VAQ 2008.2.7

A 74 year old man is brought to your emergency department after three days of persistent vomiting.
His observations are:

HR	110	/min
BP	135/70	mmHg supine
Temperature	37°C	

Reference Range			
FIO_2	0.5		
pH	7.62		(7.35-7.45)
pCO_2	28.5	mmHg	(35-45)
pO_2	234	mmHg	(80-95)
Bicarbonate	30.0	mmol/L	(22-28)
Base excess	8.3		(-3 - +3)
O_2 saturation	99.8	%	(> 95)
Lactate	1.1	mmol/L	(< 1.3)
Na^+	131	mmol/L	(134-146)
K^+	2.0	mmol/L	(3.4-5)
Cl^-	90	mmol/L	(98-106)
Glucose	12.7	mmol/L	(3.5-5.5)

This patient has significant mixed metabolic and respiratory alkaloses, with a large A-a gradient in keeping with hypoxaemic lung pathology, and a potentially life-threatening hypokalaemia requiring urgent correction to avoid cardiac arrhythmia.

Acid-Base
A – alkalaemia
R – pCO2 low in keeping with respiratory alkalosis
M – bicarbonate high in keeping with metabolic alkalosis i.e. **mixed respiratory and metabolic alkalosis**
A – N/A
D – N/A
A – likely metabolic process as primary event from history
expected pCO2 = 0.7*bic + 20 = 41 (measured 28)
i.e. co-existing respiratory alkalosis

Metabolic alkaloses (list at least 2 causes including vomiting)
Loss of acid
- GI
  - **vomiting**, NG suction (consistent with history)
- GU
  - steroid
  - diuretics
  - Carbonic anhydrase inhibitors
  - Bartter, Gitelman syndromes

Addition of alkali
- Sodium bicarbonate
- Milk alkali syndrome

Hypokalaemia (renal defense of K+)
- consistent with biochemistry

Chloride losses
- villous adenoma (not suggested)

Respiratory alkalosis (list at least 2 causes)
Hypoxaemia
Pain
Salicylates
Anxiety
Catecholaminergic states

A-a (need calculation)
FiO2 0.5
Expected pO2 = (713*0.5) – (1.25*28.5) = 356 – 36 = 320
A-a gradient = ~85; expected = age/4 + 4 = ~20
i.e. **significantly increased A-a gradient (and at least 2 causes)**
- PE
- Pneumonia
- aspiration pneumonitis with vomiting
- Pulmonary oedema/effusion
- pancreatitis

Normal lactate suggests against significant hypoperfusion

Mild hyponatraemia
salt>water losses
- clinical picture of hypovolaemic hyponatraemia
  - vomiting
  - consider SBO, pancreatitis

Severe hypokalaemia (and at least 2 causes including vomiting)
- **concern** for arrhythmias, cardiac arrest, weakness **(concern about severity should be noted, ideally mention risk of cardiac arrhythmia)**

decreased intake
- anorexia (likely given vomiting)

transcellular shift (alkalaemia consistent)
increased losses
- vomiting (consistent with history)
- diarrhoea, kaliuresis (not suggested)

Hypochloraemia
- usually passive shift to maintain electroneutrality
- normal AG noted and would be consistent

Mild-mod hyperglycaemia
- absolute or relative insulin deficiency (IDDM, NIDDM)
- ‘stress response’
- suggests against Addisonian cause for hypokalaemia

Overall picture of mixed metabolic and respiratory alkalosis with severe hypokalaemia and raised A-a gradient. Underlying cause for vomiting will need assessed but volume and potassium depletion should be corrected urgently.