Worcestershire Acute Hospitals NHS Trust

EAR LOBE CAPILLARY BLOOD GAS SAMPLING FOR RESPIRATORY PRACTITIONERS

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

THIS GUIDELINE IS FOR USE BY THE FOLLOWING STAFF GROUPS

Respiratory Nurse Specialists
Registered Nurses working in high care areas
Respiratory wards of Worcestershire Acute Hospitals NHS Trust
Respiratory Physiologists
Respiratory Physiotherapists

Lead Clinician(s)

Emma Hurst Robert Macdonald	Respiratory Specialist Nurse Countywide Lead Respiratory Physiologist
Approved by Respiratory Directorate Meeting	7th March 2022
Approved by Divisional Management Board	1st May 2022
Review Date: This is the most current document and is to be used until a revised version is available	1st May 2025

Key amendments to this guideline

Date	Amendment	Approved by:
	Guideline approved by Senior Nurses & Midwifery Group	
25.09.07	Guideline approved by Medicines Safety Committee	Alison Smith
02.02.16	Document extended for 12 months as per TMC paper approved on 22nd July 2015	TMC
Oct 16	Further extension as per TMC paper approved on 22nd July 2015	TMC
November 2017	Document extended whilst under review	TLG
December 2017	Sentence added in at the request of the Coroner	
February 2017	Change to lead nurse and Matron names	Dr Hooper
March 2018	Document extended for 3 months as approved by TLG	TLG
June 2018	Document extended for 3 months as approved by TLG	TLG
August 2019	A vasoactive cream. Safety lancets used in place of a blade for safety and reduce risk of needle stick injury.	
November 2019	New circulated list made	
October 2020	Respiratory nurse specialist or respiratory physiologist for final sign off in competency form.	
March 2022	Appendix added detailing Rubefacients and vasodilator creams.	Respiratory Directorate/ DMB

INTRODUCTION

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 PO_2, PCO_2 and pH (Wimpress, Vara, Brightling 2005, Zavorsky et al 2007)

This Guideline will cover both out-patients and in-patients with respiratory or sleep condition commonly: Chronic obstructive Pulmonary Disease (COPD),Interstitial Lung Disease (ILD), Obstructive Sleep Apnoea (OSA), Obesity Hypoventilation Syndrome (OHS) or any other condition that could affect the oxygenation of the patient.

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

- Oxygenation
- Ventilation
- Acid base balance

Capillary blood gas samples are obtained from the earlobe in adults as they are less metabolically active than fingers.

Key measurements in Capillary Blood Gas Analysis:

Measured parameters

- Hydrogen ion concentration – pH
- Oxygen tension- $P_a O_2$
- Carbon dioxide tension -$P_a CO_2$

Calculated parameters

- Bicarbonate concentration (HCO3-)
- Base excess
- Oxygen concentration

Normal arterial blood gas values	
P_aO_2	10 – 14 kPa
P_aCO_2	4.5-6.0 kPa
pH	7.35-7.45
HCO_3	22-26 mmol/L
Base Excess	-2 to +2

Oxford Medical Education (2019)

DETAILS OF GUIDELINE

Ensuring safe practice

All staff acting under this policy must have attended a course, which includes blood gas sampling and interpretation as part of the formal content. They must have completed a log book of 10 successful supervised attempts, of which the last 5 should be sequential before they can act independently.

All staff acting under this policy must expect to perform at least 5 capillary samples per month in order to maintain their level of competence.

Working under this protocol, all staff are allowed a maximum of two attempts at blood gas sampling – if unsuccessful the patient must be referred to medical staff, nurse practitioners', respiratory specialist nurses or respiratory physiologists.

Contraindications

Capillary sampling should not be performed where there is:

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

Indications

There are a number of circumstances where a ward- based patient will require capillary blood gas analysis:

- Assessment of supplementary oxygen requirements
- During Non-Invasive Positive Pressure Ventilation
- Diabetic ketoacidosis
- Poisoning

Capillary blood gas sampling should also be considered in the following clinical situations:

- Anyone with an acute exacerbation of a chronic chest condition
- Anyone with impaired respiratory effort

As the person who obtains the sample is also the person who processes the sample, they have immediate access to the results. The staff must be able to act on the information that is obtained from the sample and have an understanding of the interpretation of blood gas results.

The following are circumstances where staff would be able to take a capillary blood sample and be guided by protocol on how to act on the results:

- Monitoring a patient who has commenced NIPPV.
- Assessment for Long Term Oxygen therapy (LTOT)
- Assessment for supplementary oxygen therapy.

GUIDELINE

Equipment

- Heparinised Capillary blood gas tube (150 µL)
- Capillary end caps
- Clot catcher
- Alcohol swab
- Sharps box
- Patient label or pre-printed results page
- Gloves
- Apron
- Absorbent towel
- Appropriate Lancet (safety lancet) as close to 2-3mm in depth and length as possible.
- Clean plastic or disposable pulp tray
- Vasoactive cream , See Appendix 1'
- Sterile gauze
- Waterproof plaster
- Sharps bin

Action	Rationale
Explain the test procedure to the patient Obtain verbal consent	To obtain informed consent and co-operation
Wash hands	To reduce the risk of nosocomial infection and avoid contamination of the blood sample
Remove any earrings from the ear that is going to be sampled (Pin back hair if necessary	To reduce the risk of injury to the staff member by practicing good manual handling and practising ergonomics.
Place absorbent towel over the patient's shoulder	To protect patient's clothing from blood spillage
Apply vasodilator cream liberally to earlobe. Leave on until ear becomes red and warm (can take up to 20 mins) Per Appendix 1 Ensure lotion/creams are a PGD / prescribed.	To increase ear lobe blood flow (arterialized capillary blood sample) thus reducing the arteriovenous oxygen content difference (Hughes 1996) N.B. The arterialisation is not to make it easier to collect the sample; the "Arterialisation" is to ensure the accuracy of the sample. The sample should be collected quickly ideally < 15s
Wash hands with soap and water before putting on PPE; Apron and Gloves.	To practice good infection prevention and control
Wipe off the cream and rub earlobe vigorously with alcohol swab	To stimulate circulation and clean the surface of the ear.
Hold earlobe firmly in place and use a safety lancet.	To obtain the arterialised capillary blood sample To avoid needle stick injury 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 the blood flow is insufficient, repeat the puncture process.	To avoid haemolysis of the sample, i.e. the rupture of red blood cells, thus releasing their content into the plasma.(Canterbury health laboratories)
Always wipe away the first drop of blood	To avoid contamination with tissue fluid and remove the mixed venous and arterial blood
Collect blood in a heparinised capillary tube by holding the tube with one end in the well of blood. The tube should be held horizontally or with the end in the well of blood angled slightly upwards. Ensure that there are no bubbles or air gaps. When the tube is full, capillary cap the ends.	To aid capillary tube filling To ensure gas values do not change and sampling errors. Air bubbles result in gas equilibration between the air and the arterial blood leading to a decrease in PaCO2 and an increase in PaO2 (Williams 1998)
Cover the wound front and back with a piece of gauze and ask the patient to apply pressure until the bleeding stops.	To decrease the risk of bruising and bleeding
Rotate the tube back and forth between the tips of the fingers	To prevent clotting
Attach the addressograph label to the tray, Or have a pre-printed mount sheet	To ensure proper identification of sample
Remove gloves and wash hands	To reduce the risk of infection
Note the patient's inspired oxygen concentration (FIO_2) – usually expressed as a percentage (i.e. 24%) and temperature.	To ensure that results are correct for the patient
The sample should be analysed immediately according to the protocol from the Biochemistry department. Ensure clot catcher attached (Where appropriate) prior to inserting sample in analyser	The cellular constituents of blood remain metabolically active so arterial gas tensions in the sample will change. To eliminate any clots
Apply waterproof dressing to puncture site If bleeding does not stop	To avoid risk of infection
Wash hands	To reduce the risk of nosocomial infection

Details of the procedure including informed consent, site and number of attempts made should be recorded and signed for in the nursing record. The main Capillary BG results should be recorded in the patient's notes • Ph • PaCO2 • PaO2 • HCO3- • Base Excess	To maintain effective communication
The Staff member must act on the results in accordance with the following protocols • NIPPV Policy • Oxygen Policy • Long term Oxygen Therapy (LTOT) BTS Guidelines	
In any other circumstances a doctor must be contacted as soon as possible to discuss the implications of the results	To ensure that the results are interpreted correctly and the patient receives the appropriate treatment

MONITORING TOOL

Annual random audit of medical notes by Respiratory Specialist nurses

STANDARDS	%	CLINICAL EXCEPTIONS
All patients have informed consent	100	
Capillary blood gas to be documented in notes	100	
Oxygen % documented in notes	100	

References

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Appendix 1

Information for Topical creams
Taken from: https://www.sps.nhs.uk/wp-content/uploads/2014/11/Transvasin20memo20final.doc

	Rubefacients	Analgesic	Other	Manufacturer
Transvasin	**Hexyl Nicotinate 2% w/w and ethyl nicotinate 2% w/w**	**Tetrahydrofurfuryl salicylate 14% w/w**	**x**	**Thornton & Ross Ltd**
Deep Heat Spray*	Methyl nicotinate	Ethyl salicylate 5%, hydroxyethyl salicylate 5% and methyl salicylate 1.0%		The Mentholatum Co Ltd
Dubalm cream	Ethyl nicotinate 1%, methyl nicotinate 1%, benzyl nicotinate 1%,	Glycol salicylate 2%	Capsicum oleoresin	Norma Chemicals Ltd Currently out of stock, with a manufacturing delay of 3-4 months
Deep Heat rub‡	x	Methyl salicylate 12.8% w/w	Menthol, eucalyptus oil, and turpentine oil	The Mentholatum Co Ltd
Deep Heat Max Strength‡	X	Methyl salicylate 30%	Menthol	The Mentholatum Co Ltd
Balmosa cream‡	X	Methyl salicylate 4%	Capsicum oleoresin, menthol, camphor	Galen Consumer Ltd Currently out of stock, but should be back in stock by end of November/early December
Radian B Muscle Rub‡	x	Methyl salicylate 0.42%	Capsicum oleoresin, menthol, camphor	Thornton & Ross Ltd

It should be noted that Finalgon, Fiery Jack, Algipan and Ralgex cream and spray are no longer available/ *******To ensure local application only, the Deep Heat Spray is sprayed onto lint swab/cotton wool ball and applied to the earlobe/* ***‡These products do not contain rubefacients, and therefore it is unclear whether they would produce adequate "arterialisation" of the capillaries.***

CONTRIBUTION LIST

Key individuals involved in developing the document

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Circulated to the chair of the following committee's / groups for comments

Name	Committee / group
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Alison Smith	Principal Pharmacist Medicines Safety

Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

		Yes/No	Comments
1.	**Does the policy/guidance affect one group less or more favourably than another on the basis of:**		
	• Race	No	
	• Ethnic origins (including gypsies and travellers)	No	
	• Nationality	No	
	• Gender		
	• Culture	No	
	• Religion or belief	No	
	• Sexual orientation including lesbian, gay and bisexual people	No	
	• Age	No	
2.	**Is there any evidence that some groups are affected differently?**	No	
3.	**If you have identified potential discrimination, are any exceptions valid, legal and/or justifiable?**	N/A	
4.	**Is the impact of the policy/guidance likely to be negative?**	N/A	
5.	**If so can the impact be avoided?**	N/A	
6.	**What alternatives are there to achieving the policy/guidance without the impact?**	N/A	
7.	**Can we reduce the impact by taking different action?**	N/A	

If you have identified a potential discriminatory impact of this key document, please refer it to Human Resources, together with any suggestions as to the action required to avoid/reduce this impact.
For advice in respect of answering the above questions, please contact Human Resources.

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval

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, please arrange your supervised practice sign Off with a **respiratory nurse specialist or respiratory physiologist**.

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.

- Any problems, please contact Professional Development department.

Clinical Supervisor *(please print):* ……..…… Signature: …… Date: ……

Candidate *(please print)*: ……..…… Signature: ……..…… Date: ……

Ward/Department: ……... Directorate/ PCT: ……..…….. Location: ……..……

Comments by Supervisor

Comments by Candidate:

Worcestershire Acute Hospitals NHS Trust

PERFORMANCE CRITERIA FOR ASSESSMENT OF COMPETENCY FOR EAR LOBE CAPILLARY BLOOD GAS SAMPLING

PERFORMANCE CRITERIA	COMPETENT- Mentor Initial & Date									
	1	2	3	4	5	6	7	8	9	10
Identifies need for capillary blood gas sampling according to Trust Policy.										
Explains procedure to patient and obtains consent.										
Prepares necessary equipment.										
.Identifies and prepares appropriate site										
Applies vasodilator cream to ear lobe										
.Stabilises ear lobe and stabs fleshy part of lobe to a depth of 3 mm										
.Collects blood sample in a heparinised capillary tube										
Prepares sample for analysis.										
Notes patients inspired 02 concentration (FI02) and temperature.										
Analyses sample according to biochemistry protocol.										
Records the procedure in patients notes Procedure and site No of attempts Main CBG results ph, PaCO2, PaO2, HCO3, Base Excess										
Acts on results according to NIPPV, Oxygen or Long Term Oxygen Therapy policies.										
In any other circumstance informs medical staff of results.										
Clinical Supervisor *(please print)*: ..... **Signature**: ..... **Date:**					**Candidate** *(please print)*: ..... **Signature:** ..... **Date:**					