

## Q10 Describe the pharmacology of magnesium sulfate (Sept 2011)

Magnesium is the second most abundant intracellular cation in the body. Approximately 1% of body magnesium is present in the ECF; the remainder is stored in the ICF (50% in bone, 20% in muscle and the remainder in soft tissue). Supplemental magnesium may be used for the management of arrhythmias (particularly Torsades), hypomagnesaemic states, in pre-eclampsia and eclampsia, as a tocolytic and in the management of severe asthma.

**PHARMACEUTICAL** - comes as several preparations (magnesium oxide, chloride and sulfate); presented as oral and IV/IM formulations and well as in combination multivitamins.

### PHARMACODYNAMICS

**MECHANISM OF ACTION** → magnesium supplements play the same role as endogenous Mg in the body. These include:

- Metabolic – essential co-factor for the Na/K ATPase pump as well as many other enzyme systems, the Krebs cycle and protein and nucleic acid synthesis. Natural calcium antagonist.
- CNS – Inhibits the release of neurotransmitters and acts as a cerebral vasodilator
- CVS – Reduces catecholamine release. Decreases cardiac conduction and force of contraction. Direct vasodilator.
- Respiratory – bronchodilatory effects
- Uterine – powerful tocolytic

**SIDE EFFECTS** → excessive administration may cause hypermagnesemia (nausea, vomiting, flushing, CNS depression, areflexia, respiratory depression, cardiac arrest). May cause hypocalcaemia. May cause hypotension during administration due to vasodilatory effects. Irritation with IM injection. Administer with caution to patients with renal failure and with concurrent use of cardiac glycosides and CNS depressant drugs.

### PHARMACOKINETICS

#### ABSORPTION

Route - PO, IV, IM

Dosage - depends on Mg levels and situation. Bolus 0.1-0.2mmol/kg for Torsades.

Onset of action - immediate with IV administration, ~1hr for IM

Duration of action - 30 min IV, 3-4 hours IM

#### DISTRIBUTION

Protein binding - 33% with a further 12% bound to anions

#### METABOLISM

Bound to bone or filtered in kidneys

#### ELIMINATION

Renal clearance is proportional to Mg levels, with over 90% reabsorbed (the threshold for excretion is set just above normal renal plasma levels; below this the majority of Mg will be reabsorbed, mainly in the ascending limb of the Loop of Henle).

Primarily excreted in urine; small amounts in breast milk, faeces and saliva