

Feedback Q23

Question 23 (19 marks) 6 minutes

A 75 year old male is brought to your ED via ambulance, with Respiratory Distress, fever and confusion. On assessment, the patient is confused and combative. His vital signs on arrival are:

Temp 38.7°C

HR 120bpm, irregular

BP 110/60mm Hg

RR 32/min

O2 sats 91%on High flow nasal prong O2

The patients arterial blood gas is reprinted below

PH	7.21	(7.32 - 7.42)
PCO2	64 mmHg	(41 - 51)
PO2	75 mmHg	
HCO3	21 mmol/L	(20 - 40)
BE	-6 mmol/L	(-3.0 - +3.0)
Na	148 mmol/L	(135-145)
Cl	105 mmol/L	(95 - 107)

a) Assuming the patients K is normally 4.0, based on these acid base abnormalities

Calculate the following Parameters (expected Potassium and Delta Ratio) showing your calculations. (2 marks)

b) What is the acid base abnormality on these results? Justify your answer (2 marks)

c) List Three (3) key differential diagnosis in this case; For each differential list Two (2) investigations you would perform, with a justification for each (15 marks)

Part a) 1 mark for each of expected Potassium and Delta ratio.

K increases 0.5 for each 0.1 decrease in pH below 7.4. So the expected K is $4 + 0.5 \times 2 = 5$

A common error was to go the other way for an answer of 3. My way of remembering which way, is to think of DKA (acidosis) where you know the plasma K may be falsely elevated despite a low total body K. Another way is to remember that giving bicarb is a way to drive K into cells in hyperkalaemia- so alkalosis decreases K.

Delta ratio- Calculated from Delta Gap, Anion Gap (AG), and bicarb

Delta ratio=Delta Gap/(Normal bicarb (24)-measured bicarb)

Delta Gap= AG- Normal AG (12)

$$\blacksquare (\text{Na} - (\text{Cl} + \text{Bicarb})) - 12$$

- $(148 - (105 + 21)) - 12 = 10$

Therefore the Delta Ratio = $10 / (24 - 21) = 3.33$

Part b) 1 mark for abnormality and 1 for justification.

Minimum to score for the abnormality was “Mixed respiratory and metabolic acidosis”. Could also mention high anion gap metabolic acidosis, and metabolic alkalosis or preexisting compensated resp acidosis (from Delta ratio)

Justification must say why that is the abnormality (e.g. low pH = acidosis. High CO₂ so resp acidosis. Bicarb low -would increase in pure resp. acidosis, so some metabolic component (also high AG and BE -6 goes with this). High delta ratio implies metabolic alk or chronic resp acidosis with compensation). Better answers mentioned the delta ratio as part of their justification.

Delta Ratio	Assessment Guideline
< 0.4	Hyperchloraemic normal anion gap acidosis
0.4 - 0.8	Consider combined high AG & normal AG acidosis BUT note that the ratio is often <1 in acidosis associated with renal failure
1 to 2	Usual for uncomplicated high-AG acidosis Lactic acidosis: average value 1.6 DKA more likely to have a ratio closer to 1 due to urine ketone loss (esp if patient not dehydrated)
> 2	Suggests a pre-existing elevated HCO ₃ level so consider: <ul style="list-style-type: none"> • a concurrent metabolic alkalosis, or • a pre-existing compensated respiratory acidosis

But, be very wary of over-interpretation of delta ratio - Always check for other evidence to support the diagnosis as an unexpected value without any other evidence should always be treated with great caution.

Part c) I allowed any reasonable differential **that related to this case and the blood gas results**. The answer had to be specific. So “severe pneumonia with respiratory failure” would score, but just “Pneumonia” would not. “Toxic ingestion” would not score but “Salicylate toxicity” would. In addition, to score, the answer needed extra info for diagnoses where the usual presentation would not explain the ABG abnormalities e.g. UTI alone would not be enough, but urosepsis with decreased LOC or with aspiration would.

Examples of correct answers would be:

- Infective exacerbation of COAD
- Pneumonia with respiratory failure
- Meningitis/CNS infection with respiratory depression/Altered LOC
- Salicylate toxicity
- Hyperosmolar hyperglycaemic State (HHS) secondary infection (e.g. UTI)

I accepted other answers that were appropriate.

Each pair of investigation and its justification was worth two marks and had to relate to a correct diagnosis. The justification had to be at a consultant level and

must relate to the investigation and to the case to score. Investigations would not score any marks if they were not appropriately justified.

NB “Baseline” is not a scoring justification in the exam. “Check to see if high” is not a high-level justification. (That said, you could put down “confirmation of toxic ingestion” or “check for toxic level” if the differential was a toxic ingestion like salicylates, and the Ix was salicylate level)

Marking examples

Dx- Severe pneumonia with respiratory failure, Ix-FBE, Justification-WCC raised in infection. The Dx would score 1 mark. The justification is not at consultant level and so no marks are scored for the Ix & justification. A total of 1 mark is scored.

Dx- Severe pneumonia with respiratory failure, Ix-FBE, Justification-WCC <4 or >20 indicative of severe sepsis. The Dx would score 1 mark. The justification is at consultant level and so the Ix and justification score 2 marks, for a total of 3 marks.

Pass mark for the question 12 out of 19.

Tips

- Read the stem. Unless otherwise specifically asked in the question relate your answer to the case presented.
- KNOW BLOOD GASES and ELECTROLYTE formulas. Formulas are easy to set and if you know them are easy marks. Know blood gases and their interpretation/causes very well
- Part C had lots of marks available with little extra cognitive load. Spend time on it rather than part A or B if time pressured/unsure of calculations.
- Try to avoid using the same diagnosis system, investigation and justification in multiple lines/boxes of same sub-question. Sometimes you will not score more than once (although I did allow it in this question in the real exam it may not be allowed). That said, if you cannot think of anything else then put it down, rather than leaving the space blank.
- Investigation and justification are linked. If possible, avoid using the same investigation in two differential diagnoses.
- Don't ask for an investigation that is already given to you in the stem. E.g. in this case-ABG
- Justification must be of appropriate standard AND logical for the case

General Tips for all questions

- Watch your writing. If I can't read your answer it won't score.
- In your answer, only give the number of items asked. If “X” items are asked for only the first “X” answers will be looked at by the examiner.
- Avoid unexplained acronyms. Write it out in full the first time with the acronym in brackets. It can then be used again in same SAQ. In this case, don't write HAGMA until you have written high anion gap metabolic acidosis (HAGMA). Many acronyms are not used universally e.g. “COAD” is used in Victoria but “CAL” in NSW and COPD in other regions.
- Be specific and detailed in your answers. It's a specialist exam and your answers should be at that level. E.g. If you are asked for a diagnosis/cause

saying “medications” or “toxic ingestion” without an example will usually not score.