

JULY 2007
QUESTION 20

Describe the determinants of serum potassium. Outline the consequences of acute hyperkalaemia

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

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^+)

Balance between the ECF and ICF

- maintained by the Na.K.ATPase pump, membranes are generally relatively permeable to potassium
- influenced by
 - acid-base status (in acidaemia H^+ ions are excreted preferentially in kidneys causing $\uparrow K^+$)
 - beta 2 agonists such as adrenaline and salbutamol shift potassium into cells
 - insulin also shifts potassium intracellularly

Functions of potassium

- intracellular pH regulation
- DNA and protein synthesis
- resting membrane potential and the generation of APs
- growth and enzyme function

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 of 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

Treatment

immediate term

- stabilise cell membrane with calcium to reduce cardiac abnormalities and other muscle effects
- shift potassium into cells via insulin or beta adrenergic agents

short term

- resonium PR or PO
- consider a potassium losing diuretic such as frusemide
- consider renal dialysis

long term

- identify cause and cease (potassium sparing agent, oral potassium)