Arterial Blood Gas Analysis

Sarah Leyland (Practice Educator)

Original author – Sinimol Jence (Senior staff nurse GICU)

Indications

- Respiratory compromise
- Post cardiopulmonary arrest
- Metabolic conditions e.g. DKA
- Sudden/unexplained deterioration
- Evaluation of interventions
- Changes/titration in invasive/non-invasive ventilation settings
- Major trauma
- Prior to major surgery

Parameters

- pH :- 7.35 - 7.45 overall acid-base balance of the blood sample. It is affected by both respiratory and metabolic function.
- PaO_2 :- 10 – 13.3kPa measurement of partial pressure of O_2 dissolved in the blood sample.
- $PaCO_2$:- 4.5 – 6.0kPa measurement of partial pressure of dissolved CO_2 in the blood. In order to be carried to the lungs to be exhaled CO_2 is transported in a plasma solution as carbonic acid.

Parameters

Continued.....

- Bicarbonate (HCO_3^-) :- 22 – 26mmol/l Most important buffer in the body. Buffers in the body act as chemical sponges which absorb excess alkali or acid.
- Base Excess (BE) :- -2 mmol to +2 mmol It is the quantity of acid or base required to restore the blood to a pH of 7.4 A negative value indicates excess of acid & a positive value indicates an excess of base.
- SaO_2 :- 92 – 99% Arterial O_2 saturation is the % of O_2 that has combined with the Hb molecule.

Systematic Analysis of ABG Results

1) **Assess the oxygenation (PaO_2).**

   Is the patient hypoxic?

   What supplementary O_2 are they receiving?

   What is their Hb?

2) **Determine the pH level**

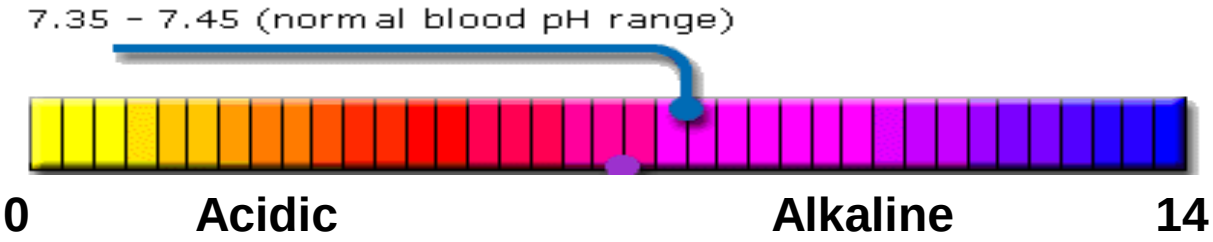
   Is there an acidosis (pH <7.35) or alkalosis (pH >7.45) present?

3) **Determine the respiratory component ($PaCO_2$)**

Systematic Analysis of ABG Results

Continued....

4) **Determine the metabolic component (HCO_3^-)**
5) **Determine for each of these parameters whether the values are acid, normal or alkaline.**
6) **Combine the findings from steps 2,3 & 4 and determine what the primary disturbance is.**



	Acid	Normal	Alkaline
pH	<7.35	7.35 - 7.45	>7.45
$PaCO_2$	>6kPa	4.5 - 6.0kPa	<4.5kPa
HCO_3^-	<22 mmol/l	22 - 26mmol/l	>26mmol/l

Classification Of Imbalance -1

Respiratory Acidosis

pH and $PaCO_2$ are in the acid column and HCO_3^- is normal.

Caused by inadequate ventilation leading to retention of CO_2 ie COPD, pneumonia, pulmonary oedema, mechanical chest injury, over sedation, neurological disorder.

	Acid	Normal	Alkaline
pH	7.24		
PaCO2	8.0kPa		
HCO3-		24mmol/l	

Classification Of Imbalance -2

Metabolic Acidosis

pH and HCO_3^- are in the acid column and $PaCO_2$ is normal.

Caused by excess acid production ie lactate or loss of HCO_3^-.

Causes include diarrhoea, cardiac arrest, DKA, renal failure etc.

	Acid	Normal	Alkaline
pH	7.20		
PaCO2		4.7kPa	
HCO3-	16mmol/l		

Classification Of Imbalance -3

Respiratory Alkalosis

pH and $PaCO_2$ are in the alkaline column and HCO_3^- is normal.

Caused by excessive ventilation leading to over excretion of CO_2 ie hysteria, excessive mechanical ventilation.

	Acid	Normal	Alkaline
pH			7.50
PaCO2			2.5
HCO3-		22mmol/l	

Classification Of Imbalance -4

Metabolic Alkalosis

pH and HCO_3^- are in the alkaline column and $PaCO_2$ is normal.

Caused by loss of acid or ingestion of bases ie severe vomiting, overdose of antacids, diuretics etc

	Acid	Normal	Alkaline
pH			**7.67**
PaCO2		**4.2kPa**	
HCO3-			**38mmol/l**

Arterial Blood Gas Examples -1

	Acid	Normal	Alkaline
PaO2 11kPa			
pH 7.30			
PaCO2 6.9kPa			
HCO3- 24mmol/l			

Arterial Blood Gas Examples -2

	Acid	Normal	Alkaline
PaO2 11.5kPa			
pH 7.49			
PaCO2 4.6kPa			
HCO3- 30mmol/l			

Arterial Blood Gas Examples -3

	Acid	Normal	Alkaline
PaO2 10.5kPa			
pH 7.32			
PaCO2 5.2kPa			
HCO3- 18mmol/l			

Arterial Blood Gas Examples -4

	Acid	Normal	Alkaline
PaO2 14kPa			
pH 7.5			
PaCO2 3.3kPa			
HCO3- 26mmol/l			

Any Questions ?