Arterial Punctures
Blood Gas Collections (ABG)

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Objectives:
• Review – define terms
• State reasoning for collecting ABG’s
• Discuss common ABG’s parameters
• Identify equipment and preferred collection sites
• Explain the reasoning for using the modified Allen’s test
• Look at procedure for collecting ABG’s
• Identify hazards associated with arterial collections
Why do we collect ABG’s?

- Used to diagnose respiratory efficiency or to diagnose/manage respiratory diseases
- Information includes:
  - Oxygenation (ability to pick up O2)
  - Ventilation (eliminating CO2)
  - Acid-base balance (body pH)

Commonly Measured Parameters with ABG

- pH – normal value of 7.35 to 7.45
- PO2 – partial pressure of O2, 80-100 mmHg
- PCO2 – partial pressure of CO2, 35-45 mmHg
- HCO3 – Bicarbonate, 22-26 mEq/L. Factor associated with acid/base balance
- O2 saturation – O2 saturation, 97-100% at optimum. Patients on room air at 92-97%
  - (Room air is around 21% oxygen)
- BE – base excess, acid/base balance, (-2) to (+2). Reflects HCO3 value.
**Arteries Used for Collection**

- For most blood gas collections, the arteries of choice, in order of preference are:
  1. Radial
  2. Brachial
  3. Femoral
  4. Dorsalis Pedis (foot) is a 4th option, may written physician order only based on institutional policy

**Radial Artery**

- The first choice and most commonly used site for ABG collection
- Most superficial
- Easy access
- Located on thumb side of wrist
- Because of the fact that the ulnar artery also supplies blood to the hand (collateral circulation), the blood supply to the hand will remain viable
- NOTE: The ulnar artery is not an approved site for an arterial puncture
**Radial Artery**

- Thumb side of wrist
- Located by palpating pulse

![Diagram of Radial Artery and Ulnar Artery]

**Brachial Artery**

- The advantage to using the brachial artery is that it is large and easy to locate, feeling for the pulse. It is located on the inside of the arm lateral to antecubital fossa
- Disadvantages include:
  - It is much deeper
  - It lies close to the basilic vein
  - It lies close to the median nerve
  - Larger vessel, so the chance of clot formation is much higher
  - Compression is more difficult so the risk of a hematoma is higher
Brachial Artery
- Located on inside of the arm
- Palpate for pulse

Femoral Artery
- Located in the groin, lateral to the pubis bone
- Advantage, it is a very large artery and can be easy to palpate pulse
- Reserved for emergency, code or doctor request
- Disadvantages include:
  - Poor collateral circulation may be an issue if artery is damaged
  - Because of location, infection risk is higher
  - It lies in close proximity to the femoral vein
  - Difficulty compressing site: direct pressure is applied for 10 minutes with the femoral artery
Femoral Artery

- Deep in the groin area

Steady (Stable) State

- It is extremely important that the patient be in a “stable-state” prior to collecting the sample, to avoid skewed results. This includes:
  - No exercising for at least 20 minutes (walking included)
  - No respiratory changes (no O2 Therapy Device changes) within the last 20 minutes
  - No suctioning in the last 20 minutes
  - No treatments in the last 20 minutes
- Keep in mind, in emergent situations (codes, respiratory distress) we are not concerned with a “stable-state” – this is life or death!
Equipment

- Filter-Pro
- Heparin Syringe
- 70% Isopropyl Alcohol
- 23-gauge needle

Performing the Allen’s Test

- The Allen’s Test is used to determine collateral circulation is present:
  - If you are unable to obtain a pulse from site, or radial site is weak or sporadic, use Allen’s test to determine if collateral circulation is present
  - Color changes within 5-15 seconds indicate collateral circulation and radial punctures at this site are acceptable.
Allen’s Test

• Apply firm pressure to the radial and ulnar pulse sites. Have the patient rapidly open and close his/her hand until the palm is blanched.

Allen’s Test

• Instruct the patient to open his/her hand and then release the pressure on the ulnar artery only. Color ("redness") should return to hand within 5-15 seconds after releasing ulnar pressure.
**Arterial Collection – Radial Artery**

- Arm is extended and wrist flexed about 30 degrees to stretch and fix the soft tissues over ligaments and bone. (Use a rolled towel/washcloth or pillow to assist positioning)
- Locate radial by assessing for pulse
- Clean site and gloved fingers with 70% isopropyl alcohol
- Relocate pulse with “off” hand
- Holding syringe like a dart, puncture skin at a 30 – 45 degree angle, bevel up and facing the blood flow. This should be 5-10 mm from the finger over the artery
- Collect specimen
- Withdraw needle and apply 5 minutes of direct pressure
  - Assess bleeding – continue applying pressure until bleeding has stopped
- Expel air bubbles
- Mix blood in heparinized syringe
  - 30-seconds horizontal rolling (first)
  - 5 inversions (next)

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**Prepare Syringe**

Remove Filter Pro
push plunger up to dispel air and attach needle
Site Selection

• With wrist flexed at 30-degree angle, palpate pulse to locate artery

Site Prep

• Cleanse site with 70% isopropyl alcohol
Arterial Puncture

- Holding the syringe like a dart, puncture artery at a 30 to 45-degree angle and collect specimen

Collect Sample

- Perform collection per work unit procedure

  Collect 2.0mL sample

  Difficult stick:
  Collect minimum of 0.5mL

*Note: Follow your institutional guidelines*
Specimen Preparation

- Tapping the syringe, or “flicking” with a finger, move air bubbles to the top to expel through Filter-Pro.

Expelling Air

- Keep fingertip on edge of Filter-Pro to prevent it from being forced off the syringe.
Mixing Sample

Roll back and forth horizontally – 30 seconds

Rotate wrist back and forth - 5 inversions

Arterial Collection Brachial or Femoral Artery

- Locate artery by assessing for pulse
- Clean site with 70% isopropyl alcohol
- Relocate pulse with "off" hand
- Holding syringe like a dart, puncture skin at a 45-90 degree angle to access the brachial artery, and a 90 degree angle for the femoral artery. The bevel of the needle is up and facing the blood flow. This should be 5-10 mm from the finger over the artery.
- Collect specimen
- Withdraw needle and apply 5 minutes of direct pressure for brachial and 10 minutes for femoral
- Expel air bubbles
- Mix blood in heparinized syringe
Collection Considerations

- Needle used is a 23-gauge (radial), or 22-gauge (brachial/femoral). Specimen is collected in 3 ml Heparin syringe; 0.5 ml minimum, 2 ml ideal
- All air bubbles must be removed from syringe (tapping syringe and expelling air through Filter-Pro)
- 5 minutes of pressure (10 for femoral puncture) is applied, followed by assessment of continued bleeding. If hemostasis has not been reached, continue to apply pressure. (Note: a gauze-wrap is not an alternative to direct pressure)
- No more than 6 ml of blood may be collected from an arterial site (unless indicated by physician)
  - Note: Follow your institutional guidelines/SOP

Transport and Send

- Ideal specimen is collected and sent immediately to HCL, as it is good for 15 minutes at room-temp
- If specimen delivery is delayed more than 15 minutes, place on ice
- Iced specimens must be delivered and tested within 60 minutes
  - Note: Follow your institutional guidelines/SOP
### Hazards & Complications of Arterial Punctures

- Arteriospasm – caused by the pain/irritation of needle insertion, an involuntary constriction of an artery
- Discomfort – a bit more than a venipuncture
- Hematoma – more vascular pressure than a vein. Apply 5 minutes of direct pressure
- Thrombus – from injury to inner wall of artery
- Vasovagal response – syncope is more likely from an arterial puncture than a venous puncture, caused by nervous-system response (increased vagus nerve stimulation)

### Preanalytical Concerns

- Air bubbles – It is imperative that all air bubbles are removed from the syringe to avoid skewed results
  - An air bubble in the syringe will increase the pO2 if it is low or decrease the pO2 if it is high in the patient’s blood and lower the pCO2
- Delay in lab analysis – O2 is metabolized even in the heparinized-syringe, changing the results. If unable to get to the lab within 15 minutes, sample must be iced
- Improper mixing – sample must be mixed in the syringe immediately to avoid clotting
- Venous blood – arterial blood is brighter and will “pulsate” into the syringe
  - Arterial blood contaminated with venous blood will decrease pO2, increase pCO2, and increase pH
Questions & Discussion