● **MONITORING REQUIREMENTS**
- Plasma and plasma substitutes are often used in very ill patients whose condition is unstable. Therefore, close monitoring is required and fluid and electrolyte therapy should be adjusted according to the patient's condition at all times. Treatment with hydroxyethyl starches should be guided by continuous haemodynamic monitoring so that the infusion is stopped as soon as appropriate haemodynamic goals have been achieved.
- Monitor renal function.
- Monitor for hypersensitivity reactions.
- Urine output should be monitored.

● **PRESCRIBING AND DISPENSING INFORMATION**
Hydroxyethyl starch is composed of more than 90% of amylopectin that has been etherified with hydroxyethyl groups; the term tetrastarch reflects the degree of etherification. Hydroxyethyl starches should only be used for the treatment of hypovolaemia due to acute blood loss when crystalloids alone are not sufficient; they should be used at the lowest effective dose for the first 24 hours of fluid resuscitation.

Volulyte® contains hydroxyethyl starch 6% (average molecular weight 130 000) in sodium chloride intravenous infusion 0.6%, containing Na^+ 137 mmol, K^+ 4 mmol, Mg^{2+} 1.5 mmol, Cl^- 110 mmol, acetate 34 mmol/litre.

● **MEDICINAL FORMS** There can be variation in the licensing of different medicines containing the same drug.

Infusion
- **Volulyte** (Fresenius Kabi Ltd) ▼
  Magnesium chloride hexahydrate 300 mg per 1 litre, Potassium chloride 300 mg per 1 litre, Sodium acetate trihydrate 4.63 gram per 1 litre, Sodium chloride 6.02 gram per 1 litre, Tetrastarch 60 gram per 1 litre Volulyte 6% infusion 500ml Freeflex bags | 15 bag PoM £229.60
- **Voluven** (Fresenius Kabi Ltd) ▼
  Tetrastarch 60 mg per 1 gram Voluven 6% infusion 500ml Freeflex bags | 1 bag PoM £10.63
  Tetrastarch 100 mg per 1 ml Voluven 10% infusion 500ml Freeflex bags | 20 bag PoM

1.3 Magnesium imbalance

Magnesium imbalance

Overview

Magnesium is an essential constituent of many enzyme systems, particularly those involved in energy generation; the largest stores are in the skeleton.

Magnesium salts are not well absorbed from the gastrointestinal tract, which explains the use of magnesium sulfate p. 1112 as an osmotic laxative.

Magnesium is excreted mainly by the kidneys and is therefore retained in renal failure, but significant *hypermagnesaemia* (causing muscle weakness and arrhythmias) is rare.

Hypomagnesaemia

Since magnesium is secreted in large amounts in the gastrointestinal fluid, excessive losses in diarrhoea, stoma or fistula are the most common causes of *hypomagnesaemia*; deficiency may also occur in alcoholism or as a result of treatment with certain drugs. Hypomagnesaemia often causes secondary hypocalcaemia, and also hypokalaemia and hyponatraemia.

Symptomatic *hypomagnesaemia* is associated with a deficit of 0.5–1 mmol/kg; up to 160 mmol Mg^{2+} over up to 5 days may be required to replace the deficit (allowing for urinary losses). Magnesium is given initially by intravenous infusion or by intramuscular injection of magnesium sulfate; the intramuscular injection is painful. Plasma magnesium concentration should be measured to determine the rate and duration of infusion and the dose should be reduced in renal impairment. To prevent *recurrence of the deficit*, magnesium may be given by mouth, but there is limited evidence of benefit. Magnesium aspartate powder for oral solution below is available as a licensed preparation and, magnesium glycerophosphate tablets and liquid p. 1112 [unlicensed] are available from 'special-order' manufacturers or specialist importing companies.

Arrhythmias

Magnesium sulfate injection has also been recommended for the emergency treatment of *serious arrhythmias*, especially in the presence of hypokalaemia (when hypomagnesaemia may also be present) and when salvos of rapid ventricular tachycardia show the characteristic twisting wave front known as *torsade de pointes*.

Myocardial infarction

Limited evidence that magnesium sulfate prevents arrhythmias and reperfusion injury in patients with suspected myocardial infarction has not been confirmed by large studies. Routine use of magnesium sulfate for this purpose is not recommended.

Eclampsia and pre-eclampsia

Magnesium sulfate injection is the drug of choice for the treatment of seizures and the prevention of recurrent seizures in women with *eclampsia*. Regimens may vary between hospitals. Calcium gluconate injection p. 1108 is used for the management of magnesium toxicity.

Magnesium sulfate injection is also of benefit in women with *pre-eclampsia* in whom there is concern about developing eclampsia. The patient should be monitored carefully.

1.3a Hypomagnesaemia

ELECTROLYTES AND MINERALS › MAGNESIUM

Magnesium aspartate

● **INDICATIONS AND DOSE**

Treatment and prevention of magnesium deficiency
- BY MOUTH
- Adult: 10–20 mmol daily, taken as 1–2 sachets of *Magnaspartate*® powder.

● **CONTRA-INDICATIONS** Disorders of cardiac conduction

● **INTERACTIONS** → Appendix 1: magnesium

● **SIDE-EFFECTS**
- **Uncommon** Diarrhoea · faeces soft
- **Rare or very rare** Fatigue · hypermagnesaemia
- **Frequency not known** Gastrointestinal irritation

SIDE-EFFECTS, FURTHER INFORMATION Side-effects generally occur at higher doses; if side-effects (such as diarrhoea) occur, consider interrupting treatment and restarting at a reduced dose.

Overdose Symptoms of hypermagnesaemia may include nausea, vomiting, flushing, thirst, hypotension, drowsiness, confusion, reflexes absent (due to neuromuscular blockade), respiratory depression, speech slurred, diplopia, muscle weakness, arrhythmias, coma, and cardiac arrest.

● **RENAL IMPAIRMENT** Avoid in severe impairment (eGFR less than 30 mL/minute/1.73^2).

● **DIRECTIONS FOR ADMINISTRATION** Dissolve sachet contents in 50–200 mL water, tea or orange juice and take immediately.