

Blood Gases For beginners

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The background of the slide is a solid blue color. In the lower right quadrant, there are several faint, concentric circular ripples, resembling water droplets hitting a surface, which add a decorative touch to the presentation.

Aims

- To have a basic understanding of Blood Gas analysis.

Objectives

- To state what acid and alkaline in the value of PH
- When analysing a blood gas determine which are:-
 - Acidotic
 - Alkalotic
 - Respiratory
 - Metabolic

Objectives

- Be able to give the correct values for Three of the Blood gas measurements.
- Give two reasons for poor Blood Gas results

Why do we take blood gases?

- To assess the effectiveness of ventilation, circulation and perfusion
- Blood gases indicate if the baby is able to move air in and out of the lungs well enough to obtain the oxygen it needs, and dispose of the carbon dioxide it doesn't
- Blood gases can also tell us if the baby is having to use its energy stores in anaerobic metabolism

What do blood gases tell us?

- Changes in the levels of
 - acidity within the blood
 - oxygen and carbon dioxide within the blood
- The pattern of these changes over time, which helps nursing and medical staff to evaluate and plan care

What is acidity?

- Acidity is a measurement of the number of Hydrogen ions (H^+) within a solution.
- A solution is:
 - Neutral if it has a pH of 7
 - Acid if it has a pH less than ($<$) 7
 - Alkaline if it has a pH greater than ($>$) 7

What is Acidity?

- Acid= gives up Hydrogen ions when in solution.
- Some give up H^+ more readily= Strong and weak Acids
- Base= Alkaline which accepts Hydrogen ions. When acid added to base a weaker acid is formed

Normal values for pH

- For a premature baby or a baby with a respiratory problem the pH of the blood should lie between 7.25 and 7.35 (Neonatal Guidelines 2007, SSBC Newborn Network)
- Babies with a pH below 7.25 are acidotic
- This can be a respiratory or a metabolic acidosis
- Looking at the balance of carbon dioxide, oxygen, bicarbonate and base excess can tell us which type of acidosis it is

Oxygen

- When we take a blood gas we look at the partial pressure of oxygen (P_{aO_2}) dissolved within the blood
- Partial pressure is the pressure exerted by the oxygen gas molecules within the blood
- The partial pressure of oxygen is measured in Kilopascals (KPa)

Normal Values of Oxygen

- For a premature baby or a baby with a respiratory problem:

The partial pressure of oxygen should lie between:-

6 and 12 KPa

Carbon Dioxide

- When we take a blood gas we look at the partial pressure of carbon dioxide (PaCO_2) dissolved within the blood
- Partial pressure is the pressure exerted by the carbon dioxide gas molecules within the blood
- The partial pressure of carbon dioxide is measured in Kilopascals (KPa)

Normal Values of Carbon dioxide

- For a premature baby or a baby with a respiratory problem:

The partial pressure of carbon dioxide should lie between:-

5.5 and 8 KPa

(Neonatal Guidelines 2007, SSBC Newborn Network)

Buffers

- Minimises changes in pH.
- Addition of strong acid or base become weaker solutions.
- Normally sufficient buffers to keep pH narrow range.
- Three buffers, which are?

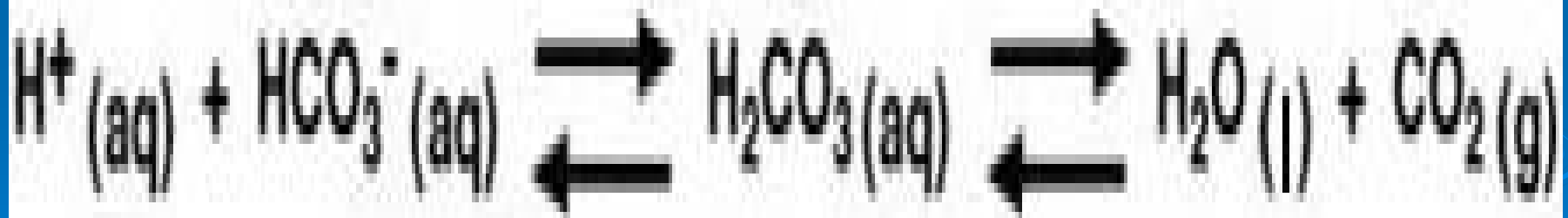
Buffers

- Bicarbonate
- Haemoglobin
- Phosphate



Bicarbonate

- Bicarbonate (HCO_3^-) is produced by a buffer within haemoglobin
- The conversion of carbonic acid to bicarbonate reduces the acidity (lowers the pH) of the blood



Bicarbonate

- Bicarbonate is measured in millimoles/litre
- The normal range for bicarbonate is 18-25 mm/L

Base Excess

- The base excess is the amount of acid which would have to be added to blood to correct the pH to 7.4
- Base excess is expressed as a + or – value
- The normal range for base excess is from -4 to +4
- A baby with a base excess below -4 is **acidotic**, as H⁺ ions need to be taken away to return the pH to 7.4
- A baby with a base excess above +4 is **alkalotic**, as H⁺ ions need to be added to return the pH to 7.4

Blood

- Blood has a pH of 7.4
- Blood maintains this pH by using buffers
- If the pH of the blood rises (becomes more alkaline) buffers release H^+ ions to lower the pH to 7.4
- If the pH of the blood falls (becomes more acidic) buffers absorb H^+ ions to raise the pH to 7.4
- Changes in pH should be avoided, as they affect the way in which the body absorbs oxygen and excretes carbon dioxide

Using blood gas results

- Look at results
- Check previous results
- Inform Medical Staff/Senior Nurse

Looking at blood gases

- So looking at blood gases means looking at absolute values and patterns
- We need to consider the numerical results of the blood gas in relation to previous blood gases and take in to account the patients' history
- Which is why blood gases can be so confusing; results which are fine for some patients are unacceptable for others!

Normal Gas values

- Ph
- P02
- Co2
- Standard bicarbonate.
- Base Excess.

Normal blood gas values

$7.25 < \text{pH} < 7.35$	pH/ acidity (Premature baby or baby with respiratory problem)
$6 < \text{PaO}_2 < 12$	Partial pressure Oxygen (O ₂)
$5 < \text{PaCO}_2 < 7$	Partial pressure Carbon Dioxide (CO ₂)
-4 to +4	Base Excess (Be)
18 – 25 mm/L	Bicarbonate (HCO ₃)

Disturbances of Acid/Base.

Respiratory Acidosis

- Poor gases exchange
- Low pH
- Raise Co_2
- Other values normal.
- what do we need to do?

Respiratory Alkalosis

- Over ventilation.
- Low CO_2 = reduce cerebral blood flow
- Therapeutic in cerebral oedema.
- pH is high
- pCO_2 is low
- Management

Metabolic Acidosis

- Accumulation of acids
- Anaerobic respiration
- Metabolic disorders
- TPN.
- Low pH
- Negative base Excess
- Normal CO_2 , O_2 normal or low.
- Treat acidosis, correction, O_2 , stop TPN.

Metabolic Alkalosis

- Too much Bicarbonate
- Persistent Vomiting
- High pH
- High bicarbonate
- Normal values for pco₂ and o₂
- Correct underlying cause.

Mixed Acidosis

- Poor gaseous exchange results in anaerobic metabolism and excessive hydrogen ions
- pH Low
- O₂ Low
- CO₂ High
- Bicarbonate is low
- Negative base excess
- Treat by improving gaseous exchange and bicarbonate

	Respiratory acidosis	Respiratory alkalosis
Cause	Unable to move CO ₂ out of lungs (poor ventilation)	Losing too much CO ₂ (over ventilation)
Signs	Low pH High pCO ₂ pO ₂ , HCO ₃ and BE may be normal	High pH Low pCO ₂
Action	CPAP, Ventilation, change ventilation	Change CPAP, change ventilation

	Metabolic Acidosis	Metabolic Alkalosis
Cause	Large loss HCO_3^- Anaerobic metabolism	Too much Sodium Bicarbonate Loss of H^+ (vomiting)
Signs	Low pH Base excess is negative pO_2 is normal	High pH High HCO_3^- Normal pCO_2
Action	Minimise the risk of anaerobic metabolism	Correct Cause

Summary

	pH	pO ₂	pCO ₂	HCO ₃	BE
Respiratory	Low	Low	High	Normal to High	Normal
Metabolic	Low	Low or Normal	Normal	Normal to Low	Low
Mixed	Low	Low	High	Low	Low

Practical Implications.

- Quality of the specimen-flowing clots.
- Poorly perfuse baby
- Beware bubbles
- Beware unexpected results-? Comparable with last gas,? repeat

