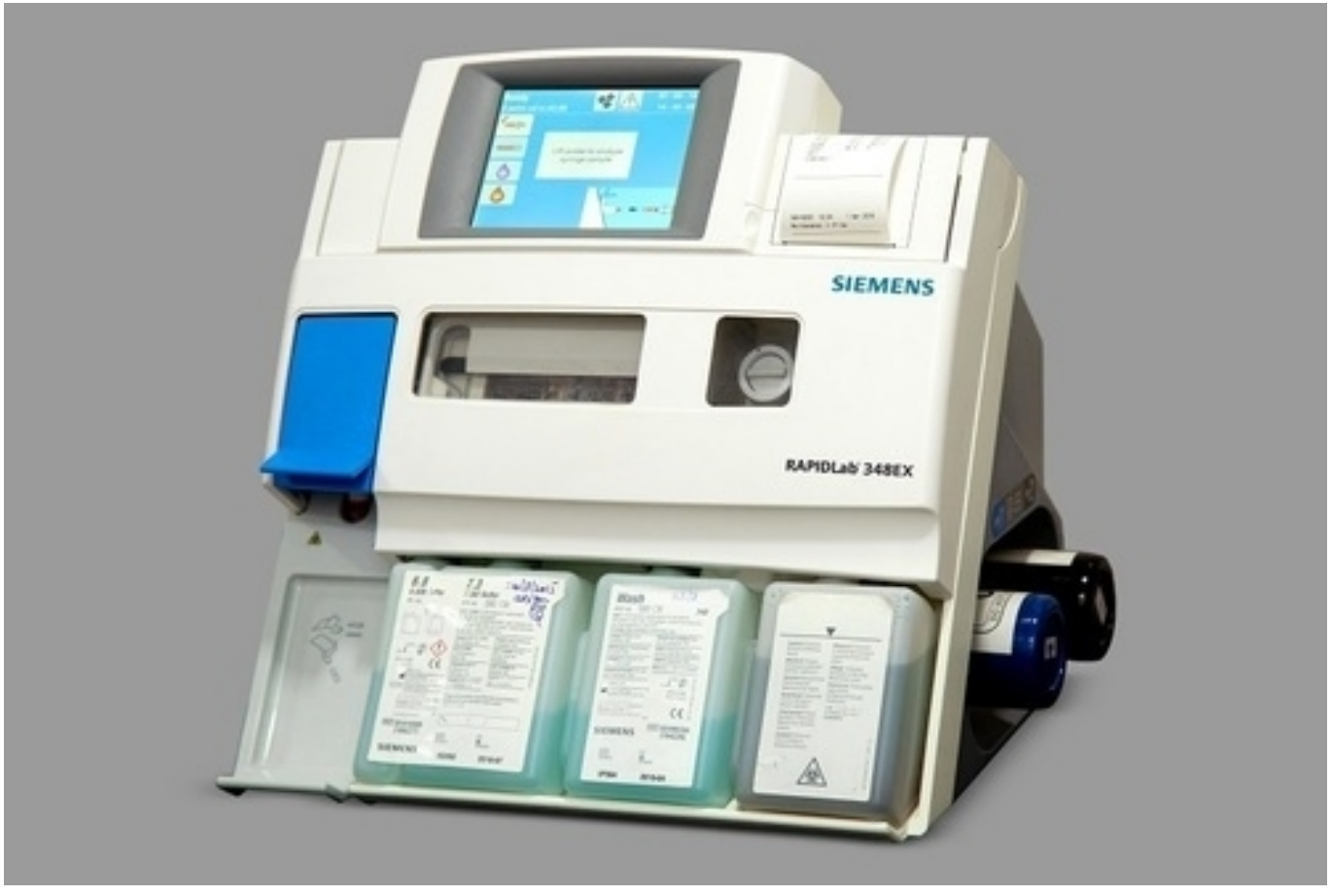
Applications of ABG

- To document respiratory failure and assess its severity.
- To monitor patients on ventilators and assist in weaning.
- To assess acid base imbalance in critical illness.
- To assess response to therapeutic interventions and mechanical ventilation

ABG EQUIPMENT

- Blood gas analyzers use electrodes to determine **pH, partial pressure of carbon dioxide** and **partial pressure of oxygen in the blood.**
- It consist of **three electrodes** measuring **pH, pCO_2** and **pO_2** at 37 degree
- It may also measure electrolytes like **sodium, potassium** and **chloride.**
- From these outputs, internal computers calculate **oxygen saturation, base excess and bicarbonate level.**



Normal serum electrolyte and arterial blood gas values.

- pH = 7.4
- Bicarbonate = 22–26 mmol/L
- Chloride = 96–106 mmol/L
- Potassium = 3.5–5 mmol/L
- Sodium = 136–145 mmol/L
- pO_2 = 95 (85–100) mm Hg
- pCO_2 = 40 (35–45) mm Hg

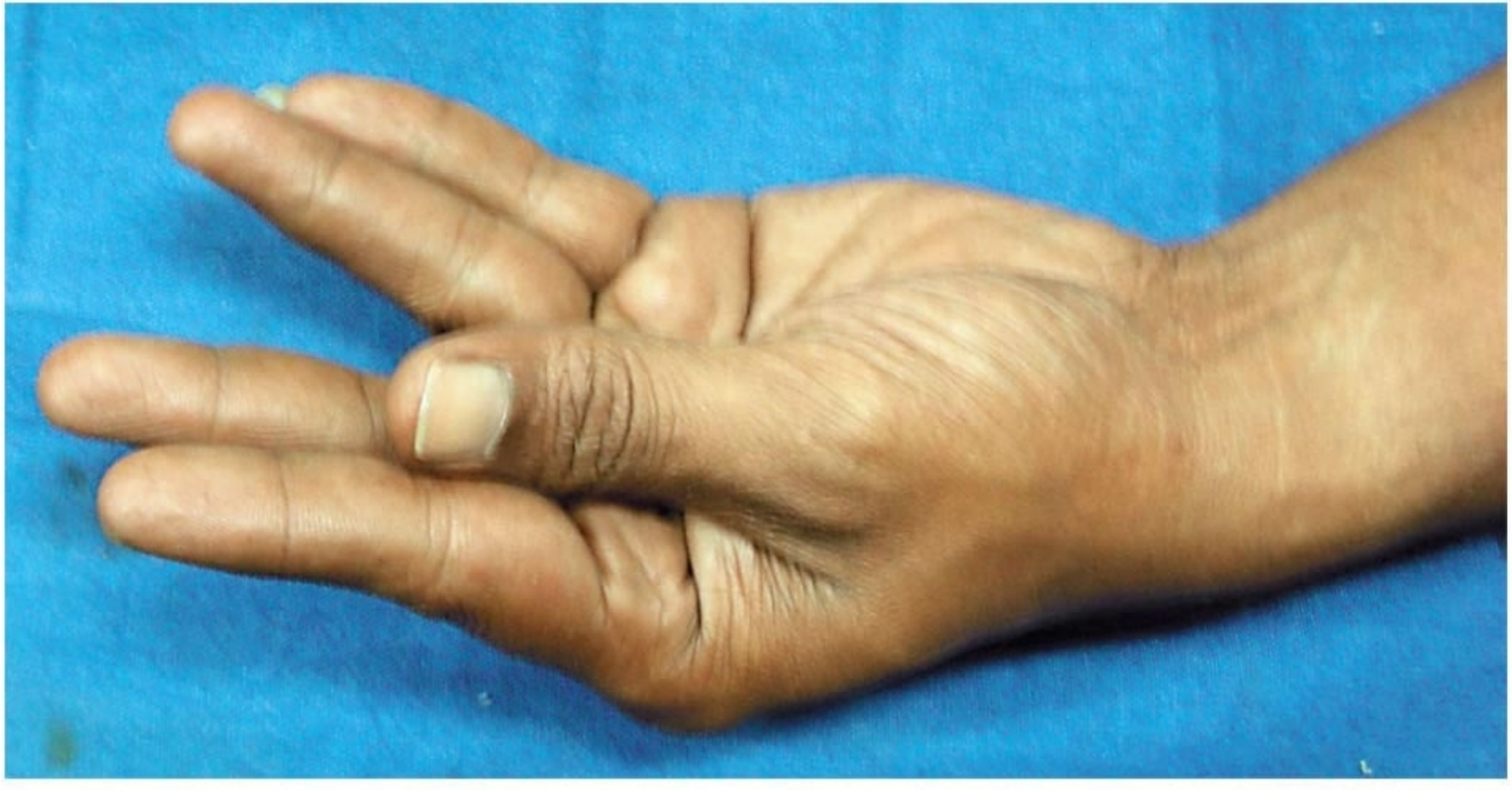
Case Study

- 1. Sheela aged 19 years brought to casuality at 11 AM with **dizziness, tingling of fingers**, **sweating, breathing heavily** and **nausea**. O/E: **Hyperventilation, carpopedal spasm** was found.

Laboratory data:

- pH **7.55**
- Pco_2 **20 mm Hg**
- HCO_3 **24 mmoles/l**

- **1. What kind of acid-base disorder is this girl suffering from? Explain.**
- **2. What are the common causes of this kind of disorder?**
- **3. Give the compensatory mechanism available in the body to correct this sort of acid-base imbalance.**



1. Respiratory alkalosis (uncompensated)

- Tingling of fingers and carpopedal spasm is due to reduction in ionized calcium caused by increased binding of calcium to albumin in alkaline pH of ECF.

2. Common cause of respiratory alkalosis is functional hyperventilation due to anxiety disorders.

- It also occurs in cases where the respiratory center in medulla is over stimulated as in encephalitis, intracranial surgery, salicylate poisoning and chronic liver disease

3. In respiratory alkalosis, there is loss of CO2 leading to decrease in pCO2 and increase in bicarbonate to carbonic acid ratio.

- In an attempt to return the pH towards normal, kidney excrete more bicarbonate in urine so that bicarbonate -carbonic acid ratio is brought back to normal

2. Ramakrishnan, 60 years old, a known smoker attended casuality with **exacerbation of bronchial asthma**. The acid base analysis report is given below. Give your interpretation.

Laboratory data:

- pH **7.04**
- Pco2 **90 mm Hg**
- HCO3 **24 meq/L**

Respiratory acidosis

- Asthma attack are characterized by episodes of airway obstruction leading to **retention of CO_2**, leading to **increase pCO_2,decreased bicarbonate to carbonic acid ratio.**
- Renal compensatory mechanisms tend to **retain bicarbonate** in the blood which in turn help to raise the bicarbonate-carbonic acid in order to attain **20:1 ratio** so that normal pH is restored.
- Generally respiratory acidosis is caused by disorders that interfere with respiratory activity- **pneumonia, asthma, pulmonary edema,COPD**
- **Morphine** and **barbiturate poisoning** cause of **depression of respiratory centre** leading to **respiratory acidosis**.

- A woman complaining of intractable vomiting suspected of suffering from pyloric stenosis receiving treatment showed following acid base data on day 1 and day 2.

Laboratory data on day 1:

- pH **7.6**
- pCO_2 **40 mm Hg**
- HCO_3 **35 meq/L**

Laboratory data on data 2 :

- pH **7.55**
- pCO2 **45 mm Hg**
- HCO3 **28 meq/L**

- Kumaran,58 year old peon in a private firm has been suffering from DM for the past 20 years. He was taking irregular treatment for DM. One day he was brought to the casuality in a stuperosed state. O/E: **Fruity odor in breath**, **Kussmaul's type of breathing +**

Laboratory data

- Urine Rothera's Test – **Positive**
- Plasma Glucose- **450 mg/dl**

ABG analysis report

- pH **7.2**
- pCO_2 **40 mm Hg**
- HCO_3 **15 meq/L**
- Na **140 mmol/L**
- K **4 mmol/L**
- Cl **102 mmol/L**

1. What is the problem diagnosis? Explain.

2. Calculate the anion gap from given laboratory data?

3. What is the value of normal anion gap?