POLICY FOR ARTERIAL BLOOD GAS SAMPLING
### Executive Summary:
This Policy sets out the procedure for Arterial Blood Gas sampling by appropriately trained health care professionals within the Medical and Surgical Business Units.

### Supersedes:
Version 1.0

### Description of Amendment(s):
References updated

### This policy will impact on:
Clinical practice as carried out by Medical Nurse Practitioners, Respiratory Nurse Practitioners, Senior Nursing staff, Critical Care Outreach Nurses and Clinical Site Coordinators.

### Financial Implications:
Medical and Surgical Business Unit budget/ Individual ward budgets for use of consumables. Financial implications re: Laboratory resources and Blood gas Analysers in ICU and A&E Dept.

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<th>Policy Area</th>
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<th>Authors:</th>
<th>Impact Assessment Date:</th>
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<tr>
<td>Medical Nurse Practitioner Team Leader and Advanced Respiratory Specialist Practitioner</td>
<td>October 2016</td>
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### APPROVAL RECORD

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# ARTERIAL BLOOD GAS ANALYSIS

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PROTOCOL FOR ARTERIAL BLOOD SAMPLING VIA RADIAL ARTERIAL PUNCTURE

1.0 Background
Arterial blood gas analysis is widely available in hospitals and the direct measurements (pH, PaO2 & PaCO2) are among the most precise in medicine (Williams 1998). Primarily, arterial blood samples provide accurate information regarding:

- Ventilatory efficiency
- Oxygenation
- Acid-base balance

The importance of Arterial Blood Gases (ABG) in both diagnosis and monitoring of a patient’s condition cannot be overstated, but the sampling procedure has potential complications. It is therefore necessary that the Practitioner is fully aware of all known implications. Further to this, since ABG results often direct the management of a patient’s condition, the practitioner must be aware of the need for accuracy in the sampling procedure. Finally, the fact that the procedure is invasive and often painful must be borne in mind when deciding to undertake ABG sampling.

Statement
An appropriately trained practitioner may, with due reference to the NMC document “Standards of Conduct, Performance and Ethics for Nurses and Midwives” (2008), obtain ABG samples at request of a Medical Officer, or at the professional discretion of the practitioner when undertaking the clinical assessment of a patient as detailed in section 1.

At this time the practitioner must decide if a local anaesthetic is required, and is so request the medical officer to prescribe this accordingly. The site of puncture will be restricted to the radial artery because:

- The artery is relatively near the surface of the arm
- The artery is relatively easy to palpate and stabilise
- The artery normally has a good collateral blood supply.
  (Williams 1998)

Reports of the dangers of brachial artery puncture are largely anecdotal. Indeed Okeson et al’s study (1998) concluded that brachial artery puncture, when correctly performed provided a safe and reliable route. However, in the absence of a significant literature review of the safety of the brachial site it is prudent to restrict puncture by nurse practitioners to the radial site.

The Allen test described below, and a contra-indications checklist will be used prior to the procedure. Steele (1999) suggests that in practice the Allen test is not routinely used before radial artery puncture. He further suggests that the test has a poor sensitivity and specificity for complications after radial artery cannulation. Jarvis et al’s study (2000) also casts doubt on the reliability of the Allen test. However, in the absence of further research and a suitable alternative solution, it is recommended that practitioners will use the Allen’s test.
In the event of a negative Allen test result or a contraindication being identified, the procedure will be abandoned. The procedure will be carried out in the manner described below and any complications documented in the patients case notes.

2.0 Criteria for the performance of the Role

- Practitioners will successfully complete a course of Trust approved training and be considered competent in performance of the procedure.
- Practitioners are required to demonstrate knowledge of potential dangers and complications associated with the procedure. In addition the NPs will demonstrate knowledge of the signs and symptoms of associated complications, and be able to identify appropriate action to safeguard the patient.
- Practitioners will undertake the role with due reference to the NMC Code “Standards of conduct, performance and ethics for nurses and midwives” (NMC 2008).

3.0 Criteria for Inclusion

The decision to obtain ABG samples will be based upon the clinical condition of the patient. According to the American Association for Respiratory Care guidelines (AARC, 1992) indications are:

- The need to evaluate the adequacy of ventilation (PaCO2), acid base (PaCO2 & pH) and oxygenation status (PaO2).
- The need to evaluate the patients response to therapeutic intervention or for diagnostic evaluation
- The need to monitor the severity and progression of a documented disease process.

If it is necessary to take repeated samples an arterial line will be required.

4.0 Criteria for Exclusion

- A negative Allen Test
- Infectious skin process at or near the puncture site.
- Current thrombolysis therapy

5.0 Cautions

- Warfarin (or other oral anti-coagulants)
- Intra-dermal Low molecular weight Heparin
- History of a clotting disorder (discuss with senior medical officer responsible for the patient)
- Severe peripheral vascular disease (discuss with senior medical officer responsible for the patient)
- Thrombolysis in the past: 24 hours (Alteplase) OR: 4 hours (Tenecteplase)
6.0 Sampling Procedure

6.1 Preparation
- Identify the correct patient for the procedure by reconciling case notes, identity band and request form.
- Prepare all necessary equipment, prior to approaching the patient (see ‘taking a sample’ for correct syringe).
- Introduce self and explain the need for the procedure.
- Obtain verbal consent from the patient, with reference to the Trust consent policy
- Conduct the Allen Test, recording the result, and abandon the process if the test is negative.

The Allen test is performed to ensure that adequate collateral blood supply is provided via the ulna artery and is performed as follows:
- Ask the patient to make a tight fist
- Apply direct pressure to both the radial and ulna arteries
- Ask the patient to clench and unclench fist until blanching of the skin occurs
- Release pressure over the ulna artery; observe the colour of the fingers, thumb and hand.

Positive result: the fingers and hand should flush within 15 seconds
Negative result: flushing does not occur

(Potter 1998)

- Consider the use of local anaesthetic agent, and administer as prescribed if appropriate.

6.2 Taking the sample
- Wash hands and apply gloves
- Expel the heparin from the sampling syringe, by fully depressing the plunger. Excess heparin will dilute the specimen and affect the test result (Hansen 1977). The syringe will still contain approximately 0.15-0.25ml of heparin, which will adequately anti-coagulate the sample without affecting the result (Potter 1998). If heparin is used and the sample requires analysis on ICU it must be lithium heparin so as not to distort the calcium result.
- Palpate the radial site with fingertips
- Stabilise artery by positioning the arm on a flat surface, and supporting wrist on a rolled towel for example. Hyperextension should be avoided as it may obliterate a palpable pulse.
- Clean area of maximal impulse with alcohol swab
- Keep fingertip on artery, just proximal to chosen site
- Hold the needle bevel up and insert at 45-60 degree angle
- Stop advancing needle when blood is noted returning to hub of needle
- Allow arterial pulsation’s to pump 3ml of blood into syringe. At least 3ml of blood is needed to avoid dilution effect of heparin (Williams 1998)
- When sampling is complete, hold gauze or swab over puncture site and withdraw needle
- Apply pressure over and just proximal to puncture site with gauze/swab
- Maintain continuous pressure over and proximal to the site for at least 5 minutes (10 minutes minimum if patient is anti-coagulated or has a bleeding disorder)
6.3 After care

- Visually inspect site for signs of bleeding or other complications (see below).
- Palpate artery site distal to the puncture site, to determine if pulse quality has changed/alteration in arterial flow
- Ensure appropriate immediate action is taken if complications are identified.
- Remove gloves and wash hands
- Make arrangements for patient to be observed for potential complications following the procedure and inform ward-nursing staff of action to take if complications are identified.

6.4 Preparing the sample

- Expel air bubbles from syringe. Air bubbles result in gas equilibration between the air and arterial blood, affecting the results (Potter 1998) and likewise occlude sample to avoid air contamination.
- Fully label specimen
- Place immediately into a bag of ice. The sample can be stored for approximately 1 hour when cooled without any clinically significant effect on the result (Williams 1998)
- Ensure all clinical details are recorded on the request form, including oxygen therapy details and patients core body temperature (Potter 1998)

7.0 Potential Complications

As identified by AARC (1998);
- Haematoma
- Arteriospasm
- Air or clotted blood emboli
- Anaphylaxis from local anaesthetic agent
- Introduction of a contagion at sample site and consequent infection in patient
- Haemorrhage
- Trauma to the vessel
- Arterial occlusion
- Vaso-vagal response
- Pain

8.0 Documentation

The practitioner will document their action in the patients case notes and report the procedure, including assessment of the patient as detailed above and any complications with the procedure itself. Any identified complications must be reported to a Medical Officer as soon as practically possible.
9.0 References

American Association for Respiratory Care (AARC) (1992) AARC Clinical Practice Guidelines 'Sampling for Arterial Blood Gas Analysis Respiratory Care 1992 37; 913-917

Hansen J.E., Simmons D.H. (1977) A systematic error in the determination of blood PaCO2 American Review of Respiratory Disease 115; 1061-1063


Updated: Sept 2016
Approved: Safety Quality & Standards Committee (SQS) Medical Business Unit
Date for review: Sept 2018
Equality Analysis (Impact assessment)

Please START this assessment BEFORE writing your policy, procedure, proposal, strategy or service so that you can identify any adverse impacts and include action to mitigate these in your finished policy, procedure, proposal, strategy or service. Use it to help you develop fair and equal services.

Eg. If there is an impact on Deaf people, then include in the policy how Deaf people will have equal access.

1. What is being assessed?

Arterial Blood Gas Analysis

Details of person responsible for completing the assessment:

- **Name:** Jackie Bayliss
- **Position:** Advanced Respiratory Specialist Practitioner
- **Team/service:** Integrated Respiratory Service

State main purpose or aim of the policy, procedure, proposal, strategy or service:

(usually the first paragraph of what you are writing. Also include details of legislation, guidance, regulations etc which have shaped or informed the document)

This policy is intended for the guidance for the Health Care Professionals undertaking this invasive procedure which is used to assess acutely ill patients in the Hospital setting and also in Oxygen assessment clinics for patients with Chronic Respiratory or Cardiac conditions.

- American Association for Respiratory Care (AARC) (1992) AARC Clinical Practice Guidelines
- Sampling for Arterial Blood Gas Analysis Respiratory Care 1992 37; 913-917

2. Consideration of Data and Research

To carry out the equality analysis you will need to consider information about the people who use the service and the staff that provide it. Think about the information below – how does this apply to your policy, procedure, proposal, strategy or service

2.1 Give details of RELEVANT information available that gives you an understanding of who will be affected by this document

Cheshire East (CE) covers Eastern Cheshire CCG and South Cheshire CCG. Cheshire West & Chester (CWAC) covers Vale Royal CCG and Cheshire West CCG. In 2011, 370,100 people resided in CE and 329,608 people resided in CWAC.
Age: East Cheshire and South Cheshire CCG’s serve a predominantly older population than the national average, with 19.3% aged over 65 (71,400 people) and 2.6% aged over 85 (9,700 people).

Vale Royal CCGs registered population in general has a younger age profile compared to the CWAC average, with 14% aged over 65 (14,561 people) and 2% aged over 85 (2,111 people).

Since the 2001 census the number of over 65s has increased by 26% compared with 20% nationally. The number of over 85s has increased by 35% compared with 24% nationally.

Race:
- In 2011, 93.6% of CE residents, and 94.7% of CWAC residents were White British
- 5.1% of CE residents, and 4.9% of CWAC residents were born outside the UK – Poland and India being the most common
- 3% of CE households have members for whom English is not the main language (11,103 people) and 1.2% of CWAC households have no people for whom English is their main language.

Gender: In 2011, c. 49% of the population in both CE and CWAC were male and 51% female. For CE, the assumption from national figures is that 20 per 100,000 are likely to be transgender and for CWAC 1,500 transgender people will be living in the CWAC area.

Disability:
- In 2011, 7.9% of the population in CE and 8.7% in CWAC had a long term health problem or disability
- In CE, there are c.4500 people aged 65+ with dementia, and c.1430 aged 65+ with dementia in CWAC. 1 in 20 people over 65 has a form of dementia
- Over 10 million (c. 1 in 6) people in the UK have a degree of hearing impairment or deafness.
- C. 2 million people in the UK have visual impairment, of these around 365,000 are registered as blind or partially sighted.
- In CE, it is estimated that around 7000 people have learning disabilities and 6500 people in CWAC.
- Mental health – 1 in 4 will have mental health problems at some time in their lives.

Sexual Orientation:
- CE - In 2011, the lesbian, gay, bisexual and transgender (LGBT) population in CE was estimated at18,700, based on assumptions that 5-7% of the population are likely to be lesbian, gay or bisexual and 20 per 100,000 are likely to be transgender (The Lesbian & Gay Foundation).
- CWAC - In 2011, the LGBT population in CWAC is unknown, but in 2010 there were c. 20,000 LGB people in the area and as many as 1,500 transgender people residing in CWAC.

Religion/Belief:
The proportion of CE people classing themselves as Christian has fallen from 80.3% in 2001 to 68.9% in 2011 and in CWAC a similar picture from 80.7% to 70.1%, the proportion saying they had no religion doubled in both areas from around 11%-22%.
- **Christian**: 68.9% of Cheshire East and 70.1% of Cheshire West & Chester
- **Sikh**: 0.07% of Cheshire East and 0.1% of Cheshire West & Chester
- **Buddhist**: 0.24% of Cheshire East and 0.2% of Cheshire West & Chester
- **Hindu**: 0.36% of Cheshire East and 0.2% of Cheshire West & Chester

ABG Policy August 2016
- **Jewish**: 0.16% of Cheshire East and 0.1% of Cheshire West & Chester
- **Muslim**: 0.66% of Cheshire East and 0.5% of Cheshire West & Chester
- **Other**: 0.29% of Cheshire East and 0.3% of Cheshire West & Chester
- **None**: 22.69% of Cheshire East and 22.0% of Cheshire West & Chester
- **Not stated**: 6.66% of Cheshire East and 6.5% of Cheshire West & Chester

**Carers**: In 2011, nearly 11% (40,000) of the population in CE are unpaid carers and just over 11% (37,000) of the population in CWAC.

**2.2 Evidence of complaints on grounds of discrimination**: (Are there any complaints or concerns raised either from patients or staff (grievance) relating to the policy, procedure, proposal, strategy or service or its effects on different groups?)

No

**2.3 Does the information gathered from 2.1 – 2.3 indicate any negative impact as a result of this document?**

No

**3. Assessment of Impact**

Now that you have looked at the purpose, etc. of the policy, procedure, proposal, strategy or service (part 1) and looked at the data and research you have (part 2), this section asks you to assess the impact of the policy, procedure, proposal, strategy or service on each of the strands listed below.

**RACE**:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, racial groups differently? Yes ☐

**Explain your response**:
If the patients' first language is not English, then full explanation of the procedure can be given and consent gained via telephone interpretation. All staff should be aware of the trust’s interpretation and translation policy.

**GENDER (INCLUDING TRANSGENDER)**:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, different gender groups differently? No ☐

**Explain your response**:
No differential impact identified regarding gender
DISABILITY
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, disabled people differently? Yes ☐

Explain your response: Following an initial equality impact assessment the Learning Disabilities group of patients may need to be excluded from the proposal, depending on the level of severity, due to the potential complexity of their needs and ability to comply with the treatment.

If the patient is visually impaired or blind, then any written information regarding the procedure would need to be translated or put in large print. During the procedure, full explanations would need to be given before each step as the patient may not be able to see what is happening. If the patient is Deaf, then a British Sign language interpreter may be used. For a hearing impaired person, staff can use a portable induction loop if the patient wears a hearing aid or a hand held communicator if not (these can be located in ward communications boxes). There are picture communication books in the boxes to assist people with limited understanding.

AGE:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, age groups differently? No ☐

Explain your response: The procedure would be carried out regardless of age groups for any adult patient.

LESBIAN, GAY, BISEXUAL:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, lesbian, gay or bisexual groups differently? No ☐

Explain your response: The procedure would be carried out regardless of sexual orientation. Staff have access to equality and diversity training as part of stat/mandatory programme.

RELIGION/BELIEF:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, religious belief groups differently? Yes ☐

Explain your response: If the patient is a Jehovah’s Witness, alternative methods for monitoring oxygenation would be used. If the patient is Muslim and it is Ramadan, then the patient should be asked if they are fasting. Staff should assess the risk of taking the blood sample and consider what the consequences and potential action might be and discuss this with the patient.

CARERS:
From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect, carers differently? No ☐

Explain your response: If a carer / relative is in attendance, they would also need a full explanation as to the reason for the procedure.
OTHER: EG Pregnant women, people in civil partnerships, human rights issues.

From the evidence available does the policy, procedure, proposal, strategy or service affect, or have the potential to affect any other groups differently? No

Explain your response:

The procedure would be carried out regardless of other status. The Staff have access to equality and diversity training as part of stat/mandatory programme.

4. Safeguarding Assessment - CHILDREN

a. Is there a direct or indirect impact upon children? No

b. If yes please describe the nature and level of the impact (consideration to be given to all children; children in a specific group or area, or individual children. As well as consideration of impact now or in the future; competing / conflicting impact between different groups of children and young people:

c. If no please describe why there is considered to be no impact / significant impact on children

Adult policy only

5. Relevant consultation

Having identified key groups, how have you consulted with them to find out their views and that the policy, procedure, proposal, strategy or service will affect them in the way that you intend? Have you spoken to staff groups, charities, national organisations etc?

Respiratory Consultants, Integrated Respiratory Team, Medical Nurse Practitioners, Critical Care Outreach Practitioners, Peri-operative Practitioners, Night Nursing Sisters and Respiratory / MAU Ward Staff

6. Date completed: Sept 2016 Review Date: Sept 2018

7. Any actions identified: Have you identified any work which you will need to do in the future to ensure that the document has no adverse impact?

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8. Approval – At this point, you should forward the template to the Trust Equality and Diversity Lead lynbailey@nhs.net

Approved by Trust Equality and Diversity Lead: 

Date: 10.10.16