

First 2008  
VIVA 6

Viva 6 - An 18 year old female has presented with weakness and dehydration following a period of prolonged vomiting. An arterial blood gas analysis was performed on room air, revealing the following findings.

pH 7.59 (7.35 – 7.45)      PaCO<sub>2</sub> 58 mmHg (35 – 45)  
PaO<sub>2</sub> 72 mmHg (90 – 110)      HCO<sub>3</sub> - 59 mmol/L (22 – 32)

This viva tested the candidate's knowledge of renal physiology related to the control of urinary pH, effects of acetazolamide and frusemide upon metabolic acid base state and respiratory response to metabolic acid base changes.

The main points expected for a pass were knowledge of :

- Respiratory response to changes in metabolic acid base. Use of correctly labelled graph/common formulae
- Renal handling of H<sup>+</sup> at the proximal and distal tubules.
- Mechanism of HCO<sub>3</sub><sup>-</sup> reabsorption and regeneration
- Urinary buffers such as phosphate, ammonia and glutamine
- Mechanism of frusemide associated metabolic alkalosis
- Affect of acetazolamide on HCO<sub>3</sub><sup>-</sup>

**“describe the respiratory handling of acids”**

Excretion of acids in the lungs (CO<sub>2</sub>) is significantly more than the renal excretion (x150) 15 to 0.1 moles  
The hydrogen, CO<sub>2</sub>, HCO<sub>3</sub> system is the most important buffer in the ECF because it is open at both ends  
Represented by the henderson-hasselback equation =  $6.1 \log [\text{HCO}_3]/0.03[\text{H}]$   
During a rapid respiratory acidosis the formula is expected  $\text{HCO}_3 = 24 + (\text{pCO}_2/10)$   
During a prolonged respiratory acidosis the formula is expected  $\text{HCO}_3 = 24 + 4(\text{pCO}_2/10)$

**“Describe the Renal handling of H”**

At the proximal tubules

H is excreted (ca catalyses CO<sub>2</sub> and H<sub>2</sub>O), then absorbed with HCO<sub>3</sub>

At the distal tubules

H is excreted by the intercalated cells (same rxn with ca)

most is buffered by the phosphate system, some possibly combines with NH<sub>3</sub> to facilitate excretion

Main role is excretion of acid from the body

Minimum urinary pH is about 4.4 (which represents a pH diff of 3 = 1000 H ions)

Creatinine may assist in excretion of titratable acids if the pH is below 5

**“How does frusemide act”**

causes a reduction in the rabsorption of Na in the descending loop of henle and inhibits the CCM

this also leads to increased K loss in the DCT

the body compensates by swapping K for H and the result is a metabolic alkalosis (conventional approach)

stewart approach explains this in terms of loss of chloride (with the Na) causing an alkalosis

**“What is the main side effect of acetazolamide overdose”**

inhibits carbonic anhydrase action

the result is increased HCO<sub>3</sub> loss because the proximal tubule cannot do its job, and therefore metabolic acidosis