

**SALEM HOSPITAL  
SALEM, OREGON 97309**

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| Department: Regional Laboratory        | <b>TITLE: ARTERIAL BLOOD GAS<br/>COLLECTION</b> |
| Area – Phlebotomy Services             | Effective Date: 11-25-96                        |
| Authored By: Craig Judge, Diane Duncan | Revised: 10-12-2000 & 04/2003                   |
| Policy #: B-1                          |   |
| Attachments:                           | Date removed from service:                      |

**PURPOSE:**

Arterial blood is the preferred specimen for Blood Gas determinations. Arterial punctures are technically difficult with potentially more risk for the patient than venipuncture; therefore, in clinical practice, it is reserved for the most essential purposes. Conditions that commonly utilize the measurement of blood gases include chronic obstructive pulmonary disease (COPD), cardiac and respiratory failures, severe shock, lung cancer, diabetic coma, coronary bypass, open heart surgery, and respiratory distress syndrome (RDS) in premature infants. Patients requiring blood gas determinations are often critically ill and require vigorous measures to support life through assisted ventilation using mixtures of gases tailored, in response to laboratory findings, to serve individual needs.

**POLICY:**

Salem Hospital employees designated to perform arterial collections must receive initial training and competency assessment through the Phlebotomy Services Supervisor in the laboratory. Central Laboratory Phlebotomy staff collect the majority of arterial blood gas samples, with the remainder of samples collected by Critical Care Nursing, Critical Care Respiratory Therapy staff, and Emergency Department Phlebotomy staff. All Salem Hospital employees performing arterial collections are required to participate in annual competency assessment. These annual activities are coordinated through the Phlebotomy Services Supervisor and will include an observed collection in addition to other tools.

- Performance of arterial collections is limited to physicians and the following Salem Hospital employee groups
- Laboratory Phlebotomists, Critical Care Nursing staff, Critical Care Respiratory Care staff & Emergency department phlebotomists.
- All Salem Hospital employees collecting arterial samples must complete initial training, successful initial and annual skills and competency assessments.
- Each clinical area & employee group will have designated staff as "Lead Trainers" that will train new staff and conduct annual competency assessments. Training and ongoing annual assessment of designated lead trainers is the responsibility of the Laboratory Phlebotomy Services Supervisor.
- Documentation of initial training, initial and annual competency assessments are maintained by the individual managers.
- Arterial punctures must not be attempted on patients less than two years of age. The patient's physician or nurse will facilitate collection of samples on this age group.

- Good judgment must be used when drawing small children. If the phlebotomist doubts his or her own ability to draw the sample, a more experienced phlebotomist must be asked for assistance.

### **SPECIMEN REQUIREMENTS:**

A standard blood gas collection kit is used in all areas. The collection kit utilizes dry lithium heparin and a syringe volume preset collection system. Routine practice is to preset the volume at 3 mL. for arterial blood gas collections. and to expel any air in the syringe after sample collection and to transport on ice to the central laboratory.

The laboratory is responsible for validating any blood gas collection system prior to house wide use.

### **MATERIALS/EQUIPMENT:**

Prepackage Concord Provent (SIMS )sterile arterial blood gas sampling kit includes:

- 1- 3cc plastic syringe with dry lithium heparin  
syringe contains approximately 25 USP units of neutralized heparin per cc capacity
- 1- 22G X 1 needle (attached)
- 1- Filter Pro syringe cap

Other items required by not Included in Kit:

- 1- Betadine swab (2% Iodine Sepp)
- 1- Sterile 2 X 2 gauze pad
- 1- pair of gloves

### **PROCEDURE:**

1. Patient Preparation
  - A. The phlebotomist must wash their hands, prior to attending to the patient, with either soap and water or "waterless soap."
  - B. Patient identification is made by cross-checking patient orders against patient arm band and room number for accuracy. See procedure: *Positive Patient Identification 2.25*
  - C. Patient is informed that the collection is an arterial puncture requested by their physician. Inform them that the puncture could be more painful than a venipuncture and that the site must be held with pressure for a at least 5 minutes. If the patient is on anticoagulants, it may require additonal holding time until bleeding has completely stopped. If bleeding persist longer than 10 minutes contact the patients nurse.
  - D. Obtain and record preliminary patient information of patient temperature, and oxygen therapy (how much and how receiving or room air.)
2. Site Selection
  - A. **Radial artery** . The radial artery is the preferred site for arterial puncture as the ulnar artery provides collateral circulation to the wrist and it is close to the surface of the wrist and easily accessible. If both radial arteries are unacceptable for use the next site would be the brachial artery.

- B. **Brachial artery.** This site is reserved for secondary use as the median and ulnar nerves and the basilic vein are in close proximity to the brachial artery. The femoral is the last site of choice
- C. **Femoral artery.** Infection is a risk at this site and it may be more difficult to control the bleeding at this site post puncture. Pressure must be applied at this site for a minimum of 10 minutes. Femoral punctures are only done by request of the physician. They are performed most frequently during "Code 99" because it is usually the easiest site to palpate and puncture .

### 3. Preparing the Site

Prior to performing a radial artery puncture, it is important to determine that the ulnar artery is capable of providing collateral circulation to the hand by performing the Allen Test.

#### A. Allen Test for collateral circulation

- 1) Have the patient extend their wrist (over a rolled towel may be helpful) and ask them to make a fist.
  - 2) Collector applies digital compression on the radial and ulnar arteries.
  - 3) Instruct the patient open and close their hand several times, until the hand pales.
  - 4) Release the pressure on the ulnar artery, keeping compression on the radial artery.
  - 5) If upon opening the hand , blood fails to return to the palm and fingers, there is indication of obstruction of the blood flow. DO NOT perform puncture in that artery. Examine the radial artery in the other arm. If both hands fail to have collateral circulation, the brachial site should be used.
- B. Palpate the artery.
  - C. Cleanse the area of puncture with the betadine swab ( 2% Iodine Sepp), by using a circular motion, starting from the inside and moving outward.
  - D. Put on gloves.

### 4. Performing the Puncture

- A. Prepare the syringe by setting the preset volume and positioning the needle with the bevel side up.
- B. Enter the artery at a 45 degree angle (radial) (90degree for brachial) slowly, until blood appears in the needle hub. If blood does not appear, the needle may be slightly redirected but remain under the skin.  
NOTE: If you are unsuccessful after two attempts then withdraw the needle and allow the patient to rest. Allow someone else to perform the puncture. Use a new syringe and needle with each attempt.
- C. When the preset volume has been collected, remove the needle and apply firm pressure for a minimum of 5 minutes (5 for radial or brachial, 10 for femoral puncture) by placing the sterile guaze pad over the puncture.
- D. Expel any air from the syringe, replace the needle with the syringe cap provided, and rotate the syringe to insure thorough mixing of the sample with the dried heparin.

### 5. Recording Information on the Requisition (blue blood gas slip)

- A. Record the sample type collected (arterial, venous, etc.)
- B. Record the oxygen status ( % O<sub>2</sub>, LPM, room air, etc.)
- C. Record the patient temperature.
- D. Record the site collected from (radial , brachial, or femoral).
- E. Record the side collected (right or left)

- F. Record , if performing radial artery puncture, the results of the Allen test (OK or NOK for R or L puncture side)
6. Transport the sample to the central laboratory immediately. If there are any expected delays (greater than 10 minutes from collection to delivery) , place the labeled arterial syringe sample in a bag inside an extra bag of ice for transportation. (Blue record slip included).

Possible Complications:

- A. Hematoma -- Higher pressure in arteries compared to veins is more apt to leak through the puncture site, especially if appropriate post puncture pressure is not applied for adequate time. Hematoma is greatly enhanced in patients receiving anticoagulant therapy.
- B. Arteriospasm -- A reflex constriction of the artery in response to pain or stimuli. This may stop blood flow although the needle is properly located in the lumen of the artery.
- C. Thrombosis -- A thrombus may form if the inner wall of the vessel is injured. The incidence of obstruction of an artery by a thrombus is directly related to the size of the cannula and the duration of cannulation and inversely related to the diameter of the artery and the rate of blood flow in the artery.
- D. Infection -- Inadequate cleansing of the arterial puncture site, resulting in introduction of microorganisms into the arterial circulation is more likely to cause infection than poor cleansing in a venipuncture. With arterial punctures the organisms are easily transported to areas of the body without coming into contact with protective capabilities of the lymphatic system by transport through the venous system.
- E. Nerve damage -- Risk of nerve damage is greater with an arterial puncture, due to the need to puncture deeper into tissue to reach the artery, which increases the possibility of encountering a nerve.

**LIMITATIONS OF PROCEDURE:**

SOURCES OF SAMPLE ERROR:

- A. Air in the sample syringe -- The atmospheric oxygen enters the specimen and carbon dioxide from the specimen enters the air bubble.
- B. Clotted Sample -- Caused by inadequate mixing of the specimen with anticoagulant after collection.
- C. Delay in testing a sample not on ice -- Blood cell metabolism continues utilizing oxygen and produces carbon dioxide and acids that lower pH.
- D. Insufficient patient information documentation -- No patient temperature. No oxygen therapy information. Site of puncture and Allen test not recorded.
- E. Patient hyperventilation during procedure can cause false changes in metabolic status.

**REFERENCES:**

National Committee for Clinical Laboratory Standards Approved Standard H11-A2: Percutaneous Collection of Arterial Blood for Laboratory Analysis. NCCLS , Villanova, PA, May 1992

Susan King Stasinger, Marjorie A Di Lorenz: Phlebotomy Workbook., Chapter 18; Arterial Blood Collection, F.A. Davis Co.

Gerald F. Dixon, M.D., Video Presentation Material , *Routine Radial Artery Puncture for Arterial Blood Gas Analysis*

Shapiro, BA, et. al: Clinical Application of Blood Gases. Year Book Medical Publishers, Chicago, 1982.

**DISTRIBUTION OF PROCEDURE:**

Clinical Laboratory Phlebotomy Procedure Manual  
 Chemistry Supervisor's Office  
 Critical Care Respiratory Therapist  
 Critical Care Nursing Manual  
 COM LAB  
 DOS  
 KEIZER OUTPATIENT LAB  
 Phlebotomy Supervisor's Office

| <b>PROCEDURE ACCEPTANCE AND REVIEW</b> |       |
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| VALIDATED BY:                          | DATE: |
| SECTION SUPERVISOR:                    | DATE: |
| ADMIN. DIRECTOR:                       | DATE: |
| PATHOLOGIST:                           | DATE: |
| Reviewed Annually By:                  | DATE: |
|  | DATE: |
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