

POLICY AND PROCEDURE FOR

The sampling of an arterial blood gas via an indwelling arterial catheter

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Ratified by: Senior Nursing and Midwifery Leadership Committee

Date Issued: January 2014

Review Date: May 2021

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History

Issue	Date Issued	Brief Summary of Change	Approved by
1	Oct 2013	This is an updated policy for the policy titled 'Procedure for the sampling of an arterial blood gas via an arterial indwelling catheter' in Critical Care dated 2004	SNMLC

For more information on the status of this document, please contact:	Louise Maltby (Band 7 CPE) Daniel West (Band 7)
Date of issue	May 2018
Review due	May 2021
Ratified by	SNMLC
Audience	All Intensive Care Clinical Staff

POLICY AND PROCEDURE FOR THE SAMPLING OF AN ARTERIAL BLOOD GAS VIA AN INDWELLING ARTERIAL CATHETER

1. INTRODUCTION

Definition:

The procedure enables the withdrawal of blood from a transduced indwelling arterial catheter for the means of analysing arterial blood gas values.

2. PURPOSE

Aim:

The procedure aims to provide guidance to the healthcare professional on how to safely withdraw blood from an arterial line to provide a sample for blood gas analysis via an analysing machine. Thereby, utilising a safe and clean technique without any undue stress or discomfort to the patient.

Arterial blood gases are measured to give an indication of pulmonary function (adequacy of ventilation and oxygenation) and metabolic function (the body's ability to maintain acid base balance).

Patients with respiratory disease are at risk of inadequate lung ventilation and inadequate tissue oxygenation. Arterial blood gas sampling will provide information about lung ventilation through the interpretation of partial pressures of carbon dioxide and tissue oxygenation through the interpretation of partial pressures of oxygen.

Patients with certain metabolic diseases and selected drug overdoses are at risk of acid base abnormalities. Acid base problems are diagnosed through interpretation of arterial PH, partial pressure of carbon dioxide and bicarbonate levels (Urden et al 2010).

Blood gas sampling is routine practice in the intensive care unit (ICU), however the importance of its role in the direction of treatment must not be underestimated and unusual or vastly different values must not be acted upon in isolation.

Within this trust there are different types of indwelling arterial catheters available. This includes: Vygon- arterial leadercath, Venisystems- Abbocath, Arrow- arterial catheter and BD- Flow switch arterial cannula.

3. DUTIES AND RESPONSIBILITIES

Staff caring for patients in a critical care setting should have the competency to access an indwelling arterial catheter. The staff should also have the knowledge and skills to respond appropriately to changes and problems relating to this procedure. Staff should be assessed and deemed competent before carrying out this procedure unsupervised.

4. CLINICAL STATE

Indications:

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- The need to evaluate the adequacy of ventilation, acid base balance, oxygenation status and the oxygen carrying capacity of blood.
- The need to assess the patient's response to therapeutic intervention and/or diagnostic evaluation (e.g. oxygen therapy, mechanical ventilation).

The following may assist in the decision whether arterial blood sampling is indicated:

- Initiation of, administration of, or a change in oxygen requirements, or changes in ventilator settings.
- Clinical indicators of respiratory failure – signs of respiratory distress, a fall in pulse oximetry readings, increased end tidal carbon dioxide level.
- Clinical indicators of hemodynamic instability
- Electrolyte levels

Frequency of sampling – the frequency at which sampling is repeated should depend on the clinical status of the patient and the indication for performing the procedure and not on an arbitrarily designated time or frequency. Use of non-invasive ventilation techniques such as pulse oximetry and end-tidal carbon dioxide monitoring reduces the number of arterial blood gases that are required. Therefore, sampling must be done on an individual basis.

Arterial blood samples should always be drawn when the patient is in a stable state. The actual time that is required for the attainment of a steady state differs slightly between patient's disease and activity.

Consequently arterial blood gas samples must be taken:

- 20-30 minutes after a change in oxygen therapy or ventilation.
- Patients breathing spontaneously should be at rest for at least 5 minutes prior to blood sampling.
- 20-30 minutes after endotracheal suctioning, physiotherapy or position changes.

Contraindications:

- None

5. PROCEDURE

Resources required:

- Arterial blood gas syringe
- 5ml syringe
- 2% chlorhexidine in 70% alcohol
- Personal Protective Equipment (PPE): apron, gloves and protective goggles

Checklist:

- Explain the procedure to the patient and relatives
- Ensure all equipment is available and within reach

Action and Rationale:

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- Explain and discuss the procedure with the patient. This is to ensure the patient understands the procedure and gives their valid consent (NMC 2008).
- Wash hands with soap and water. Then apply alcohol hand sanitiser to minimize the risk of cross-infection (Department of Health DH, 2010).
- Press silence button on arterial monitor for duration of sampling. The continual alarm disturbs both the patient and others in the unit. Alarms of no clinical significance should be minimized.
- Check the three-way tap is closed to port (see figure 1). This is done to prevent back-flow of blood and blood spillage.
- Apply PPE to prevent contamination of hands with blood (DH 2010).

Procedure and rationale:

- Remove cap from three-way tap and clean port with 2% chlorhexidine swab and allow to dry. This is to minimise the risk of infection (DH 2010).
- Attach the 5 mL syringe ready for aspiration. The syringe will remove saline, old blood and small emboli from the dead space within the cannula.
- Turn three-way tap to artery and port (see figure 2). To prevent contamination of blood with flush solution.
- Withdraw the appropriate volume of blood (3-5mls) to allow for sampling only of arterial blood. This must be done SLOWLY over 10 seconds to prevent the artery going into spasm (Lipsitz 2004).
- Turn the three-way tap diagonally to close off both the artery and flush (see Figure 3). This is to enable the syringe to be removed without blood loss and to prevent backflow from artery.
- Remove the 5 mL syringe and connect the blood gas syringe. Ensure the gas syringe is open to the artery in order to withdraw the sample.
- Turn three-way tap on to artery and port (see figure 2). This allows the syringe to open directly onto the artery.
- Slowly remove the recommended amount of blood (as specified in manufacturer's instructions-GEM 4000 requires 1ml). To prevent the artery going into spasm, ensuring the correct volume of blood mixes with the recommended heparin in the gas syringe (Lipsitz 2004).
- Turn the three-way tap diagonally to close off both the artery and flush (see figure 3). To prevent haemorrhage or blood spillage.
- Remove the gas syringe, gently rotate syringe. Ensure the blood and heparin contained within the syringe is mixed gently by continuously keeping the blood in the syringe moving until it can be analysed. Apply supplied cap to gas syringe top and push blood to top of cap to remove excess air.
- Apart from the arterial blood sample for analysing, all the remains need to be discarded into a sharps waste bin.
- Analyse the sample at your designated blood gas analysis machine, ensuring the correct patient details are inputted as these can affect the results: correct concentration of oxygen and temperature.
- All the PPE's should be discarded in the clinical waste bin.

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Post procedure:

- Turn three-way tap onto flush and port; apply a sterile swab to the port flush squeezing the actuator. The swab will absorb the blood; preventing contamination this allows for blood to be cleared from the port, reducing risk of thrombosis and micro emboli (Doherty and Lister 2011).
- Turn three-way tap onto flush and artery, flush cannula by gently squeezing actuator. As the cannula is flushed observe digits for signs of blanching, discoloration or complaints of pain from the patient. Blood is cleared from the cannula and arterial tubing.
- Clean port with 2% chlorhexidine in alcohol swab. To minimise the risk of infection (DH 2010).
- Apply sterile Luer-Lok cap and check it is secure. This minimizes the risk of infection and prevents exsanguination.
- Check pressure infuser cuff is inflated to 300 mmHg, thus preventing backflow of blood into circuit.

Complications:**Occlusion:**

- Possible kink of the arterial catheter.
- BD- flow switch arterial cannula may be in the off position.

Haemorrhage:

- Ensure all connections are secure, Leur Lock tight and 3 way tap appropriately adjusted.

Infection:

- Strict use of PPE and hand hygiene is essential, whilst maintaining a clean non-touch technique throughout the procedure.

Artery spasm:

- Limb appears blanched. Stop procedure and allow time for recovery. Warming of the opposite limb can elicit reflex vasodilation.

Thromboembolism:

- Ensure flushing of the line each time a sample is taken. If the catheter is not aspirating or reading adequately, request an urgent review by the Doctors.

Inaccurate results:

- Analyse the sample immediately. After blood is drawn from the artery, it continues to absorb oxygen and produce carbon dioxide.
- Expel any air bubbles in the syringe before analysing.

6. DISSEMINATION AND IMPLEMENTATION

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This policy will be available to view on the trust intranet set up on the critical care pages. Any changes to practice arising from the policy will be disseminated to the appropriate staff by the practice education team within ITU.

7. MONITORING OF COMPLIANCE

An annual clinical audit will be undertaken to monitor the compliance of this procedure. This will be an observational audit of ten procedures in each clinical area where this procedure is performed. This will be overseen by the clinical practice educator in ITU.

8. EQUALITY IMPACT ASSESSMENT

Please refer to Appendix 1

9. ARCHIVING ARRANGEMENTS

This is a trust wide document and archiving arrangements are managed by the quality department, who can be contacted at request for a master/archived copy.

10. REFERENCES

- Department of Health 2010 *Clean Safe Care. High Impact Intervention. Taking Blood Cultures. A Summary of best practice.* Department of Health, London.
- Doherty L and Lister S (Eds) (2011) *The Royal Marsden Manual of Clinical Nursing Procedures.* 8th Edn. Blackwell Science.
- Lipsitz EC 2004 Cannulation injuries of the radial artery. *American Journal of Critical Care.* 13 (4) 314-319
- Nursing and Midwifery Council (NMC) (2008) Consent. NMC, London.
- Urden LD, Stacey KM and Lough ME (2010). *Critical Care Nursing: Diagnosis and Management* (6th Edn.) St Louis, Mosby Inc.

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Appendix 1

Equality Impact Assessment Summary

Name: Esther-Louise Rogers

Policy/Service: The Sampling of an arterial blood gas via an indwelling arterial catheter.

Background

The aim of this policy is to give clear and concise guidelines on how a sample of blood required for analysis should be obtained from an indwelling arterial catheter.

Patients requiring arterial lines usually are at risk of inadequate lung ventilation and inadequate tissue oxygenation. Arterial blood gas sampling will provide information about lung ventilation through interpretation of partial pressures of oxygen and carbon dioxide.

Patients with certain metabolic diseases and selected drug overdoses are at risk of acid base abnormalities. Acid base problems are diagnosed through interpretation of arterial PH, partial pressure of carbon dioxide and bicarbonate levels (Urden et al 2010).

The policy outlines pre and post care required when caring for patients with an arterial line, identifies potential risk factors and identifies complications associated with sampling.

This policy is only relevant to the areas where there are patients who have an indwelling arterial catheter.

Methodology

This policy does not exclude any particular group of people. It encompasses all patients within the same group. The Policy itself is created from using best practice guidelines, national guidelines and Trust policies.

Key Findings

No adverse impacts for any groups of patients that need the indications are identified.

Conclusion

In conclusion this policy offers a set guideline for 'The Sampling of an arterial blood gas via an indwelling arterial catheter', for healthcare practitioners who may undertake this task in their role. Staff must adhere to this policy as it is set out to ensure safe practice for themselves and their patients.

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Recommendations
There should be no changes made to the policy following the EIA process but the guidelines will continue to be reviewed every two years.

Guidance on Equalities Groups

Race and Ethnic origin (includes gypsies and travellers) (consider communication, access to information on services and employment, and ease of access to services and employment)	Religion or belief (include dress, individual care needs, family relationships, dietary requirements and spiritual needs for consideration)
Disability (consider communication issues, access to employment and services, whether individual care needs are being met and whether the policy promotes the involvement of disabled people)	Sexual orientation including lesbian, gay and bisexual people (consider whether the policy/service promotes a culture of openness and takes account of individual needs)
Gender (consider care needs and employment issues, identify and remove or justify terms which are gender specific)	Age (consider any barriers to accessing services or employment, identify and remove or justify terms which could be ageist, for example, using titles of senior or junior)
Culture (consider dietary requirements, family relationships and individual care needs)	Social class (consider ability to access services and information, for example, is information provided in plain English?)

ACTION FIGURES:

Figure 1:

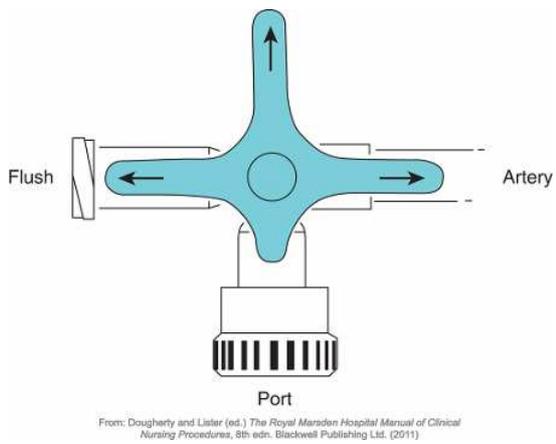


Figure 2:

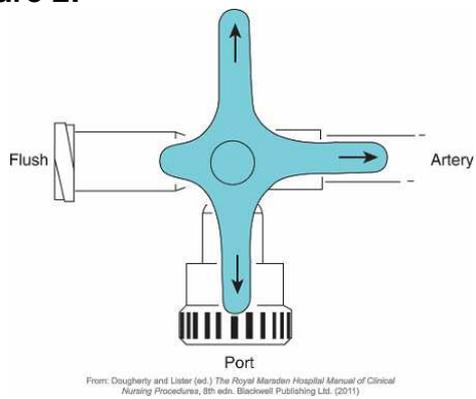


Figure 3:

