



## Arterial Blood Gas (ABG) Sampling- Clinical Procedural Skills Guidance



## Learning Objectives

- Understand the role of Arterial Blood Gas (ABG) Sampling
- Describe the contraindications to ABG sampling
- Describe the equipment necessary for ABG sampling
- Understand the procedure for ABG sampling including performing Allen's test
- Understand the complications of ABG sampling

## **Role of ABG sampling.**

An ABG provides useful information in a variety of clinical scenarios and provides clinicians with useful information about a patient's respiratory and metabolic function. ABG sampling allows

- Interpretation of oxygenation levels
- Assessment of potential respiratory derangement
- Assessment of potential metabolic derangement
- Monitoring of acid-base balance
- Assessment of carboxyhaemoglobin in carbon monoxide poisoning
- Assessment of lactate

Other parameters are measured in an ABG including electrolytes, glucose and haemoglobin, however local policy should be followed when using such information to make decisions about clinical care.

ABG sampling can be conducted either as a single measurement or more commonly as repeated sampling to assess the patient's response to intervention. Patients in a critical care environment often have an arterial cannula inserted to allow invasive blood pressure monitoring and facilitate repeated arterial blood sampling.

## VENOUS BLOOD GAS SAMPLING

Much of the information obtained from an arterial blood gas sample is equally available from a venous blood gas sample (especially lactate used in assessment of sepsis)

Before taking an arterial blood gas sample- consideration should always be given as to whether this investigation is required or could the necessary information be obtained from a venous blood gas sample which can be taken from a cannula or during venepuncture for other blood samples.

Arterial sampling is particularly useful in carbon dioxide assessment and is necessary to evaluate carboxyhaemoglobin levels.

## THINK BEFORE ARTERIAL SAMPLING

## **Contraindications to ABG Sampling**

- Local infection (evidence of erythema or swelling at the sample site)
- Distorted anatomy (unable to palpate the pulse). Anatomy is often distorted by repeated previous attempts at ABG sampling.
- Arterio-venous fistula at or near the sample site.
- Known coagulopathy or recent thrombolysis
- Peripheral vascular disease of the limb with the sample site

## **Equipment required for ABG Sampling**

- Appropriate personal protective equipment (gloves, apron, face-mask)
- Accessible and functioning sharps bin.
- Cleaning swab
- Gauze
- Tape
- ABG Sampling Syringe
- Pillow/Blanket for the patient to rest their wrist on when the sample is being taken.

ABG sampling syringes vary between different sites but all of them are heparinised to prevent the ABG sample coagulating between the time the sample is obtained from the patient and then processed in the gas analyser.

Many ABG sampling syringes require some degree of assembly before use- such as requiring the needle to be placed on the syringe and the heparin to be expelled from the syringe before use.

Some ABG sampling syringes are “self-filling” where once the needle enters the artery, the blood pressure will fill the syringe. Other ABG sampling syringes require the operator to withdraw the plunger to aspirate the sample.

## Procedure for ABG sampling

ABG sampling is most commonly performed at the radial artery.

The patency of the ulnar artery must be assessed before ABG sampling from the radial artery. This is to ensure that the arterial supply to the hand will not be compromised should injury occur to the radial artery during the ABG sampling process.

The assessment of the patency of the ulnar artery is called Allen's test.



### ALLEN'S TEST- STEP A

Both the radial and ulnar arteries are occluded with the patient's fist tightly clenched



### ALLEN'S TEST- STEP B

Patient releases their clenched fist.

Pressure on radial and ulnar arteries is maintained



### ALLEN'S TEST- STEP C

Pressure released on ulnar artery

Assess how long the palm takes to return to normal colour.

Normal is less than 2 seconds

Prolongation of time indicates an abnormal test.

**AN ABNORMAL ALLEN'S TEST IS A  
CONTRAINDICATION TO RADIAL ARTERY  
SAMPLING**

1. Obtain verbal consent from the patient explaining the procedure.
2. Check for contraindications.
3. Don the appropriate personal protective equipment.
4. Perform Allen's test to ensure ulnar artery patency.
5. Position the patient's wrist in supination and extension with a pillow or rolled-up blanket underneath the wrist.

Rolled-up blanket  
under the  
patient's wrist



Wrist in  
supination and  
extension

### Position for radial artery sampling

Set-up the tray with the necessary equipment: cleaning swab, ABG sampling syringe, gauze and tape.

6. Clean the patient's skin with the cleaning swab.
7. Palpate for the radial pulse.
8. When the location of the pulse is identified- the operator should fix this between their index and middle fingers.



Patient's radial artery fixed between the operator's index  
and middle fingers.

9. Take the ABG sampling syringe in the other hand and insert the needle distally to the index and middle fingers which are fixing the patient's radial artery.



### Position of insertion of ABG sampling syringe

10. Depending on the ABG sampling syringe, when the needle enters the artery, the syringe will self-fill or there will be a "flash-back" and the operator will require to aspirate using the plunger.
11. Withdraw 1-2 mls of sample
12. Remove the syringe from the radial artery and immediately apply pressure using gauze.

Remove the needle from the ABG sampling syringe and safely dispose of it in the sharps bin. Most ABG sampling equipment sets have a cap to apply to the syringe for transportation to the gas analyser.

Pressure requires to be applied for a longer period than following venepuncture. If the patient is able, they could be requested to apply pressure at the sampling site. Usually at least 5 minutes of pressure is required.

After pressure has been applied, tape the piece of gauze over the sampling site.

### LOCAL ANAESTHETIC

Arterial blood gas sampling can be very painful for patients.

The level of discomfort can be reduced by infiltrating local anaesthetic around the sampling site.

Before using local anaesthetic- ALWAYS ASK ABOUT ALLERGIES

When infiltrated, local anaesthetic can distort anatomy making obtaining the sample more challenging

## Post-Procedure

- Take the sample to the analyser without delay.
- Ensure that the results slip is labelled with the patient's details.
- Ensure that the results are documented in the patient's notes. Avoid simply sticking the results slip into the notes as these easily fall out and are lost.
- Ensure that the patient's inspired oxygen concentration is clearly documented- for example: "breathing room air" or "35% oxygen)
- Check on the patient to ensure that there is no haematoma at the sampling site. In the event of a haematoma- apply further pressure and elevate the affected limb.

Following an unsuccessful attempt- obtain senior help early.

Repeated attempts are very painful for the patient and quickly distort local anatomy making further sampling very challenging.

## **Top Tips for ABG Sampling success**



**Assess the patient for contraindications and balance these against the clinical urgency of the sample. Remember- there is often another site which can be used**



**Become familiar with the ABG sampling equipment- is it self-filling? What kind of cap is provided for transportation to the analyser?**



**ASK the patient about local anaesthetic use**



**Avoid inserting the needle through visible superficial veins- this will result in a mixed arterial and venous sample.**



**If you do not initially enter the artery- it is possible to reposition the needle without withdrawing it from the skin.**



**Make sure you are aware of the location of the nearest functioning gas analyser and you have the necessary credentials to use it.**



**ABG sampling is painful for patients- ensure good communication and consistent reassurance.**