



- Acid-base disturbance:

- **Acidemia: pH < 7.35**
 - ✓ $\uparrow H^+$, $\uparrow pCO_2$, $\downarrow HCO_3$
- **Alkalemia: pH > 7.45**
 - ✓ $\downarrow H^+$, $\downarrow pCO_2$, $\uparrow HCO_3$
- **There are two types of acid-base disturbance:**

Respiratory	Metabolic
Acidosis ($\uparrow pCO_2$)	Acidosis ($\downarrow HCO_3$)
Alkalosis ($\downarrow pCO_2$)	Alkalosis ($\uparrow HCO_3$)

- **Compensatory response:** it is a defense mechanism that function to reduce the effect of a particular disorders on the pH. This is done either by kidneys or lungs to alter pCO_2/HCO_3 ratio.
 - ✓ Metabolic disorder: respiratory compensation.
 - ✓ Respiratory disorder: metabolic compensation
- **Metabolic acidosis:**
 - ✓ It is compensated by low pCO_2 which is done by hyperventilation (kussmal breathing).
- **Metabolic alkalosis:**
 - ✓ It is compensated by increasing pCO_2 which is done by hypoventilation.
- **Respiratory acidosis:**
 - ✓ It is compensated by increasing HCO_3 through either buffering system or renal excretion of $[H^+]$.
- **Respiratory alkalosis:**
 - ✓ Kidneys will compensate by lowering $[H^+]$ secretion.

- Diagnosis of acid-base disturbance:

- **History.**
- **Physical examination.**
- **Arterial Blood Gas (ABG).**

Normal values of arterial blood gas	
pH	7.35 – 7.45
HCO ₃	20-28 meq/L
pCO ₂	35-45 mmHg

- ✓ Steps for interpretation of ABG:
 - ❖ Look at pH.
 - ❖ Inspect serum bicarbonate and carbon dioxide.
 - ❖ Determine whether the patient's compensation is appropriate.

- Case-1:

- **3 days newborn had respiratory distress, connected to mechanical ventilator at PIO₂ 60%, rate 60/minute and PEEP 4. His ABG is as the following:**

pH	7.5
pCO ₂	20 mmHg
pO ₂	85 mmHg
HCO ₃	18 meq/L

- ✓ Interpretation: non-compensated respiratory alkalosis.
- ✓ Causes of this condition could be:
 - ❖ Hyperventilation of psychogenic origin.
 - ❖ Overventilation mechanically (by a ventilator).
 - ❖ Early stage of acidic overdose.
- ✓ Clinical features: parasthesia of extremities due to reduction of ionized calcium.



- **Case-2:**

- **1-year-old child was admitted to the hospital for repeated vomiting. His physical examination showed dry mucous membrane. His blood gas results were as shown below:**

pH	7.49
pCO₂	45 mmHg
HCO₃	35 meq/L

- ✓ **Interpretation:** partially-compensated metabolic alkalosis.
- ✓ **Causes of this condition could be:**
 - ❖ Loss of hydrogen (e.g. vomiting or gastric aspiration).
 - ❖ Increased renal reabsorption of bicarbonate.
- ✓ **Clinical features:** mostly asymptomatic but the patient might suffer from weakness and muscle cramps.

- **Case-3:**

- **A 65-year-old man with bronchial asthma was admitted to the hospital for respiratory distress. His blood gas results were as shown below:**

pH	7.35
pCO₂	65 mmHg
pO₂	40 mmHg
HCO₃	28 meq/L

- ✓ **Interpretation:** fully compensated respiratory acidosis
- ✓ **Causes of this condition could be:**
 - ❖ Neuromuscular disorders.
 - ❖ Airway obstruction.
 - ❖ Sedative overdose.
 - ❖ Kyphoscoliosis.
- ✓ **Clinical features:** increased cerebral blood flow, increased intracranial pressure and headaches.

- **Case-4:**

- **A 1-week-old newborn was admitted to the hospital for poor feeding and lethargy. His blood gas results were as shown below:**

pH	7.2
pCO₂	20 mmHg
pO₂	88 mmHg
HCO₃	15 meq/L

- ✓ **Interpretation:** partial compensation metabolic acidosis.
- ✓ **Causes of this condition could be:**
 - ❖ Renal tubular acidosis.
 - ❖ Diabetic ketoacidosis.
 - ❖ Diarrhea.
 - ❖ Poisoning.
 - ❖ Lactic acidosis.
 - ❖ Inborn errors of metabolism.
- ✓ **Clinical features:**
 - ❖ Kussmaul breathing (deep, rapid respiration).
 - ❖ Decrease in cardiac function which results in hypotension and pulmonary edema.

- **Anion gap was discussed in another note.**