 hours, etc, until required number of specimens are drawn.
 - d. Some sites still require a collection of urine at same time blood is drawn.
 - e. Label specimen with appropriate information AS WELL AS the hour of the specimen, ie, “1 hour”, “2 hour” , etc.

E. Postprandial glucose test

1. Screening test for diabetes.
 - a. Patient eats high carbohydrate diet for 2-3 days prior to the test.
 - b. Eat breakfast of orange juice, cereal with sugar, milk and toast.
 - c. Blood is drawn 2 hours after the meal.
2. Glucose should return to normal two hours after a meal, if still high a GTT should be done.

F. Lactose tolerance test:

1. Healthy people who have problems digesting lactose, a milk sugar, lack a mucosal enzyme which breaks down lactose.
2. This results in GI discomfort and diarrhea which goes away when milk is eliminated from the diet.

3. Procedure:
 - a. Perform 3 hour GTT 1 day in advance.
 - b. Next day do lactose tolerance test, which is done in the same manner as the GTT except given lactose instead of glucose.
 - c. Specimens drawn in same way: fasting, 30", 1 hour, 2 hour and 3 hour.
 - d. Specimens tested for glucose, and should have same curve as GTT.
 - e. Have bathroom handy.

G. Therapeutic Drug Monitoring (TDM)

1. Complex endeavor, requires coordination between lab, nursing and pharmacy.
2. Used to evaluate appropriate dosage level of drugs.
3. Specimens are collected and evaluated for trough and peak levels.
 - a. Trough lowest level, peak highest.
 - b. Time it takes to peak varies with mode of infusion (IM vs IV) and rate of infusion.
4. Random level appropriate for continuous infusion.
5. Time is more critical for drugs with short half life - gentamicin, tobramycin, procainimide - than those with longer half life - phenobarbital or digoxin.
6. Timing critical, specimen should not be collected immediately after dose is given. Usually 30" before for trough, 30" after for peak.
7. Need following information:
 - a. Patient information/Doctor/Test ordered
 - b. Whether order is for peak, trough or continuous infusion random sample specimen.
 - c. Date and time of last dose.
 - d. Date and time of next dose.
 - e. Nurse's verification that dose was administered.
8. TDMs collected in plain red tops, no additives or serum separators.
9. Keep specimens upright, away from stopper which may release interfering substances.

H. Collection for Trace Metals

1. Must use special tubes prepared especially for trace metal analysis.
2. Special acid washed plastic syringes are suitable.
3. For aluminum, needle must be free of aluminum.
4. For lead, lead free heparinized tubes and stainless steel needles.
5. Special collection guidelines must be established.

I. IV Line Collections

1. A **vascular access device** (VAD), also called an indwelling line, consists of tubing inserted into a main vein or artery, or, in the case of newborns, the umbilical cord.
 - a. A variety of types are used, but the most common type is **central venous catheters** (CVC), also called **central venous line** (CVL).
 - b. Another type of VAD, an **implanted port**, is a small chamber that is attached to an indwelling line.
 - 1) The chamber is surgically implanted under the skin and is located by palpating the skin.
 - 2) Access is gained by inserting a needle through the skin and into the self sealing septum (wall) of the chamber.
 - c. The latest type of VAD, a **peripherally inserted central catheter** (PICC) is inserted into the peripheral venous system and threaded into the central venous system.
 - 1) It does not required surgical insertion.
 - 2) Commonly placed in either the basilic or cephalic vein with the exit in the vicinity of the elbow.
 - 3) Because a PICC tends to collapse on aspiration, it is not recommended for drawing blood.
2. VADs are used primarily for administering fluids and medications, monitoring pressures, and drawing blood.
 - a. VADs that are to be used for blood drawing should only be accessed by **specialty trained personnel**.
 - b. Phlebotomists may be trained to draw from lines, but usually nurses perform this type of collection.
3. Procedure:
 - a. To keep blood from clotting in the line, heparin or saline is used to flush the line.
 - b. Any samples first taken from the line contain a mixture of blood and heparin or saline, so it is **critical** to discard the first 5-7 mls of blood drawn. **Not discarding the first blood drawn may cause erroneous laboratory results.**
 - c. After discard, the blood can be drawn as if drawing from a vein.
 - d. After drawing the blood from the line, heparin or saline is injected into the line until all the blood is pushed back into the patient, this keeps the line from clotting.
 - e. Line draws are **not** recommended for coagulation testing, however, some hospital policies allow the sample to be drawn if first 10 mls of blood drawn is discarded.

4. A **heparin lock or saline lock** is a special winged needle set that can be left in patient's vein for up to 48 hours. **NOTE:** Heparin locks are now used only for those patients who have coagulation disorders.
 - a. It is used to administer medication and draw blood.
 - b. It is periodically flushed with heparin or saline (depending on patient) to keep it from clotting; therefore, a 5 ml discard tube should be drawn prior to specimen collection.
 - c. Drawing coagulation test specimens from heparin locks is not recommended.
 - d. Only specially trained personnel should draw blood from a heparin lock.
 - e. Heparin locks are very useful for patient's with difficult veins who require a GTT.

5. A **cannula** is a temporary surgical connection between an artery and a vein used for dialysis and blood drawing.
 - a. Tubing of the cannula extends to the outside surface of the arm and has a rubber diaphragm cap through which a needle may be inserted to draw blood.
 - b. A discard tube must be drawn prior to specimen tubes.
 - c. Drawing blood from a cannula should be done only by specially trained personnel with the permission of the patient's physician.

6. A **fistula** (shunt) is created by a surgical procedure, which fuses a vein and artery together **permanently**.
 - a. It is used for dialysis and should not be used for phlebotomy procedures.
 - b. Specimens should be drawn from the opposite arm.
 - c. If a specimen must be drawn from this arm cleanse the site thoroughly.
 - 1) Primary risk is infection and inflammation which may shut down all veins.
 - 2) Surgery would be required to put in a new shunt.

J. Donor Room Collections

1. Donor interview and physical *serve two purposes*:
 - a. To protect donor by ensuring that the donation will not endanger their health.
 - b. To protect potential recipient from blood transmitted diseases.

2. Donor interview
 - a. Questions about current health history: cancer, heart or liver disease, symptoms associated with AIDS and any current infections.
 - b. Should be done in such a manner as to ensure privacy as many questions about sexual practices/history are asked.
 - c. Blood centers have a standardized questionnaire based on criteria established by the American Association of Blood Banks (AABB).
 - d. Deferrals may be temporary or permanent based on oral history.
 - 1) Permanent deferral: hepatitis after age 11, most cancers, heart disease, IV drug abuser, and AIDS.
 - 2) Temporary deferral, usually 12 months: transfusion, major surgery, pregnancy, STD, recent inmate of penal institution, etc.

3. Donor physical performed to confirm that the donor is healthy and includes the following:
 - a. Weight - minimum is 110 lbs.
 - b. Temperature - cannot exceed 99.5 F
 - c. Blood pressure - cannot exceed 180 systolic and 100 diastolic

- d. Hematocrit - minimum of 38
 - e. Hemoglobin - minimum of 12.5 g/dl
 - f. Phlebotomy site must be free of lesions
 - g. General appearance - not excessively nervous or appear to be under the influence of drugs or alcohol.
4. Collection of donor's blood
- a. Prepare the phlebotomy site to a state of surgical cleanliness using alcohol and Betadine.
 - b. Apply tourniquet and, using a 15-18 gauge needle, perform the venipuncture.
 - c. Unit of blood should be collected within 10 minute, mixing of the blood bag with anticoagulant should be performed frequently during collection.
 - d. Tubing is clamped upon completion, remove needle and apply pressure.
 - e. Have donor sit up on donor chair for approximately 5-10 minute after donation, then release to lounge.
 - f. Donor should remain seated in lounge with refreshments offered for 10-15 minutes prior to leaving.
5. **Autologous donation**
- a. Donation of blood by the patient to be given back to the patient during elective surgeries, ie, total hip replacement, heart surgery, etc.
 - b. Doctor will write an order for the number of units needed, may be up to 4.
 - c. Donor requirements are not as strict, as this blood will only be used for this patient.
 - d. Safest transfusion possible.
6. **Directed donors**
- a. Patient is unable to donate autologous blood and has friends and relatives donate blood for their use.
 - b. Expensive and the least safe type of blood to use of the options available.
7. **Therapeutic phlebotomy**
- a. Procedures where removal of blood is beneficial to the patient, i.e., polycythemia vera.
 - b. Physician must provide a written request.
 - c. May be done at the blood center or hospital depending on physical condition of patient.

K. The Emergency Center

- 1. Phlebotomist's role will vary from state to state, hospital to hospital.
 - a. Local laws may allow phlebotomists to start IVS in some states, prohibit in others.
 - b. Phlebotomist needs to become familiar with limitations and expectations at their particular institution.
- 2. Atmosphere very different.
 - a. ER chronically filled with people in pain, ranging from minor illnesses or injuries to major trauma.
 - b. Patients who have no regular doctor us ER for treatment of chronic illnesses.
 - c. Family members who accompany the patient may be very emotional and vocal.

3. Patients are prioritized at a central reception area according to severity of illness or injury.
 - a. **Triage** is a procedure where by medical professionals evaluate each patient and determine which patients need immediate attention and which ones can wait.
 - b. Stressful for patients with minor illness/injuries, as they may be continually “bumped” back if more serious patients come in during the waiting period.

4. Stress level may be very high.
 - a. Phlebotomists have 2 responsibilities:
 - 1) Be completely familiar with **all** equipment and very skillful in blood collection.
 - 2) When specimen is needed STAT, respond quickly and be able to successfully collect the proper volumes in the proper tubes, there may not be time for a recollect.

 - b. It is **vital** that the phlebotomist have the ability to follow orders **exactly** and not require extensive, time consuming directions.

 - c. Phlebotomist must be able to handle the sight and sound of traumatically injured patients in pain, profuse bleeding, disfigurement due to injuries, moaning and groaning.

 - d. Due to stressful environment, tension runs high and minor personality conflicts occurs more readily.
 - 1) Phlebotomists and other ER personnel must learn to resolve and quickly dismiss irritations and loss of temper which may interfere with patient care.
 - 2) Requires a mature, responsible personality.

 - e. The ER is not for everyone, some work for a short time and can’t handle it, others thrive on the stress and excitement and wouldn’t work anywhere else.

 - f. Experienced, confident phlebotomists are best suited for these positions and must be able to perform their duties without distraction.