
Station ONE: Blood Gas Interpretation

Candidate instructions

Dr X is a PGY3 junior doctor. They wish to discuss a patient's clinical presentation and VBG with you.

At your urban district Emergency Department it is 11am on a Wednesday morning.

The patient is a middle aged male, whose identity is unknown, although the triage nurse recognises him as a frequent presenter with chronic alcohol abuse. He was found altered at a local train station and the police report that he appears to be intoxicated. His other medical history is unknown.

He is currently in a resuscitation bed and being attended to by a senior registrar, so you have time to discuss the case with Dr X.

Your tasks are to:

- Interpret the VBG (which will be provided in the station)
- Discuss the potential causes for the patient's presentation
- Explain further investigations and management which may be required

You will **not** be required to take further history.

This OSCE will assess the following domains:

- Medical expertise
 - Teaching and Scholarship
-

Role player instructions

You are Dr X, a PY3 junior doctor currently working in the ED. You have seen this patient, who is an unknown 40 yo male, along with the senior registrar who has continued to manage the situation in the resuscitation bay. The patient was found at a local train station and is apparently intoxicated. The triage nurse recognised him as a patient who regularly presents with chronic alcohol abuse. You do not know any further details about the history or exam, and should steer the candidate away from this line of questioning if needed. You are looking for guidance about VBG interpretation in this setting, and are also wondering about further investigation and management of this patient. You will recognise the acidosis, and if asked will be able to suggest that it is metabolic but do not know more than this.

As the candidate enters the room you will hand them the VBG and give a basic summary of the case whilst they look at it:

'Hi I'm Dr X thanks for helping me with this case. I've just seen this patient, who was found intoxicated at the local train station. He has a history of chronic alcohol abuse. I have been in the resuscitation room with the senior registrar Suzanne, who is looking after him at the moment. I was just wondering if you could help me interpret this VBG'

The candidate may then ask for your understanding, or experience with blood gases in general

- *'I've not had much experience with blood gases, I can see there is an acidosis...'*
- If asked for further detail *'Is it Metabolic...?'*

The candidate is then expected to put you out of your misery by explaining the findings. You should not give anything else away but prompt for the following:

- explanation of metabolic acidosis and anion gap
 - Osmolar gap and explanation - differential diagnosis, essentially the VBG strongly suggests toxic alcohol poisoning but reasonable for candidate to be open to other sensible possibilities eg sepsis, seizure etc
 - Better candidates may also discuss the possibility of false elevation of lactate due to ethylene glycol poisoning, and talk about expected hypocalcaemia but this is not required
-

If necessary ask *‘Are there any other calculations we should do on this Gas?’* (Osmolar gap), and *‘So what are the possible causes in this patient?’*

If any part of the explanation is not clear please ask for further clarification

This discussion should take around 3 minutes and the discussion can then move on to investigation and management. If this has not happened at 4 minutes you should prompt the candidate to move on - *‘so what other investigations might we perform in this patient?’* Allow a reasonable list and then ask for management at 6 minutes if this has not already been covered. If clarification is needed you are asking for **general management points**, not specific to this patient as the candidate would need more information for this.

The main points expected to be covered here are covered below, basic prompts are allowed:

Ix

- general screening tests for toxicological exposure - ECG, paracetamol level (glucose done already)
- Specific Ix for toxic alcohols - UEC (renal failure), Calcium (hypo in ethylene glycol), Ethanol level to guide treatment (breath or serum), urine microscopy (calcium oxalate crystals are pathognomonic for ethylene glycol, but not always present - rarely useful in practice). CTB can show characteristic basal ganglia haemorrhages in methanol poisoning but not sensitive or specific. Serum levels of ethylene glycol and methanol can be considered (if available in reasonable timeframe) purely as confirmation
- Other investigations - may be reasonable for given differential eg cxr, ketones etc however probably aren't required

Mx

- Resus and supportive care
 - early intubation considered, being sure to maintain hyperventilation
 - Treat seizures with benzo's
 - Correct significant electrolyte abnormalities
 - Decontamination - not indicated
 - Enhanced elimination
 - Dialysis is the definitive treatment if renal failure, visual symptoms (methanol), severe acidosis, large ingestion/high serum levels or large osmolar gap
 - Antidotes - ethanol and fomepizole (not currently available in australia)
 - Disposition - ICU for severe OD's - will require an ICU with haemodialysis capabilities
 - Other points - consider intentional OD/psyche, health advocacy regarding chronic alcohol misuse, consider batch brewing of methanol and potential for wider health risk.
-

Examiner instructions

VBG interpretation

- Severe acidaemia
- Very low HCO_3 and negative BE = metabolic acidosis
- Expected $\text{CO}_2 = (8 \times 1.5) + 8 = 20$. Accept ± 1 . Therefore respiratory compensation is appropriate
- Anion Gap = $135 - (95 + 8) = 32$. HAGMA
- Delta Ratio = $(32 - 12) / (24 - 8) = 1.25$. Which means isolated HAGMA
- Hyperkalaemia - expected K for pH 7.15 = 6.25 therefore K is in keeping with level of acidosis
- High lactate could be explained by false elevation due to presence of glycolic acid, hypoperfusion/shock
- Osmolar gap = serum osmolality - calculated osmolality
- Calculated = $2\text{Na} + \text{gluc} + \text{urea} = 284$ or 285
- So osmolar Gap = $320 - 284$ or $285 = 35$ or 36
- High osmolar gap **strongly** suggests Toxic alcohol poisoning in this setting

Other causes of raised osmolar gap are rare and unlikely in this setting (mannitol, sorbitol, TURP syndrome) - it would be reasonable for the candidate's differential to be strongly focussed on toxic alcohol poisoning

Investigations and management are as above, copied on next page

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Key assessment criteria

- Good understanding and explanation of the VBG main findings
 - Inclusion of toxic alcohol poisoning as the number one differential diagnosis
 - Reasonable list of investigations to include at least ethanol level, UEC and calcium
 - Management with sensible discussion of airway protection, antidotes and dialysis as a minimum
 - Candidate should demonstrate that they are teaching to the junior doctor
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pH	7.15	
pCO2	20	mmHg
HC03	8	mmol/L
BE	-16	
Na	135	mmol/L
K	6.5	mmol/L
Cl	95	mmol/L
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Urea	8.1	mmol/L
Lactate	5.2	mmol/L
Osmolality	320	mosm/Kg

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OSCE Station:

COMPONENT ASSESSMENT

For each domain below select the **ONE** option which best represents this candidates performance. The option '**Minimum level of competency displayed**' represents the minimum level of safe independent practice as a junior FACEM in Australasia.

Response Category	Percentage
Very poor	35%
Well below minimum standard	25%
Below minimum standard	15%
At minimum standard	10%
Above minimum standard	8%
High standard	5%
Very High standard	2%

Please rate all the following domains:

[illegible]

EXAMINER'S COMMENTS

GLOBAL ASSESSMENT RATING

Please rate this candidate's OVERALL performance in this OSCE:

In terms of a **safely practising junior emergency physician** please select the ONE option which best reflects this candidate's performance in this station

**Well
Below
Standard**

☐

**Below
Standard**

☐

**Just at
Standard**

☐

**Above
Standard**

☐

**Well
Above
Standard**

☐