

Q4 Outline the role of calcium in the body (70% of marks). Outline the differences between calcium chloride and calcium gluconate solutions (30% of marks). (March 2011)

Calcium:

- Found in bone (99%) and ICF (1%)
- Normal plasma range total calcium 2.25-2.55mmol/L
- Plasma calcium
 - o Free/ionized calcium (diffusible) – 45%
 - o Complexed with HCO₃⁻/citrate (diffusible) – 10%
 - o Bound to albumin/globulins (nondiffusible) – 45%
- Plasma levels regulated by Vitamin D, parathyroid hormone and calcitonin

Functions:

- Neuromuscular transmission and action potential initiation / propagation → via specific calcium ion channels on excitable membranes
- Excitation/contraction coupling in muscles → required for cross bridge cycling and thus muscle contraction to occur
- Releases of hormones and neurotransmitters → an influx of calcium ions is required for the secretion of both endocrine and exocrine organs
- Enzyme activation → also plays important role as intracellular second messenger
- Blood coagulation → necessary for the activation of clotting factors in plasma
- Structural support → calcium is bound the cell surfaces and is important for membrane stability and intercellular adhesion. Also an important component of bone.

Calcium chloride:

- pH 5.5-7.5
- 10ml of 10% solution contains 6.8mmol of calcium
- 3 times more potent than Ca gluconate
- Administer via CVC if possible as very irritant to veins

Calcium gluconate:

- pH 6.0-8.2
- 10ml of 10% solution contains 2.2mmol calcium
- Preferred to CaCl except in resuscitation cases as less irritant to veins
- Commonly believed to require hepatic metabolism to exert its effect, however, a study by Tang et al in 1990 showed no difference in the availability of ionized calcium between CaCl and Ca gluconate even during the anhepatic stage of liver transplantation (Martin TJ, Kang Y, Robertson KM, Virji MA, Marquez JM. Ionization and hemodynamic effects of calcium chloride and calcium gluconate in the absence of hepatic function. *Anesthesiology*. 1990 Jul;73(1):62-5)