



HEALTH HOLDING

HAFER ALBATIN HEALTH  
CLUSTER  
MATERNITY AND  
CHILDREN HOSPITAL

<b>Department:</b>	Pediatric Intensive Care Unit (PICU)		
<b>Document:</b>	Departmental Policy and Procedure		
<b>Title:</b>	Blood Gas Analysis in Pediatric Patient		
<b>Applies To:</b>	All Pediatric Intensive Care Unit		
<b>Preparation Date:</b>	January 12, 2025	<b>Index No:</b>	PICU-DPP-022
<b>Approval Date:</b>	January 26, 2025	<b>Version :</b>	2
<b>Effective Date:</b>	February 26, 2025	<b>Replacement No.:</b>	PICU-DPP-022 (1)
<b>Review Date:</b>	February 26, 2028	<b>No. of Pages:</b>	8

## 1. PURPOSE:

- 1.1 To assess the acid base status of the body whether alkalosis, or acidosis, if respiratory or metabolic in origin and to what degree.
- 1.2 To provide diagnostic interpretation and evaluation of response to clinical interventions and integrity of ventilator control systems.
- 1.3 To evaluate the efficiency of pulmonary gas exchange.

## 2. DEFINITIONS:

- 2.1 **Blood Gas Analysis** – an evaluation that helps determine respiratory function, particularly how well the patient's body is exchanging oxygen and carbon dioxide, as well as the acid/ base status (pH) of the blood. It determines the patient's respiratory status and can also access issues caused by metabolic or renal disorders.

## 3. POLICY:

- 3.1 Blood Gas Analysis – Arterial Blood Gas (ABG), Venous Blood Gas (VBG) or Capillary Blood Gas (CBG) samples are indicated routinely for patient with oxygen support, post resuscitation mechanical ventilation, metabolic disorder such as diabetic ketoacidosis, renal failure or as ordered by the physician.
- 3.2 Arterial Blood Gas sampling must be done by a physician, Respiratory Therapist (RT) who are capable and skill full to puncture safely Venous and Capillary Blood Gas sampling is performed by a trained staff nurse competent in performing the procedure.
- 3.3 Collateral circulation must be assessed during the modified aseptic technique.
- 3.4 Assess the patient and determine the site for the capillary sampling.
- 3.5 Heparinized syringe is used to obtain the arterial/ venous blood gas sample.
- 3.6 A capillary tube is used to obtain capillary sample.
- 3.7 Punctured arterial site should be assessed frequently.
- 3.8 Blood Gas Analysis result must be notified immediately to the attending physician for further intervention as needed.
- 3.9 Blood gasses results must be documented.

## 4. PROCEDURE:

- 4.1 Verify physician order.
- 4.2 Identify patient correctly using two identifiers (4 names for the Saudi and complete name for the non-Saudi and Medical Record Number) via identification band and verify with another staff.
- 4.3 Explain procedure to the patient/ parents and that the procedure will elicit pain.
- 4.4 Ensure that the blood gas machine is functioning and calibrated well before obtaining sample.
- 4.5 Perform hand hygiene and wear gloves to prevent spread of infection as well as protection from exposure to blood and body fluids. Wear sterile gloves for arterial/ venous puncture to ensure sterility.

- 4.6 Clean the chosen site with alcohol swab or Povidone – Iodine solution to ensure sterility thus prevents infection.
- 4.7 Provide comfort to the patient during the blood extraction.
- 4.8 Verify patient's inspired oxygen concentration. Changes in inspired oxygen concentration alter PaO<sub>2</sub>. Degree of hypoxemia cannot be assessed without knowing the inspired oxygen concentration.
- 4.9 Obtain patient's temperature. Hyperthermia and hypothermia may influence oxygen release from hemoglobin and may cause inaccurate result.
- 4.10 Heparinized the 1ml syringe to prevent form clotting.
- 4.11 Expel excess heparin and air bubbles from the syringe. Air in the syringe may affect the measurement of the PaO<sub>2</sub>. Heparin in the syringe may affect the measurement of the pH. Specimen must be place in an iced container when transporting to ABG machine.
- 4.12 Select the site according to the type of Blood Gas Analysis to be done as ordered by the physician.
- 4.13 Site selection should be based on:
  - 4.13.1 Availability of collateral circulation.
  - 4.13.2 Accessibility.
  - 4.13.3 Presence of other surrounding anatomical structures such as nerves.
  - 4.13.4 Accompanying veins or bone.
  - 4.13.5 Condition of the site.
- 4.14 Arterial Site:
  - 4.14.1 Palpate the radial/brachial or femoral artery. If puncturing the radial artery perform the modified Allen's test. The radial artery is the preferred site of puncture. Arterial puncture is performed on areas where a good pulse is palpable. The modified Allen's test is a simple method for assessing collateral circulation in the hand.
    - 4.14.1.1 Instruct the patient to clench his/her fist, or if the patient is unable, you may close the hand tightly.
    - 4.14.1.2 Using your fingers, apply occlusive pressure to both the ulnar and radial arteries. This maneuver obstructs blood flow to the hand.
    - 4.14.1.3 While applying occlusive pressure to both the arteries, have the patient relax his/her hand. Blanching of the palm and fingers should occur. If does not, you have not completely occluded the arteries with your fingers.
    - 4.14.1.4 Release the occlusive pressure on the ulnar artery. You should notice a flushing of the hand within 5 to 15 seconds. This denotes that the ulnar artery is patent and has good blood flow. This normal flushing of the hand is considered to be a positive modified Allen's test. A negative modified Allen's test is one in which the hand does not flush within the specified time period. The radial artery supplying arterial blood to that hand should not be punctured.
  - 4.14.2 Site with any inflammation, infection, or poor integrity must be avoided.
  - 4.14.3 Punctures to the ulnar artery should be avoided; such punctures can result in impaired collateral circulation damage to the hand and damage to the ulnar nerve and the median nerve that lie in close proximity to the ulnar artery.
- 4.15 Capillary Site:
  - 4.15.1 Assess the patient and determine whether a finger or a heel would be most appropriate to use for capillary puncture. This will be determined by:
    - 4.15.1.1 The age of patient.
    - 4.15.1.2 The patient's size.
    - 4.15.1.3 Availability of sites.
- 4.16 Venous Site:
  - 4.16.1 Indicated for routine laboratory tests as these is less hazardous for pediatric patients and less painful than arterial access.
- 4.17 Assist in arterial puncture (technique of Arterial Blood Gas puncturing):
  - 4.17.1 Advance the needle slowly until arterial blood is obtained or resistance is felt. If resistance is felt while advancing the needle deeper, the needle is slowly withdrawn without advancement

- is changed slightly to one side and then to the other. If the artery has not been punctured after redirecting the needle several times, withdraw the needle and tests its patency.
- 4.17.2 Once the artery is punctured, arterial pressure will push up the hub of the syringe and pulsating flow blood will fill the syringe within a few seconds.
  - 4.17.3 Withdraw needle and apply firm pressure over the punctured site with dry gauze over 5 minutes after blood is obtained. Significant bleeding can occur because of pressure in the artery. Apply 5 minutes more on punctured site to patient with prolong clotting time.
  - 4.17.4 Place the capped syringe in the iced container to prevent significant loss of oxygen.
  - 4.17.5 Identify if patients requiring serial monitoring of arterial blood. An arterial catheter connected to a flush solution of heparinized Normal Saline (1unit/ml of fluid) is inserted into the radial or femoral artery. All connections must be tight to avoid disconnection and may cause rapid blood loss. The arterial line allows for direct blood pressure monitoring in the critically ill patient.
- 4.18 Capillary Puncture:
- 4.18.1 Check the expiry date of the capillary tube.
  - 4.18.2 Perform the puncture on the most medial or most lateral portion of the plantar surface of the heel.
  - 4.18.3 Wipe away the first drop of blood; this may contain alcohol that could affect test results. A second drop of blood will form over the puncture site.
  - 4.18.4 When the tip of the collection tube touches this drop, blood will flow into the tube by capillary action into the bottom of the tube.
  - 4.18.5 Obtain a free flowing sample without air bubbles in the capillary tube to have accurate results.
  - 4.18.6 Hold the puncture site downward below heart level and gently applying intermittent pressure to the surrounding tissue (or proximal to the puncture site when the blood is obtained from a finger) to enhance blood flow to the punctured site.
  - 4.18.7 Excessive squeezing, "milking" or "scooping" the blood from the skin into the collection tube should be avoided as it both may result in hemolysis or tissue fluid contamination of the specimen.
  - 4.18.8 When the necessary amount of blood is obtained, clean gauze is used to apply gentle pressure on the puncture site.
  - 4.18.9 When full, gently invert the capillary tube several times to mix the blood.
- 4.19 Venous Puncture:
- 4.19.1 Direct puncture of the vein by venepuncture or by vascular access devices such as central venous catheters or inhalation peripheral intravascular line access.
  - 4.19.2 Do not aspirate manually too fast as these also contributes to hemolysis of sample.
  - 4.19.3 If a tourniquet is used to facilitate venepuncture, it should be released about one minute before the sample is drawn to avoid changes induced by local ischemia.
- 4.20 Check sample for presence of small bubbles. If small bubble gets into sample, point the top of the syringe up and expel the air bubbles immediately. An air bubble in the sample can change the blood gas values. Recap the needle by scooping method to prevent room air from mixing with blood specimen and avoiding needle stick injury.
- 4.21 Mix the sample in two dimensions by rolling it between the hands and inverting it vertically right after sampling to prevent clotting. A clotted sample is not homogeneous, and the result is not reliable. Do not mix vigorously as this may cause hemolysis of the sample.
- 4.22 Send blood gas sample immediately for analysis once sample is extracted. PaO<sub>2</sub> and pH can change rapidly. Analyse within thirty (30) minutes. If storage is unavoidable:
- 4.22.1 Do not store the sample directly on ice cubes. There is a risk of blood cell rupture when samples are cooled directly on ice.
  - 4.22.2 Blood samples separate when stored, the red blood cells sediment. The sample must be mixed thoroughly before analysis to ensure homogeneity.
- 4.23 Ensure that the sample has been labelled properly. Always enter patient Medical Record (MR) number into the analyser.
- 4.24 Inspect the puncture site, and assess for coldness, numbness, tingling or discoloration. Hematoma and arterial thrombosis are complications following the arterial puncture.

- 4.25 Inform the physician about the blood gas result and the route the sample obtained due to correlation and variability of the results depending on the route obtained with the hemodynamic stability of the patient for further intervention.
- 4.26 Make certain that all blood gas relayed must be seen and stamped by the physician who covers the investigation on the particular time analysis.
- 4.27 Changes in the ventilation setting may require repeat blood gas analysis as ordered by the physician. The PaCO<sub>2</sub> and pH results will determine whether to maintain increase or decrease in the FiO<sub>2</sub> or changes in tidal volume and rate of patient's ventilator.
- 4.28 Write nursing care plan according to identified patient's problem using nursing process approach and refer to nursing clinical practice guidelines.
- 4.29 Document the following in the nurses notes:
  - 4.29.1 Time of sampling.
  - 4.29.2 Physician or respiratory therapist who performed ABG sampling.
  - 4.29.3 Site of puncture.
  - 4.29.4 Type of blood gas sampling obtained (Arterial, Venous, and Capillary).
  - 4.29.5 Amount of blood removed.
  - 4.29.6 Length of time pressure was applied to control bleeding.
  - 4.29.7 Patient's tolerance to procedure.
- 4.30 Record the following in the print out Blood Gas Result and Blood Gas Form:
  - 4.30.1 Ventilator setting/ parameters or type and amount of oxygen therapy.
  - 4.30.2 Type of blood gas sampling obtained (Arterial, Venous, and Capillary).
  - 4.30.3 Results.
  - 4.30.4 Any subsequent changes in therapy.

## 5. MATERIALS AND EQUIPMENT:

- 5.1 1ml Heparinized Syringed with Gauge 25 or 27 Needle
- 5.2 Anesthetics Agent 1% (Optional)
- 5.3 Sterile Germicide (Povidone, Isopropyl Alcohol 70%)
- 5.4 Cup, Plastic Bag or Kidney Basin with Ice
- 5.5 Sterile Gloves/ Unsterile Gloves
- 5.6 Capillary Tube
- 5.7 Gauze
- 5.8 Cotton

## 6. RESPONSIBILITIES:

- 6.1 Physician
- 6.2 Nurses





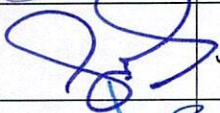


## 7. APPENDICES:

- 7.1 Physician Order Sheet
- 7.2 Nurses Progress Notes

## 8. REFERENCES:

- 8.1 Kingdom of Saudi Arabia, Ministry of Health Baish General Hospital, 2018.

9. APPROVALS:

	Name	Title	Signature	Date
Prepared by:	Ms. Asmaa AlShammary	Head Nurse of PICU		January 12, 2025
Prepared by:	Dr. Eman Abdelhakim Amer	Pediatric Specialist		January 12, 2025
Reviewed by:	Mr. Sabah Turayhib Al Harbi	Director of Nursing		January 13, 2025
Reviewed by:	Dr. Ali Alfayez	PICU Head of the Department		January 14, 2025
Reviewed by:	Mr. Abdulelah Ayed Al Mutairi	QM&PS Director		January 17, 2025
Reviewed by:	Dr. Tamer Mohamed Naguib	Medical Director		January 19, 2025
Approved by:	Mr. Fahad Hazam Al Shammari	Hospital Director		January 26, 2025





