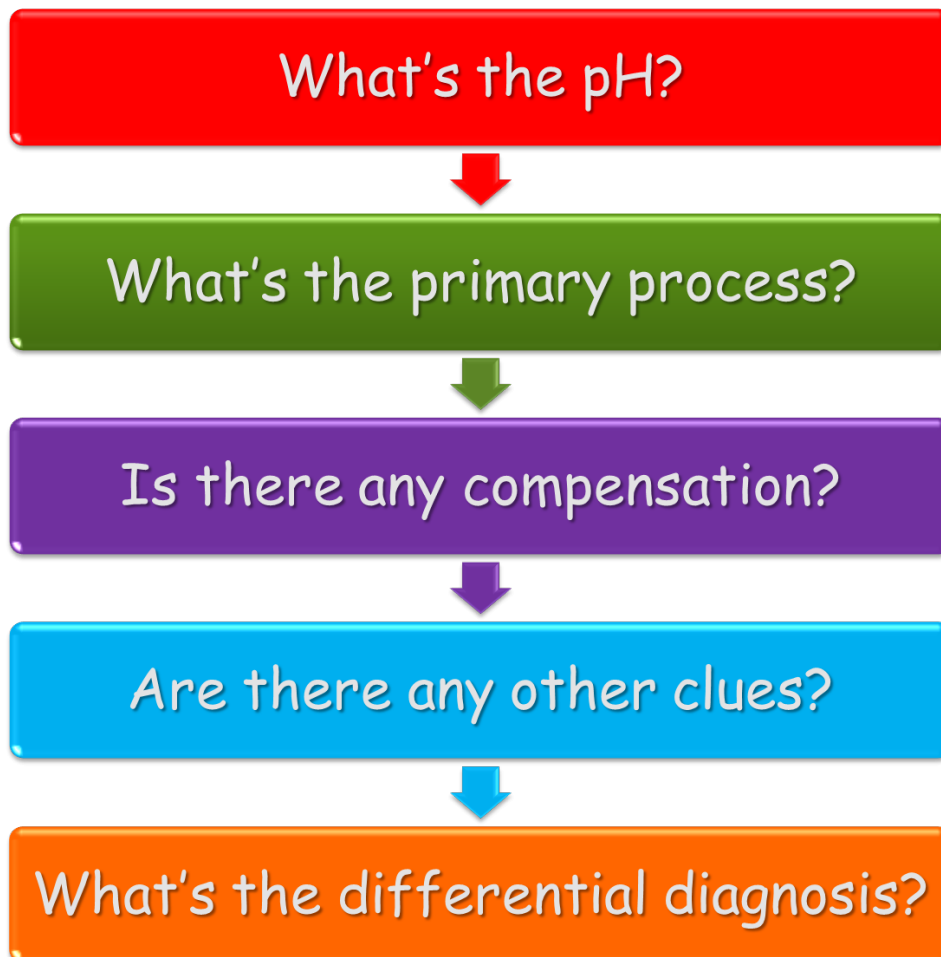


Blood Gas #8

History: A 25-year-old man is brought in by the police in a highly agitated state. Below is his arterial blood gas shortly after arrival:

pH 7.59	Na 148 mmol/L
pCO ₂ 17 mmHg	K 3.8 mmol/L
pO ₂ 126 mmHg (FiO ₂ 0.21)	Cl 112 mmol/L
HCO ₃ 17 mmol/L	Glucose 5.5 mmol/L
Lactate 3.8 mmol/L	

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What's the pH?

7.59 = alkalaemia

What's the primary process?

pCO₂ 17 = primary respiratory alkalosis

Is there any compensation?

Expected HCO₃ = 24 - 2 × ((40 - Measured pCO₂)/10)

= 24 - 2 × ((40 - 17)/10)

= 19.4

Actual bicarbonate is 17 suggesting a co-existing metabolic acidosis

Are there any other clues?

$$\text{Expected PAO}_2 = 150 - (\text{pCO}_2 \times 1.25)$$

$$= 150 - (17 \times 1.25)$$

$$= 128.75$$

$$\text{A-a gradient} = \text{PAO}_2 - \text{PaO}_2$$

$$= 128.75 - 126$$

$$= 2.75$$

Therefore there is no significant A-a gradient.

$$\text{Anion gap} = \text{Na} - (\text{Cl} + \text{HCO}_3)$$

$$= 148 - (112 + 17)$$

$$= 19$$

Therefore there is an elevated anion gap acidosis.

$$\text{Delta gap} = (\text{Anion gap} - 12) \div (24 - \text{HCO}_3)$$

$$= (19 - 12) \div (24 - 17)$$

$$= 1$$

Consistent with a high anion gap acidosis.

Electrolyte clues:

Chloride, sodium and lactate are elevated. Potassium and glucose are within normal limits.

What's the differential diagnosis?

Description: This arterial blood gas shows an alkalaemia secondary to a primary respiratory alkalosis, with coexisting high anion gap metabolic acidosis. There is no significant A-a

gradient and oxygenation is appropriate. Lactate is elevated, contributing to the anion gap. Chloride is elevated, which is normally associated with a non-anion gap metabolic acidosis. Sodium is also elevated.

Interpretation: This gas is most consistent with primary hyperventilation, causing a respiratory alkalosis. In view of the metabolic acidosis, underlying causes of agitation may include toxicological causes (salicylates, stimulants) or sepsis with delirium and end organ perfusion deficit causing the elevated lactate. An elevated intracranial pressure with increased respiratory drive secondary to meningitis/encephalitis should also be considered. A respiratory source of sepsis is less likely, given the normal A-a gradient.

Additional information: The strong ion gap = $\text{Na} - \text{Cl} = 36$, revealing a non-anion gap metabolic acidosis that is not otherwise calculated elsewhere.

Diagnosis: Agitation and hyperventilation secondary to ingestion of an methamphetamines (*quelle surprise!*).