

Arterial Blood Gas (ABG)



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What is **ABG** ?

It is a diagnostic procedure in which a blood is obtained from an artery directly by an arterial puncture or accessed by a way of indwelling arterial catheter

Why do you need **ABG?!**

- Assessment of ventilation, Assessment of oxygenation, Assessment of acid base balance so help in diagnoses and assess the complication of certain disease
- Modification of treatment plan
- Follow up

ABG
Sampling

Sites for obtaining ABG sample!

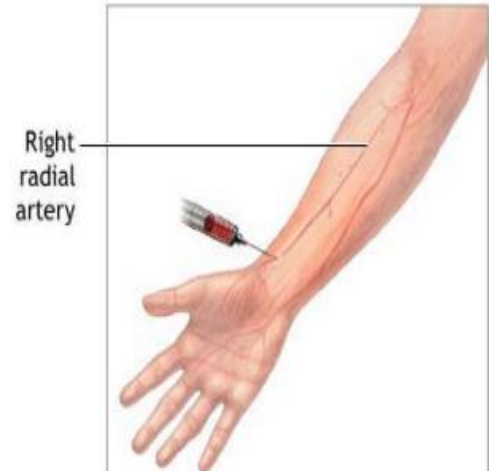
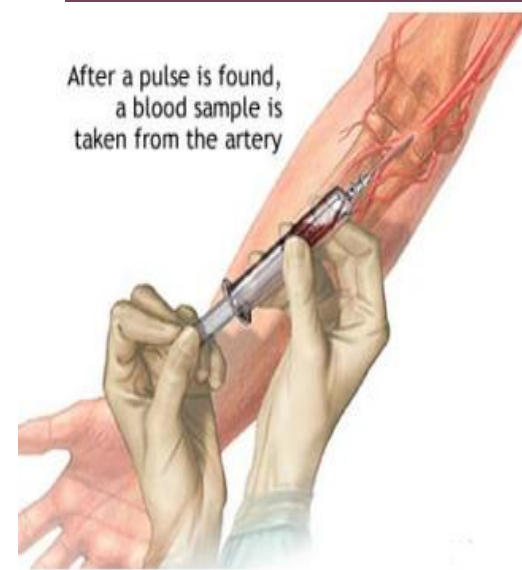
- Radial artery:

The most preferable site used because:

- . It is easy to access as It is not a deep artery which facilitate palpation, stabilization and puncturing
- . The artery has a collateral blood circulation

- Brachial artery

- Femoral artery

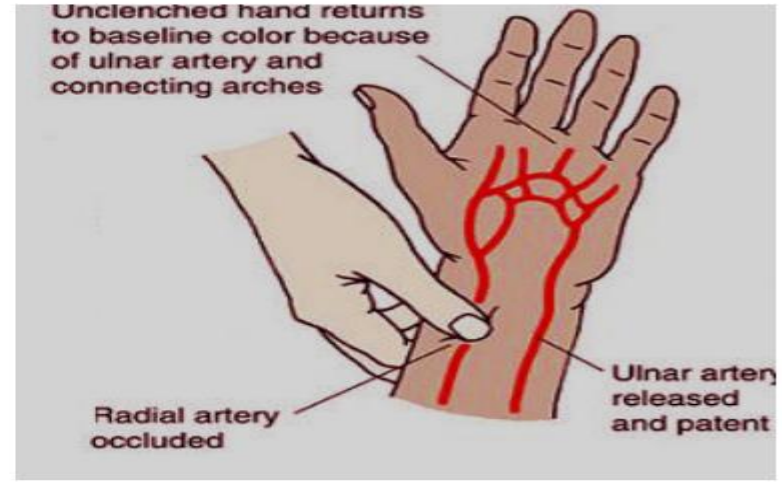
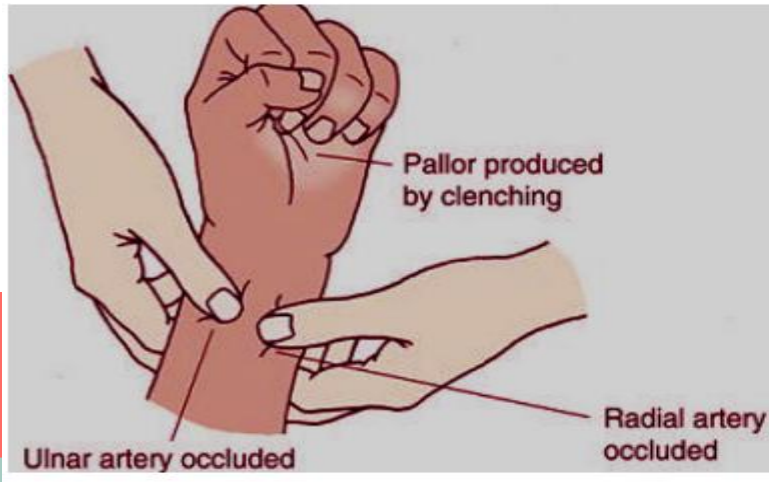


Steps of ABG sampling

- 1-** Wash hands and Put on gloves
- 2-** Palpate the artery for maximum pulsation (If radial, perform Allen's test)
- 3-** Warn the patient that he may feel pain at the puncture site and take the sample in resting state (unless you want to test ABG after exercise)
- 4-** Clean with alcohol swab in circular motion Skin
- 5-** Insert needle at 45 (90 femoral a.)
- 6-** Withdraw the needle and apply digital pressure on the puncture site
- 7-** Check bubbles in syringe Place the capped syringe in the container of ice immediately Maintain

ALLEN'S TEST

It is a test done to determine that collateral circulation is present from the ulnar artery, in case thrombosis occur in the radial





ALLEN'S test video



ABG Sampling video

Complication of sampling

Hemorrhage , hematoma

Distal ischemia, Arteriospasm

Infection

Numbness (nerve injury)

Vasovagal response (painful)

-----XXXX Diagnostics-----

Blood **Gas** **Report**
 328 03:44 Feb 5 2006
 Pt ID 3245 / 00

Measured **37.0 °C**
 pH 7.452
 pCO2 45.1 mm Hg
 pO2 112.3 mm Hg

Corrected **38.6 °C**
 pH 7.436
 pCO2 47.6 mm Hg
 pO2 122.4 mm Hg

Calculated Data

HCO3 act **31.2** mmol / L
 HCO3 std 30.5 mmol / L
 B E 6.6 mmol / L
 O2 ct 15.8 mL / dl
 O2 Sat 98.4 %
 ct CO2 32.5 mmol / L
 pO2 (A -a) 30.2 mm Hg Δ
 pO2 (a/A) 0.78

Entered Data

Temp 38.6 °C
 FIO2 30.0 %
 ct Hb 10.5 gm/dl

ABG Report

Request No:	Date:	Time:	Units	Arterial Ref Range
BLOOD GASES				
Temperature	37.0		Deg. C	
pH	<u>7.10L</u>			7.35-7.45
pCO2	<u>35</u>		mmHg	35-45
HCO3 (Std)	<u>11L</u>		mmol/L	22.0-30.0
Base Excess	<u>-17.4L</u>		mmol/L	-3.0/3.0
pO2	<u>169H</u>		mmHg	75-100
O2 Sat	<u>99</u>		%	95-100
ELECTROLYTES (Whole Blood)				
Potassium	<u>3.2L</u>		mmol/L	3.5-5.5
Sodium	<u>146H</u>		mmol/L	135-145
Chloride	<u>129H</u>		mmol/L	95-110
iCa++	<u>0.89L</u>		mmol/L	1.12-1.30
Glucose	<u>7.4</u>		mmol/L	3.6-7.7
Lactate	<u>4.9H</u>		mmol/L	0.2-1.8

ABG COMPONENT

pH: measures hydrogen ion conc. in the blood (acidity/alkalinity)

PaCO₂: partial pressure of CO₂ (in the arterial blood) known as respiratory parameter.

PaO₂: partial pressure of O₂ (in the arterial blood).

SaO₂: (oxyhemoglobin saturation) = the content of oxygen (combined with HB) in arterial blood*100/ maximum oxygen capacity (combined with HB) in arterial blood

HCO₃: known as the metabolic parameter, it reflects the kidney's ability to retain and excrete bicarbonate.

ABG COMPONENT

Normal value

pH

= 7.35 – 7.45

PaCO₂

= 35 – 45 mm Hg

PaO₂

= 80 – 100 mm Hg

HCO₃

= 22 – 26 mmol/L

RADIOMETER ABL800 BASIC

ABL800 BASIC
PATIENT REPORT

Syringe - 3.85uL
pH+BG+OXI

01:42 AM 1.12/2016
Sample # 83791

Identifications

Patient ID
Patient Last Name
Patient First Name
Sample type
T

Not specified
37.0 °C

Blood Gas Values

pH	7.440	[7.350 - 7.450]
pCO ₂	35.2 mmHg	[32.0 - 48.0]
pO ₂	85.2 mmHg	[83.0 - 108]

Oximetry Values

ctHb	16.4 g/dL	[- -]
sO ₂	95.8 %	[- -]
FO ₂ Hb _e	95.0 %	[- -]
FHHb _e	4.2 %	[- -]

Temperature Corrected Values

pH(T)	7.440	
pCO ₂ (T)	35.2 mmHg	
pO ₂ (T)	85.2 mmHg	

Oxygen Status

ctO ₂ e	21.9 Vol%
p50 _e	28.24 mmHg

Acid Base Status

cBase/Ecf/c	-0.1 mmol/L
cHCO ₃ / (P.St)c	24 mmol/L

Notes

c Calculated value(s)
e Estimated value(s)

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INTERPRETATION

1. Assessment of oxygenation:

-look for PaO₂

-Hypoxemia means : PaO₂ is less than 80 mm Hg.

-Respiratory failure type I: PaO₂ is less than 60 mm Hg. at sea level.

Q. Mention the symptoms and signs of hypoxemia.

Q. Mention the causes of hypoxemia /RF I.

Q. How to treat a case of respiratory failure type I ?

2. Assessment of ventilation:

-look for **PaCO₂**

-Hypocapnea: PaCO₂ is less than 35 mm Hg. (i.e. CO₂ wash)

-Hypercapnea: PaCO₂ is more than 45 mm Hg.

-Respiratory failure type II: PaCO₂ is more than 50 mm Hg.

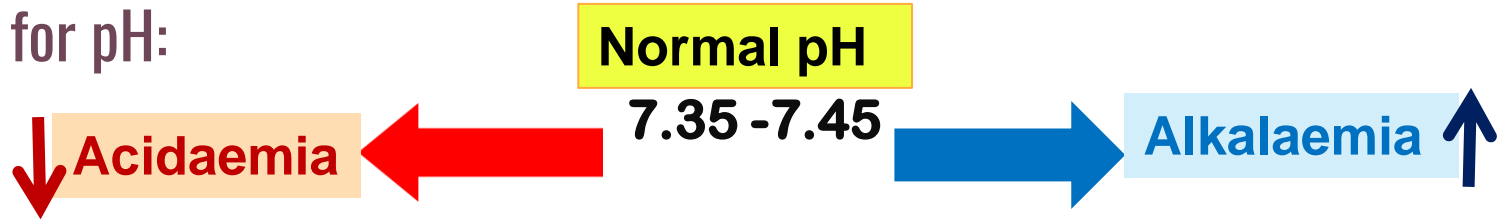
Q. Mention the symptoms & signs of respiratory failure type II.

Q. Mention the causes of RF II.

Q. How to treat a case of respiratory failure type II and why?

3. Acid base balance:

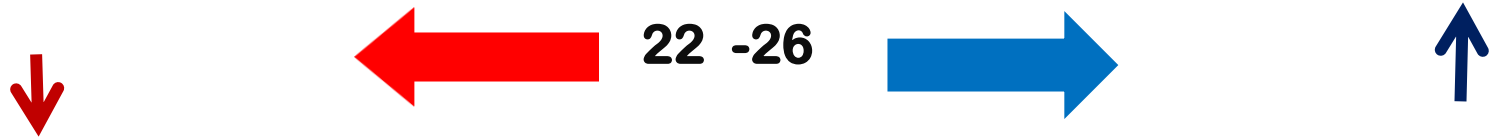
-look for pH:



-look for PaCO₂ (assess the respiratory cause):



-look for HCO₃⁻ (assess the metabolic cause):



- Assess the compensation

COMPENSATION

- With respiratory causes of acid base imbalance, the kidney try to correct the pH to maintain it within normal and also if the imbalance was due to metabolic cause the respiratory system make its best to regulate the pH i.e. **{Trial of compensation}** .
- When the mechanisms of compensation fail in maintenance of normal pH it will be **uncompensated imbalance** e.g. uncompensated respiratory acidosis.

Q. Could you tell me when to say compensated /uncompensated / partially compensated respiratory acidosis?

Mechanism of compensation

The respiratory system respond to metabolic based pH imbalance:

1. metabolic acidosis>>> increase respiratory rate and depth (**hyperventilation**) due to stimulation of respiratory center indirectly (by the act of peripheral chemoreceptors). (P_aCO_2 ↓)
2. metabolic alkalosis>>> decrease respiratory rate and depth (**hypoventilation**) due to inhibition of respiratory center indirectly(P_aCO_2 ↑)

The renal system respond to respiratory based pH imbalance:

1. respiratory acidosis>>> increase reabsorption of bicarbonates

(HCO_3^- ↑)

2. respiratory alkalosis>>> decrease the reabsorption of(HCO_3^-)



Full Compensation

	pH	PaCO ₂	HCO ₃
Respiratory Acidosis	↑	↑
Respiratory alkalosis	↓	↓
Metabolic Acidosis	↓	↓
Metabolic Alkalosis	↑	↑

Partial Compensation

	pH	PaCO ₂	HCO ₃
Respiratory Acidosis	↓	↑	↑
Respiratory alkalosis	↑	↓	↓
Metabolic Acidosis	↓	↓	↓
Metabolic Alkalosis	↑	↑	↑

Un Compensation

	pH	PaCO ₂	HCO ₃
Respiratory Acidosis	↓	↑
Respiratory alkalosis	↑	↓
Metabolic Acidosis	↓	↓
Metabolic Alkalosis	↑	↑

N.B.

Acute : each (10mmHg) change in P_aCO_2 need a corresponding change in HCO_3 by (1mmol/l) to maintain pH with in normal range (in the same manner either increase or decrease)

Chronic: each (10mmhg) change in P_aCO_2 need a corresponding change in HCO_3 by (3-3.5mmol/l) to maintain pH with in normal range

EXAMPLE

NORMAL ABG

RADIOMETER ABL800 BASIC


ABL800 BASIC
PATIENT REPORT

Syringe - S 85uL
pH+BG+OXI

01:42 AM 1/12/2016
Sample # 83791

Identifications

Patient ID
Patient Last Name
Patient First Name
Sample type
T

جاء الوريد

Not specified
37.0 °C

Blood Gas Values

pH	7.440		[7.350 - 7.450]
pCO ₂	35.2	mmHg	[32.0 - 48.0]
pO ₂	85.2	mmHg	[83.0 - 108]

Oximetry Values

ctHb	16.4	g/dL	[- -]
sO ₂	95.8	%	[- -]
FO ₂ Hb _e	95.0	%	[- -]
FHHb _e	4.2	%	[- -]

Temperature Corrected Values

pH(T)	7.440		
pCO ₂ (T)	35.2	mmHg	
pO ₂ (T)	85.2	mmHg	

Oxygen Status

ctO _{2e}	21.9	Vol%	
p50 _e	28.24	mmHg	

Acid Base Status

cBase(Ecf) _c	-0.1	mmol/L	
cHCO ₃ ⁻ (P,st) _c	24.7	mmol/L	

Notes

c Calculated value(s)
e Estimated value(s)

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INTERPRETATION OF ABG RESULTS:

Exp.1 : ABG sample for a patient in ER diagnosed as acute exacerbation COPD :

PH 7.36
PaCO₂ 60 mmHg
PaO₂ 50 mmHg
HCO₃ 30 mmol/l

- ✓ **Decreased PaO₂** [hypoxemia]
- ✓ **Increased** (hypercapnea i.e respiratory cause)
- ✓ **Normal pH**
- ✓ **Normal HCO₃** (un compensation)

N.B. Even if pH was normal look for PaCO₂ and HCO₃ to exclude compensated acid base imbalance

*Respiratory failure type 2, fully compensated
Respiratory acidosis*

EX. 2: ABG for a patient with history of chronic renal disease, presented to ER with respiratory distress, kussmaul breathing

PH: 7.13
PaCO₂: 20 mmHg
PaO₂: 55 mmHg
HCO₃ : 12mmol/l

- ☑ Hypoxemia (resp. failure Type I)
- ☑ Decreased (co₂ wash)
- ☑ **Acidosis**
- ☑ **decreased** HCO₃(metabolic cause)

*Respiratory failure type 1,
partially compensated
Metabolic acidosis*

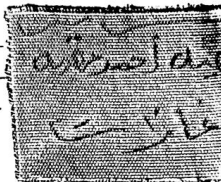
Q. Comment on the following ABG report

PH: 7.29
 PaCO₂: 67.9 mmHg
 PaO₂: 35 mmHg
 HCO₃⁻: 26mmol/l

RADIOMETER ABL800 BASIC

ABL800 BASIC
 PATIENT REPORT

Syringe - S 85ul
 pH+BG+OXI



Identifications

Patient ID
 Patient Last Name *Emergency*
 Patient First Name
 Sample type Not specified
 T 37.0 °C

Blood Gas Values

↓ pH 7.291 [7.350 - 7.450]
 ↑ pCO₂ 67.9 mmHg [32.0 - 48.0]
 ↓ pO₂ 35.1 mmHg [83.0 - 108]

Oximetry Values

ctHb 15.9 g/dL [- -]
 sO₂ 56.7 % [- -]
 FO₂Hb_e 56.3 % [- -]
 FHHb_e 42.9 % [- -]

Temperature Corrected Values

pH(T) 7.291
 pCO₂(T) 67.9 mmHg
 pO₂(T) 35.1 mmHg

Oxygen Status

ctO_{2e} 12.6 Vol%
 p50_e 31.84 mmHg

Acid Base Status

cBase(Ecf)_c 5.5 mmol/L
 cHCO₃⁻(P,st)_c 26.0 mmol/L

Notes

↑ Value(s) above reference range
 ↓ Value(s) below reference range
 c Calculated value(s)
 e Estimated value(s)

o j w a g e o

THANKS

