ARTERIAL BLOOD GASES

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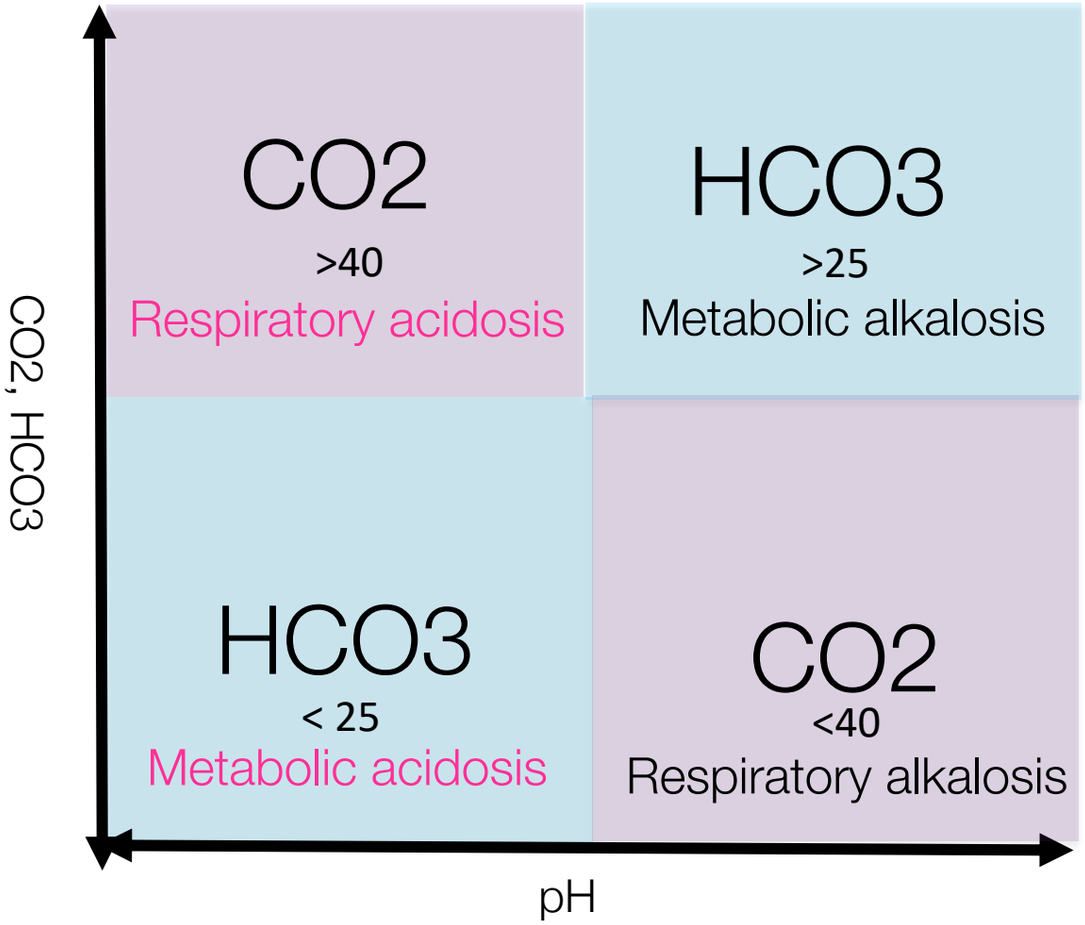
Arterial Blood Gases (ABG)



Interpreting ABG:

- Look at pH (N=7.35-7.45)
  - ↓ acidosis, ↑ alkalosis
- Look at pCO2 (N= 35-45, if pregnant pCO2= 30)
  - ↓ resp alkalosis, ↑ resp acidosis
  - pCO2 is normally ↓ in pregnancy
- Look at HCO3 (N= 21-27)
  - ↓ metab acidosis, ↑ metab alkalosis
- Compensation: compare pH (acidosis/alkalosis) to direction of pCO2 and HCO3

Compensation:

- Compensation by lungs (pCO2) is fast, compensation by kidneys (HCO3) is slow
- **Predicted change in pH= (40-pCO2) x 0.008**
  - For every 1mm Hg of uncompensated change in pCO2 from 40, pH will change by 0.008
  - Metabolic acidosis: measured pH is less than predicted pH
  - Metabolic alkalosis: measured pH is greater than predicted pH
- Fully compensated- if pH is within normal range, <7.4 but normal, then primary is acidosis, if >7.4 but normal then primary alkalosis (full compensation does not correct past 7.4)

Mixed acidosis:
Low pH, high pCO2, high BD

Respiratory acidosis:
Low pH, high pCO2, normal BD

- COPD, asthma
- Acute pulmonary edema
- Aspiration
- Pneumonia
- ARDS
- Pneumothorax
- Respiratory depression
- Cardiac arrest
- Head injury
- CNS depression, neuromuscular disorders that interfere with breathing → MS, MD
- Severe obesity that interferes with expansion of lungs

Respiratory alkalosis:

- Hyperventilation, mechanical overventilation
- Anxiety, fear
- Pain
- Fever
- Sepsis
- Brain tumour

Metabolic acidosis:
Low pH, normal pCO2, high BD

- DM
- AKI, CKD
- Severe diarrhea
- Alcoholism
- Starvation
- Salicylate overdose
- Pancreatic fistula

Metabolic alkalosis:

- Vomiting, gastric suction (loss of gastric acid), gastric outlet obstruction
- Long-term diuretic use (thiazide, furosemide)
- Hypercalcemia
- Excessive NaHCO3 administration

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Metabolic Acidosis:

- **Anion gap= (Na^+)- (Cl^-+HCO_3^-)**
  - K is not counted since it is mostly inside the cells
  - Normal= 10-15mmol/L serum concentration of anions
  - **High anion gap metabolic acidosis if >15mmol/L** (extra anions are present)

High anion gap metabolic acidosis	**MUD PILES** • M- methanol • U- uremia (renal failure) • D- ketoacidosis- DKA, alcoholic ketosis, starvation, hyperosmotic hyperglycemic state in diabetes • P- paraldehyde • I- isioniazide, iron • L- lactatic acid • Different types of lactic acid- L-lactate, D- lactate (used as suspension for meds- IV atavan, IV phenobarbutol) , oxyproline (byproduct of acetaminophen- chronic Tylenol users), propylene glycol • E- ethylene glycol, propylene glycol • S- salycilates- ASA • Toluene ingestion (if renal function is impaired) • Chronic renal disease

Normal anion gap metabolic acidosis Aka hyperchloremic metabolic acidosis	**HARDUP** • H = hyperalimentation (e.g., starting TPN) • A = acetazolamide use • R = RTA (renal tubular acidosis) • D = diarrhea, GI losses (ex. Tube drainage), pancreatic drainage • U = uretosigmoid fistula (because the colon will waste bicarbonate), ureterosigmoidostomy • P = pancreatic fistula (because of alkali loss--the pancreas secretes a bicarbonate-rich fluid) • After treatment of ketoacidosis • Carbonic anhydrase inhibitors • Ureteral diversion (ex. Ileal loop) • Chronic renal disease • Toluene ingestion (if renal function is normal → hippurate production)

- **Osmolar gap= measured osmolality- calculated osmolality**
  - **Measured osmolality is reported in bloodwork**
  - **Calculated osmolality= 2 salts and a sugar bun= 2[Na^+]+ glu+ BUN**
    - Normal: 272-300 mOsm/L
  - Normal osmolar gap ≤10 → high anion gap metabolic acidosis
  - Osmolar gap >10 → suspect unknown osmotically active substances
    - Need to measure fractionated alcohol levels

References

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