RESPIRATORY

CAUSES OF ACID-BASE DISORDERS

Causes of Respiratory Acidosis (high H+, high CO2)

Hypoventilation

- **Obstructive pulmonary disease:** COPD, asthma
- **Upper airway obstruction**
- **Mechanical obstruction to lung expansion:** pneumothorax, pleural effusion, chest wall deformities
- **Neuromuscular disease:** Guillain-Barre syndrome, myasthenia gravis
- **CNS depression:** sedatives, stroke, intracranial bleed

Causes of Respiratory Alkalosis (low H+, low CO2)

Stimulated respiratory drive

- **CNS:** stroke, intracranial bleed, psychogenic
- **Hypermetabolic:** thyrotoxicosis, pregnancy, fever, delirium tremens
- **Hyperthermia**
- **Iatrogenic mechanical ventilation**

Hypoxia-induced

Compensation for metabolic acidosis

Causes of Metabolic alkalosis (low H+, high HCO3-)

Loss of acid

- **Loss from GI tract:** vomiting, ileostomy
- **Loss from renal tract:** hyperaldosteronism, diuretics

Gain of alkali

- **Bicarbonate infusion**
- **Excessive antacid/laxative consumption**
- **Massive blood transfusion** (citrate in PRC converted to bicarbonate)

Causes of Metabolic Acidosis (high H+, low HCO3-)

Increased acid production

- **Tissue hypoxia:** cardiorespiratory depression or impaired oxygen carrying capacity (carbon monoxide poisoning, methaemaglobinaemia)
- **Production of ketoacids:** DKA, alcoholic ketoacidosis and ethanol/isoniazid poisoning
- **Interference with ATP usage:** paracetamol, valproate, metformin, CO, cyanide

Exogenous acids

- **Poisoning by acidic substances:** salicylates
- **Poisoning by substances with acidic metabolites:** methanol & ethylene glycol

Loss of bicarbonate

- **Loss from GI tract**: diarrhoea, pancreatic fistula
- **Loss from the renal tract:** renal tubular acidosis

Decreased acid elimination

- **Acute kidney injury**
- **Toxic metabolites causing renal impairment:** ethylene glycol

The **anion gap** can be calculated to help work out the cause of a metabolic acidosis. The anion gap is equal to the difference between the plasma concentrations of the measurable cations (positive ions: Na+ and K+) and anions (negative ions: Cl- and HCO3-):

(Na + K) – (HCO3 + Cl)

A **normal anion gap is <18mmol/L**. A high anion gap is associated with the addition of endogenous or exogenous acids which are paired with an unmeasured cation.

Metabolic acidosis with raised anion gap	Metabolic acidosis with normal anion gap
Methanol	GI HCO3- loss (eg diarrhoea)
Uraemia	Renal HCO3- loss (renal rubular acidosis)
Diabetic ketoacidosis	Renal failure
Paraldehyde	Hypoaldersteronism
Iron/isoniazid	Carbonic anhydrase inhibitors
Lactic acid	Chloride ingestion (eg magnesium chloride)
Ethanol/ethylene glycol	
Salicylates	