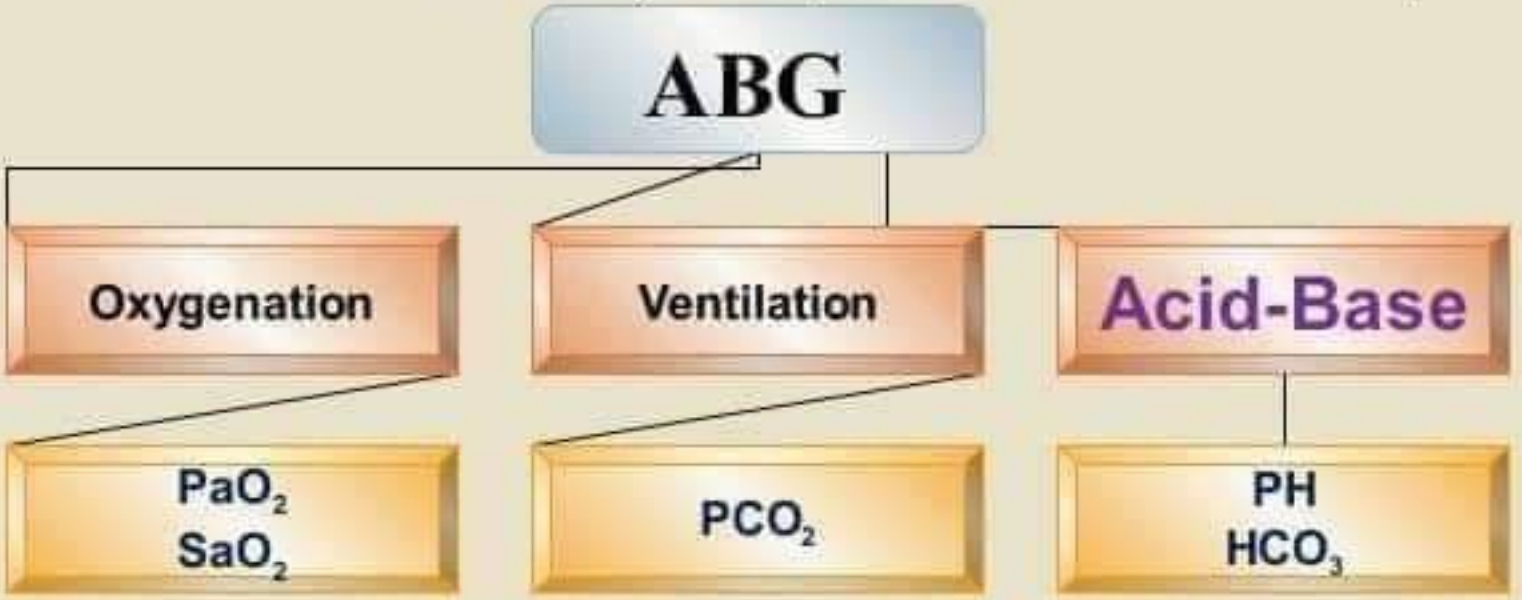
What is the ABG?

- Arterial blood gas analysis is an essential part for diagnosing and managing the patient's **oxygenation** status, **ventilation** status and **acid base balance**.
- Drawn from **arteries**(radial, brachial and femoral)



What are the components of ABG?

pH

Measurement of acidity or alkalinity, based on the hydrogen (H+)

7·35 – 7·45

PaO_2

The partial pressure oxygen that is dissolved in arterial plasma.

80 - 100 mm Hg

$PaCO_2$

The amount of carbon dioxide dissolved in arterial blood.

35 – 45 mmHg

What are the components of ABG?

HCO_3

The calculated value of the serum concentration of bicarbonate

22 – 26 mEq/L

SaO_2

The arterial oxygen saturation.

>95 %

ACID-BASE BALANCE

❖The primary aim of keeping this delicate balance is to preserve the **Homeostasis** i.e. the highly complex interactions that maintain all body systems to functioning within a normal range.

❖Any extreme change in this balance (PH **< 6.8** or **> 7.8**) may result in disastrous changes e.g. **denaturation of proteins** & shut down of **all enzymatic and metabolic processes**. Such disturbed environment would be *incompatible with life*.

(I) Respiratory Acidosis

- It is defined as a pH less than 7.35 with a $PaCO_2$ greater than 45 mmHg.
- Acidosis is the accumulation of co_2 which combines with water in the body to produce **carbonic acid**, thus lowering the pH of the blood.

ABG	pH	$PaCO_2$	HCO_3
Respiratory Acidosis	↓	↑	normal

(II) Respiratory Alkalosis

- It is defined as a pH greater than 7.45 with a $PaCO_2$ lesser than 35 mmHg.
- Alkalosis is due to excessive **wash** of co_2 (**hyperventilation**), thus increasing the pH of the blood.

ABG	pH	$PaCO_2$	HCO_3
Respiratory Alkalosis	↑	↓	normal

(III) Metabolic Acidosis

- It is defined as a pH less than 7.35 with a HCO_3 less than 22 mEq/L.

- **Toxic Causes :** Any disorder that will lead to **tissue hypoperfusion** whatever the cause will lead eventually to increase in lactic acid production resulting in Metabolic Acidosis.

1) **Late salicylate**
2) **Methanol**
3) **Ethylene glycol**
4) **Iron**

ABG	pH	$PaCO_2$	HCO_3
Metabolic Acidosis	↓	normal	↓

(IV) Metabolic Alkalosis

- It is defined as a pH greater than 7.45 with HCO_3 greater than 28 mEq/L

- **Causes**

It is due to **excessive acid loss** (repeated vomiting and nasogastric suction) OR **bicarbonate retention** e.g. overuse of sodium bicarbonate .

ABG	pH	$PaCO_2$	HCO_3
Metabolic Alkalosis	↑	normal	↑

Pattern of Changes in Acid-Base Disorders

Primary disorder	*Initial change*	*Compensatory change*
Metabolic acidosis	↓ HCO_3	↓ PCO_2
Metabolic alkalosis	↑ HCO_3	↑ PCO_2
Respiratory acidosis	↑ PCO_2	↑ HCO_3
Respiratory alkalosis	↓ PCO_2	↓ HCO_3

Normal Values

ANALYTE	Normal Value	Units
pH	7.35 - 7.45	
PCO2	35 - 45	mm Hg
PO2	72 – 104	mm Hg`
[HCO3]	22 – 30	meq/L
SaO2	95-100	%
Anion Gap	12 ± 4	meq/L
ΔHCO3	+2 to -2	meq/L

Arterial Blood Gases

PH acidosis < 7.4 > alkalosis

PH	7.35 - 7.45
PaCo2	35 - 45
HCo3	22 - 28

← Respiratory

← Metabolic

R Respiratory — PH ↑ PCo2 ↓ Alkalosis

O Opposite — PH ↓ PCo2 ↑ Acidosis

M Metabolic — PH ↑ HCo3 ↑ Alkalosis

E Equal — PH ↓ HCo3 ↓ Acidosis

Uncompensated : Co2 or HCo3 normal

Partially Compensated : Nothing is normal

Compensated : PH is normal (7.4 baseline/neutral)