

Earlobe Capillary Blood Gas Sampling Procedure

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1					

Brief Summary of Document:	The purpose of this protocol is to outline the minimum standard for Ear Lobe Capillary Blood Gas Sampling for Respiratory Practitioners in secondary, primary and community care settings.
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Scope	This procedure must be followed by all HealthCare Professionals involved in the provision of ear lobe capillary blood gas sampling within secondary, primary and community care in Hywel Dda University Health Board. All registered healthcare professionals acting within this procedure must have attended a course, which includes capillary blood gas sampling as part of the formal content and must have completed 10 successful supervised attempts.
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To be read in conjunction with:	289 -Record Keeping for Nurses and Midwives Policy 192 - Health Records Management Policy 156 - Risk management Strategy & Policy
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Owning committee/group	Respiratory Planning and Delivery Group
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Reviews and updates		
Version no:	Summary of Amendments:	Date Approved:
1	New Procedure	

Glossary of terms

Term	Definition
PaO ₂	Partial pressure of Oxygen
PaCO ₂	Partial pressure of Carbon Dioxide
pH	Unit of measurement of acidity of blood
HCO ₃	Bicarbonate
SaO ₂	Arterial oxygen saturation measured by pulse oximetry
NIPPV	Non Invasive Positive Pressure Ventilation
LTOT	Long term Oxygen Therapy
ABG's	Arterial Blood gases
EBG	Earlobe blood gases
NOT	Nocturnal Oxygen Therapy
AOT	Ambulatory Oxygen Therapy
SBOT	Short Burst Oxygen therapy
HOS Team	Home Oxygen Service Team

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1. AIM

Arterial blood gases (ABG's) represent the 'gold standard' method for acquiring patients' acid base status (Honarmand 2006). Arterial blood sampling potentially can cause spasm, intraluminal clotting, bleeding, haematoma formation and transient obstruction of blood flow.(Williams 1998).

Patients often report this procedure as a painful and unpleasant experience (Crawford 2004).

Earlobe blood gas (EBG) sampling is a useful alternative to ABG's. Properly obtained capillary blood samples accurately reflect arterial blood gas measures of PO₂, PCO₂ and pH (Murphy 2001, Wimpress et al 2005, Zavorsky et al 2007)

2. OBJECTIVES

The purpose of this procedure is to provide a clear framework to enable all healthcare professionals to:-

- Demonstrate competence in ear lobe capillary blood gas sampling
- Demonstrate understanding of normal blood gas readings and identify according to guidelines those who need LTOT, NOT, SBOT, AOT.
- Demonstrate the ability to undertake all appropriate quality control measures.

See Appendix 1 for competency assessment form

3. SCOPE

This procedure must be followed by all healthcare professionals involved in the provision of assessing patients for long term oxygen therapy within secondary and community care in Hywel Dda University Health Board. Earlobe capillary blood gas sampling is only to be performed by registered healthcare professionals.

Hywel Dda University Health Board recommends that healthcare professionals attend a course which includes capillary blood gas sampling as part of formal content, and must have successfully completed 10 supervised attempts, of which the last 5 should be sequential before they can act independently.

4. BACKGROUND TO THE TEST

a. Introduction

This procedure outlines the health board guidance for the undertaking of earlobe capillary blood gas sampling. It is intended as a guide to practice but does not remove the need for clinical judgement when carrying out a procedure.

Capillary blood gases are taken to evaluate the patient's:

- Oxygenation
- Ventilation
- Acid base balance

Capillary blood gas samples are usually obtained from the earlobe.

Key measurements in Capillary Blood GASA analysis:

Measured parameters

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- Hydrogen ion concentration – pH
- Oxygen tension – PaO₂
- Carbon dioxide tension – PaCO₂

Calculated parameters

- Bicarbonate concentration HCO₃
- Base Excess
- Oxygen concentration

Normal arterial blood gas values	
PaO ₂	>10.6kPa
PaCO ₂	4.7-6.0kPa
pH	7.35-7.45
HCO ₃	24-30mmol/L
SaO ₂	≥95%
Base Excess	-2 to +2
TCO ₂	

b. Indications

Earlobe capillary blood gas sampling may be indicated in the following circumstances:

- Home assessment for LTOT, SBOT, AOT, NOT
- Home annual review of any person on supplementary oxygen
- Referrals to the HOS team for assessments that have a SaO₂ of ≤92%.
- Inpatient assessment of supplementary oxygen requirements
- Inpatient monitoring of a patient commenced on NIPPV

c. Referrals

Referrals can be accepted from any registered health care professional within Hywel Dda University Health Board.

5. EQUIPMENT & PREPARATION FOR TESTING

a. Contraindications to Testing.

Capillary sampling should not be performed where there is;

- Inflamed, swollen or oedematous tissue
- Cyanotic or poorly perfused tissues
- Localised area of infection
- Patient with shock

Contraindications are relative and sometimes the need to perform the test will override the risks to the patient procedure. At these times guidance from Consultant Physician should be sought.

b. Health & Safety

- General considerations.

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All staff are reminded of general Health Board Health & safety policies available on the intranet.

c. Infection Control

- **General considerations.** All staff are reminded of general Health Board Infection Control policies available on the intranet.
- **Cleaning & disinfection of equipment.** iSTAT machine cleaned regularly in accordance with manufacturer's guidance.
- **Cartridges**
 - Store in the fridge
 - Check expiry date
 - Use at room temperature.
 - Once removed from fridge use within 2 months do not return to fridge

d. Quality Control

- **Quality control.**
 - Each iSTAT analyser should undergo a quality control using the simulation.
 - Every new batch quality control using aqueous control solutions
 - External monthly quality control via Biochemistry department.
- **Pre-Test Instruction**
- **Insert user code** – 5 digit code
- **Assess the patient for contra-indications to earlobe capillary blood gas sampling.** It should not be assumed that these have already been assessed by the referrer, and for some patients a degree of clinical judgement will be required in interpreting contraindications. Ensure the patient is not allergic to the vasodilator cream
- **Document patient demographics** & enter required values into the iSTAT machine..Hospital Number or identifiable number in case further sampling is needed. Age and gender – selecting the appropriate reference values if necessary.
- Cartridge and operator code.
- **Explain the procedure** to the patient so that they understand what is required to obtain the earlobe capillary blood gas sample.

e. Performing Earlobe Capillary Blood Gases

ACTION	RATIONALE
Explain the test procedure to the patient Obtain verbal consent	To obtain informed consent and co-operation
Wash hands and put on protective gloves	To reduce the risk of nosocomial infection and avoid contamination of blood sample
Position the patient in the semi-recumbent position	To decrease the risk of vasovagal response
Remove any earrings from the left ear	To identify the most appropriate site

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(this is the most convenient side for sample taking for right handed technicians)	
Pin back hair if necessary	
Place absorbent towel over the patients shoulder	To protect patient's clothing from blood spillage
Apply vasodilator cream liberally to earlobe, (Transvasin Cream is recommended.) Leave on until ear becomes red and warm (can take up to 20 minutes)	To increase ear lobe blood flow (arterialised capillary blood sample) this reducing the arteriovenous oxygen content differences (Hughes 1996)
Wipe off cream and rub earlobe vigorously with gauze	To stimulate circulation and remove traces of cream
Hold earlobe firmly in place using a surgicut stab the ear on a fleshy part of the lobe (towards the edge if possible) to a depth of 3mm.	To obtain the arterialised capillary blood sample. To avoid piercing the other side
Blood flow from the puncture site should flow freely. Blood flow can be encouraged by stroking the earlobe gently DO NOT squeeze the ear. If blood flow insufficient stab again.	To avoid haemolysis of the sample i.e. the rupture of red blood cells, thus releasing their content into the plasma
Always wipe away the first drop of blood	To avoid contamination with tissue fluid
Collect blood in a heparinised capillary tube by holding the tube with one end in the well of blood. Fill capillary tube to black line. Gently rotate the capillary tube whilst obtaining blood sample The tube should be held horizontally or with the end in the well of blood angled slightly downwards. Ensure there are no bubbles or gaps.	To aid capillary tube filling. To obtain adequate sample for testing Activates the heparin in the tube and prevents clotting of the sample. Air bubbles result in gas equilibration between the air and the arterial blood leading to a decrease in PaCO ₂ (Williams 1998) Prevents blood from clotting.
Cover the wound front and back with a piece of gauze and ask the patient to apply pressure until the bleeding stops. Apply waterproof dressing to procedure sight if indicated.	To decrease the risk of bruising and bleeding To avoid risk of infection
Insert the tube into the cartridge well using the plunger insert the required amount of blood. Fold the flap over the well and snap into place.	To ensure the cartridge is not broken or contaminated
Insert the cartridge into the analyser port, holding on its sides. Follow the instructions on the machine and wait for results. Prior to removing cartridge identify on machine arterial or capillary sample Remove cartridge	Ensure accurate recordings Single use only

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Dispose of cartridge into sharps box.	
Note results and outcome in patient's notes.	To maintain effective communication

f. Interpreting and Reporting of Results

Earlobe capillary blood gas sampling should only be conducted by a trained and assessed Health Care Professional. Documentation of attendance at a course and completion of required competencies should be noted in personnel files.

g. Reporting the earlobe capillary blood gas results

Any deviations from criteria for preparation and performance of test (outlined above) should be reported.

h. Storing and communicating the results

- Each iSTAT machine can store 4000 results
- Each operator has a unique number.
- Use printer or write results immediately into patient notes
- Always check sample is from the correct patient
- Write patients name on hard copy
- Each patient should have a unique number (i.e. hospital number) so results can be stored and recalled for future reference if required

6. REFERENCES

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- Crawford, A (2004) An audit of the patient's experience of arterial blood gas testing **British Journal of Nursing** 13,9, p529-532
- Girling K Hobbs G (1997) Arterial blood sampling and peripheral arterial cannulation in **Essential Medical Procedures** (Peter J Toghill Ed) Arnold London.
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- Hughes JMB (1996) Blood gas estimation for arterialised capillary blood gases versus arterial puncture, are they different? **Eur Respir J** 9 p184-185
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- Wimpres, S Vara, DD, Brightling, CE (2005) Improving the sampling technique of arterialised capillary samples to obtain more accurate PaO₂ measurements **Chronic Respiratory Disease** 2,1,p47-50
- Zavorsky, GS Cao, JMayo, NE Gabbay, R Murias, JM (2007) Arterial versus capillary blood gases:a meta-analysis **Respir Physiol Neurobiol** Mar15,155 (3)p268-279

Appendix 1

ASSESSMENT OF COMPETENCY FOR EAR LOBE CAPILLARY BLOOD GAS SAMPLING

ASSESSMENT SPECIFICATION: The candidate should be able to demonstrate competence in ear lobe capillary blood gas sampling using the following knowledge evidence and performance criteria

KNOWLEDGE EVIDENCE: The candidate should be able to:

- a) Demonstrate skill in the technique of ear lobe capillary blood gas sampling
- b) Discuss the principles of safe practice with regards to ear lobe capillary blood gas sampling
- c) Discuss the role, responsibility and accountability with reference to the Code of Professional Conduct.
- d) Know the normal ranges for blood gas values
- e) Demonstrate a systematic approach to blood gas interpretation
- f) Know some of the common causes of blood gas abnormalities and what to do about them.

You need a mentor who is competent in ear lobe blood gas sampling who has a completed their competences and passed working within respiratory services.

If the candidate still feels they lack competence after supervised practice of at least 10 capillary blood gas samplings, they should seek further training or supervised practice.

- Please attempt to complete competencies within 6-8 weeks of attending course

Clinical Supervisor (*please print*): Signature:

Date:

Candidate (*please print*): Signature:

Date:

Department: Directorate : Location:.....

Comments by Supervisor

Comments by Candidate:

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PERFORMANCE CRITERIA FOR ASSESSMENT OF COMPETENCY FOR EARLOBE CAPILLARY BLOOD GAS SAMPLING

Performance Criteria	COMPETENT –Mentor Initial and Date									
Identifies need for capillary blood gas sampling according to Health Board Policy										
Explains procedure to patient and obtains consent										
Prepares necessary equipment										
Identifies and prepares appropriate site										
Applies vasodilator cream to ear lobe										
Stabilises earlobe and stabs fleshy part of lobe to depth of 3mm										
Collects blood sample in correct capillary tube										
Prepares sample for analysis										
Records result accurately and correct patients notes										
Records outcome of care following earlobe capillary sampling										
Clears away appropriately										
Evidence of discussion with patient and /or carer on outcomes and next steps										
Clinical Supervisor name (<i>please print</i>): Signature:..... Date:.....	Candidate name (<i>please print</i>): Signature:..... Date:.....									

When you have completed your competencies please ensure a copy is shown to your line manager and a copy goes into your personnel file

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Appendix 2

ASSESSMENT OF COMPETENCY i-STAT Analyser

ASSESSMENT SPECIFICATION: The candidate should be able to demonstrate competence in pre-operational inspection, quality control measures, operational use, cleaning and maintenance using the following knowledge evidence and performance criteria.

KNOWLEDGE EVIDENCE: The candidate should be able to:

- a) Demonstrate competence in the pre operational inspection and application of the i-stat analyser
- b) Demonstrate and discuss the appropriate quality control measures for the i-STAT analyser
- c) Identify, interpret and operate the i-STAT analyser.
- d) Demonstrate and discuss the cleaning and maintenance of the i-STAT analyser
- e) Discuss the above in relation to the Code of Professional Conduct.

You need a mentor who has completed this competency and works within respiratory services.

If the candidate still feels they lack competence after supervised practice, they should seek further training or supervised practice.

- Please attempt to complete competencies within 6-8 weeks of attending course.

Clinical Supervisor (*please print*): Signature:

Date:

Candidate (*please print*): Signature:

Date:

Department: Directorate : Location:.....

Comments by Supervisor

Comments by Candidate:

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Performance criteria	Intended answer/outcome	Evaluation method	Achieved/ Not achieved	Date assessed	Assessed by
Performance criteria 1					
Demonstrate the pre-operational inspection and application of the i-STAT analyser					
Explains the checks prior to use	Explains <ul style="list-style-type: none"> • Checks the unit for any sign of damage • Check the unit appears clean 	Questioning/Direct observation			
Identifies the main features of the i-STAT	Explains <ul style="list-style-type: none"> • Point of care analyser • Used for blood gas analysis (can be used for other analysis) • Stores 4000 results including QCs • Separate printer for hard copy • Both arterial and capillary blood can be used 	Questioning			
Identifies the appropriate equipment for use with the i-STAT	Explains <ul style="list-style-type: none"> • i-STAT analyser • Electronic simulator • G3+ cartridge (blood gas) • Balanced heparinised syringe or capillary tube • Printer • QC file, operates manual 	Questioning/Direct observation			
Performance Criteria 2					
Demonstrates the ability to undertake the appropriate quality control measures					
Storage of equipment	Explains <ul style="list-style-type: none"> • Analyser and printer stored at room temperature away from extremes of temperature • G3+ cartridges and aqueous quality control solutions stored between 2-8^o C 	Questioning			

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	<ul style="list-style-type: none"> • Daily record of fridge temperature 				
Frequency of QC testing	<p>Explains</p> <ul style="list-style-type: none"> • Daily using the simulator. Analyser will lock if not performed • On delivering of each new batch of cartridges using aqueous solutions • Monthly external QC via Biochemistry Dept. • Hard copy of all QC results kept 	Questioning			
Use of aqueous QC solutions	<p>Explains</p> <ul style="list-style-type: none"> • Store in fridge between 2-8°C • Remove from fridge at least 4 hours before use • Once removed do not return to the fridge and use within 5 days. Write the new expiry date on the ampoule label • Check the expiratory date before use • Shake vigorously for 10 seconds before use, holding the top and base, then use immediately • Record test results on sheet provided and file away for future reference • Contact Abbott Customer Support if the results are outside the expected ranges 	Questioning/Direct observation			
Use of electronic simulator	<p>Explains</p> <ul style="list-style-type: none"> • Stored at room temperature away from extremes of heat in its protective box with cap in place over the electrodes • Never try to remove the simulator if 'cartridge locked' is displayed on the screen • Record test results on the sheet provided and file away for future reference 	Questioning/Direct observation			

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	<ul style="list-style-type: none"> If test fails, try again ensuring electrodes are clean if it still fails contact Abbott Customer Support 				
Use of G3 cartridges	<p>Explains</p> <ul style="list-style-type: none"> Store in fridge between 2-8°C Remove single cartridge 5 minutes before use (whole box 1 hour) and once removed not to return to fridge. Now ready to use Once removed from the fridge the cartridge must be used within 2 months.. Write expiry date on the cartridge wrapper. Check expiry date. Remove the cartridge carefully form the wrapper once ready to use. Hold it on its sides only. Taking care not to touch the contact pads and the calibration pack in the centre of the cartridge. Insert only the required amount of blood into the well, as indicated on the cartridge. Fold the flap over the well and snap it in place. Inset the cartridge carefully into the analyser port, holding on its sides. Never try to remove the cartridge with the 'cartridge locked' displayed on the screen. Single use and disposed of as clinical waste. 	Questioning/Direct observation			
<p>Performance criteria 3 Identifies, interprets and operates i-STAT analyser</p>					
On/off switch	Explains	Questioning/Direct observation			

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	<ul style="list-style-type: none"> The button is pressed to switch the analyser on or off. The analyser will automatically switch on when a cartridge is inserted and switches itself off after a period of being idle. 				
Menu button	<p>Explains</p> <ul style="list-style-type: none"> Allows access to the various functions by selecting from the menu and choosing the desired function. 	Questioning/Direct observation			
Operator ID	<p>Explains</p> <ul style="list-style-type: none"> Unique number given to each operator on the named operator list. 	Questioning/Direct observation			
Simulator ID	<p>Explains</p> <ul style="list-style-type: none"> Found on the back of the electronic simulator and required to input when doing the daily simulator test. 	Questioning/Direct observation			
Lot numbers	<p>Explains</p> <ul style="list-style-type: none"> Found on both cartridges and aqueous quality control solutions Inputted when requested by either scanning or barcode manually. 	Questioning/Direct observation			
Patient identification	<p>Explains</p> <ul style="list-style-type: none"> Seven digit number given to all patients in hospital Where no hospital number available, use date of birth, e.g. 5th October 1080 = 05101980 Where no hospital number available also enter the patient initials Check sample from correct patient Writes patient name on the printed hard copy 	Questioning/Direct observation			

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Display and printing results	Explains <ul style="list-style-type: none"> Results are displayed on screen and can be printed off Align printer with analyser to print off results Results are stored and can be recalled for future reference and printed if required. 	Questioning/Direct observation			
Cartridge lock message	Explains <ul style="list-style-type: none"> Under no circumstances should the simulator or cartridge be removed when this message is displayed on screen. 	Questioning/Direct observation			
Performance criteria 4					
Cleaning and maintenance					
Cleaning	Explains <ul style="list-style-type: none"> Clean the analyser using a multi-surface mild detergent wipe Dry immediately Do not let moisture into the analyser. 	Questioning/Direct observation			
Changing the batteries	Explains <ul style="list-style-type: none"> Change when low battery is displayed Use two 9V lithium batteries 	Questioning/Direct observation			
Clinical Supervisor name (<i>please print</i>): Signature:..... Date:.....			Candidate name (<i>please print</i>): Signature:..... Date:.....		

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