

First 2011  
VIVA 7

Briefly outline the functions of the kidney?

This viva tested, briefly, knowledge of renal function, as well as covering hyperkalaemia in some depth. Candidates had a general knowledge related to hyperkalaemia, but struggled to explain the cardiac consequences as they related to the cardiac action potential and as they reflected upon the ECG.

**“Could you please outline the key functions of the kidney?”**

Maintenance of body water homeostasis

    this is achieved via sensors (osmoreceptors in hypothal) and effectors ADH and the CCM

    this is augmented by low pressure receptors in the right ventricle and large veins

Urea, creatinine and drug excretion

Electrolyte homeostasis especially potassium, calcium and sodium

Acid base homeostasis via HCO<sub>3</sub> reabsorption and the acidification of urine

Endocrine functions

    hormones produced - calcitriol, erythropoetin, prostaglandins

    enzymes released by the kidney - renin, kallikrien

    hormones which act on the kidney - ADH, aldosterone, parathyroid hormone, ANP

**“Please discuss the physiology of potassium”**

major intracellular cation

distribution is between ICF 90%, Bone 8% and ECF 2% (bone usually ignored - bound)

ICF concentration is approximately 150, ECF concentration 3.5-5

total content is 40-45 mmol/kg

**“What is the serum potassium level dependent on?”**

Total body potassium

    balance between intake (1.5 - 5g daily) and excretion in renal tubules

    influenced by diet and aldosterone (facilitates tubular sodium reabsorption in exchange for K<sup>+</sup>)

Balance between the ECF and ICF

    maintained by the Na.K.ATPase pump, membranes are generally relatively permeable to K

    influenced by

        acid-base status (in acidaemia H<sup>+</sup> ions are excreted preferentially in kidneys causing ↑ K<sup>+</sup>)

        beta 2 agonists such as adrenaline and salbutamol shift potassium into cells

        insulin also shifts potassium intracellularly

**“What are the consequences of hyperkalaemia?”**

refers to serum potassium level greater than 5

rapid changes in concentration cause symptoms at lower levels than chronic changes

symptoms are related to alterations in the generation in action potentials

    cardiac muscles

        demonstrate conduction abnormalities and arrhythmias

        ECG changes: peaked T waves, shortening of QT, prolonged PR, flat p waves, wide QRS

        Eventually there is a sine wave and asystole

    other muscles

        demonstrate muscle weakness and paralysis

other symptoms relate to potassium excretion

    potassium is preferentially excreted in the distal tubules, conserving hydrogen and leading to metabolic acidosis