Ballarat Health Services

DRUG GUIDELINE

MAGNESIUM SULFATE (Obstetric)

SCOPE (Area): **FOR USE IN:** Labour Ward, 5N, ICU, ED and Theatre
EXCLUSIONS: Paediatrics, Coronary Care Unit and other General Wards
SCOPE (Staff): Medical, Nursing and Pharmacy

This guideline only refers to the use of magnesium in pre-eclampsia or eclampsia, and must be used in conjunction with 'Hypertension Disorders in Pre-eclampsia/Eclampsia' Clinical Practice Protocol – see Related Documents. For other indications refer to Magnesium Sulfate (Non-Obstetric) DRG0001.

BRAND NAMES
No brand names.

PHARMACOLOGY AND PHARMACOKINETICS
Magnesium is essential for normal energy storage and transfer, as well as skeletal development, nerve conduction and muscle contraction. The effect on cardiac muscle is to slow the rate of sinoatrial node impulse formation and prolong conduction time. Centrally, magnesium has a depressant effect and may block neuromuscular transmission, producing anticonvulsant effects. Peripherally, magnesium produces vasodilatation with flushing and sweating at moderate doses and lower blood pressure at higher doses. Onset of action after intravenous administration is virtually immediate and lasts for approximately 30 minutes. Magnesium is mainly renally cleared.

INDICATIONS
- Management/prophylaxis of seizures in Eclampsia and Pre-eclampsia.

CONTRAINDICATIONS
- **Hypermagnesaemia.**
- **Heart block** – magnesium can exacerbate.

PRECAUTIONS
- **Renal impairment** – increased risk of hypermagnesaemia, dose reduction may be required, seek Specialist advice.
- **Myasthenia gravis** – magnesium interferes with neuromuscular transmission and may increase muscle weakness (especially respiratory), monitor closely.
- **Hypotension** – systolic BP less than 90 mmHg as this may be worsened, especially with faster rates of administration.
- **Monitor for signs of hypermagnesaemia** – see Monitoring and Adverse Effects. Calcium gluconate must be available whenever magnesium is given, to reverse the effects of magnesium toxicity.

PREGNANCY AND BREASTFEEDING

Pregnancy – No ADEC category listed, considered safe to use.
Breastfeeding – May excrete into milk, but has not been shown to have clinical effects in infants. Considered safe to use.
Seek specialist advice for further information.

DRUG INTERACTIONS

- **Digoxin** – use magnesium cautiously as excessive dosing requires the use of calcium which can lead to serious changes in cardiac conduction via the synergistic action of digoxin and calcium.
- **Neuromuscular blocking agents (suxamethonium, rocuronium, atracurium, cisatracurium, mivacurium, pancuronium, rocuronium and vecuronium)** - magnesium can potentiate their effect leading to excessive neuromuscular blockade. Monitor respiratory function.
- **Aminoglycosides (gentamicin, tobramycin, amikacin and streptomycin)** – may have an additive neuromuscular blockade with magnesium. Monitor respiratory function.
- **Calcium channel blockers (nifedipine, felodipine, amlodipine, nicardipine, nimodipine, clevidipine, diltiazem, verapamil** - can exaggerate magnesium's effects. Monitor for hypotension and muscle weakness, especially in renal failure.
- **Central nervous system depressants** - can have enhanced central nervous system effects when used with magnesium.

DOSAGE AND ADMINISTRATION

ECG monitoring is not required during magnesium sulfate administration for pre-eclampsia or eclampsia, but must be available if requested by the lead clinician.

One to one Nursing care is required during administration of IV magnesium sulfate (injection or infusion), and for 4 hours (or longer if indicated by the Lead Obstetrician) following the end of the last dose of IV magnesium sulfate (injection or infusion). This nursing care may be provided in Labour Ward, ICU or the Postnatal Ward as determined by the Lead Obstetrician depending on the clinical condition of the patient.

Magnesium sulfate is usually administered by IV infusion (using the premixed bag) with an initial loading dose over 15 minutes, followed by a continuous infusion. Rarely magnesium sulfate may need to be given by IV injection (using the ampoules/vials) for rapid loading dose or for recurring seizures – see below for further information.

For administration only in

- **ICU, ED, Theatre, Labour Ward, Postnatal Ward**

IV injection (rapid doses) only to be administered by

- **Lead Obstetrician or Senior Obstetric Registrar**
- **ICU Consultant or Registrar**
- **Anaesthetists**
- **Nursing staff under the direct supervision of the Medical staff listed above**

Medical staff must remain present in the room for the duration of IV injection administration and stabilisation.

Administer slowly via CVC or a large peripheral vein. Sites such as the back of the hand are not to be used except in emergency management until alternative IV access is obtained. Use a dedicated line for infusion. Secondary access is required for administration of other medications/fluids.

Rapid administration may precipitate hypotension, flushing, ECG abnormalities, circulatory collapse, heart block and cardiac arrest.

When giving magnesium sulfate, calcium gluconate may be required as treatment for hypermagnesaemia, and must be present in the room. See under Monitoring for more information.

Premixed magnesium 8 g in 100 mL water for injection minibags are only kept on imprest in Labour Ward, ED and Pharmacy. Theatre has 2 bags only in their Obstetric magnesium infusion pack. If required for ICU, stock should be obtained from Labour Ward or Pharmacy.

Magnesium sulfate ampoules/vials are available as 2.5 g (5 mL = 10.3 mmol) vials or 2.465 g (5 mL = 10 mmol) ampoules. For ease of use in this guideline the vials are quoted as 2.5 g (5 mL = 10 mmol). The two slightly different strengths can be viewed as interchangeable.

Note: Coadministration with labetalol, hydralazine or nifedipine may result in an enhanced hypotensive effect, monitor carefully.

IV loading dose (via large peripheral vein or CVC):

Only to be administered in ICU/Labour Ward/ED/Theatre by staff listed in box above
Use premixed magnesium sulfate 8 g in 100 mL (8%) water for injection minibag.
Magnesium sulfate 4 g (50 mL) over 15 minutes, administered by IV infusion at 200 mL/hr.
To administer the load, commence the maintenance infusion on the Alaris LVP at the rate prescribed (as outlined below), and then select 'Bolus' - set as default 4 g over 15 minutes. When the load finishes, the maintenance infusion will then automatically start.

IV maintenance infusion to immediately follow loading dose (via large peripheral vein or CVC):

Only to be administered in ICU/Labour Ward/ED/Theatre by staff listed in box above
Use premixed magnesium sulfate 8 g in 100 mL (8%) water for injection minibag.
Rate: Administer at 1-2 g/hr (12.5-25 mL/hr) by IV infusion for a minimum of 24 hours post delivery or from the last seizure (whichever is the later); or as directed by the Lead Obstetrician. See Monitoring for information on magnesium levels.

Rapid IV loading dose (via large peripheral vein or CVC where possible):

Reserved for Eclamptic patients - only to be administered in ICU/Labour Ward/ED/Theatre by staff listed in box above
Use magnesium sulfate 2.5 g in 5 mL vials.
Magnesium sulfate 4 g (8 mL) given undiluted by IV injection over 5-10 minutes.

Rapid IV dose for recurring or continuing seizures (via large peripheral vein or CVC where possible):
**Reserved for Eclamptic patients - only to be administered in ICU/Labour Ward/ED/Theatre by staff listed in box above **
Use magnesium sulfate 2.5 g in 5 mL vials.
Magnesium sulfate 2 g (4 mL) given undiluted by IV injection over 5 minutes.
May be repeated after 2 minutes.

IM loading dose (where not able to access IV):
Use magnesium sulfate 2.5 g in 5 mL vials.
Magnesium sulfate 4 g (8 mL) given undiluted by IM injection, spilt as 2 doses (each 2 g (4 mL)) – one given in each buttock.

General Administration Information

- **Infusion preparation:**
  Premixed bags are used. Infusion stable for 24 hours once minibag started.
- **Infusion pump:** Alaris® PC unit with pump module utilising Guardrails®.
- **Routes of administration:**
  IV injection: Yes, slow after appropriate dilution
  IV intermittent infusion (15-60 minutes): Yes, not usually given this way
  IV continuous infusion: Yes
  IM injection: Yes, rarely indicated (only if IV access unavailable)
  Subcut injection: No
- **Compatible/incompatible IV drugs/fluids:**
  Note: Incompatible with calcium and phosphate.
  Consult the Australian Injectable Drugs Handbook ('Yellow book') in your ward area. **Assume all unlisted drugs and IV fluids are incompatible – contact Pharmacy for further advice.**

MONITORING (INCLUDING BLOOD TESTS)

- Prior to commencing magnesium ensure knee or other tendon reflex is present, respiratory rate greater than 16 breaths/minute, urine output greater than 30 mL/hr for last 2 hours,
- Medical Officer to set parameters for blood pressure, heart rate, heart rhythm and SpO2 for Nursing Staff to follow.
- Monitor for any signs of hypermagnesaemia (see table below and Adverse Effects). Disappearance of the patellar reflex can indicate the onset of magnesium toxicity, and this should be checked after the loading dose and then hourly for the duration of the infusion, and for four hours following the cessation of the infusion. If the patella reflex is absent report immediately to the medical officer. Calcium gluconate can be given as an antidote to hypermagnesaemia (see below).
- **Serum Levels**
  - Serum levels may be performed 6 hourly whilst the infusion is in progress, however is not required for all patients and is at the discretion of the Lead Obstetrician. Monitoring is required in women with renal impairment and/or a low urine output (less than 30 mL/hr) as magnesium can accumulate. A level should be taken if signs of hypermagnesaemia are present (e.g. respiratory rate less than 12 breaths/minute, loss of patellar reflexes, urine output less than 100 mL in 4 hours) or if recurrent seizures.
  - Where levels are taken, titrate the infusion aiming for the therapeutic range in the table below (report all results to the Senior Obstetric Registrar or Obstetrician). The infusion should be ceased, and the Obstetrician consulted if levels are greater than 3.5 mmol/L:

Magnesium serum level (mmol/L)	Effects
0.8 -1.0	Normal plasma level
1.7-3.5	Therapeutic range
2.5 - 5.0	ECG changes (P-Q interval prolongation, widen QRS complex)
4.0 - 5.0	Reduction in deep tendon reflexes
Greater than 5.0	Loss of deep tendon reflexes
Greater than 7.5	Sinoatrial and atrioventricular blockade. Respiratory paralysis and CNS depression
Greater than 12	Cardiac arrest

- **Calcium gluconate** – must be in the room when magnesium sulfate is being administered as it is the antidote for magnesium toxicity. For information other than dosing see Calcium Gluconate Drug Guideline (DRG0005). Solution should be clear and colourless, vials with precipitate are not to be used.

Calcium gluconate IV injection dose for hypermagnesaemia:
Continuous ECG monitoring is required, only to be administered by a Medical Officer or Nursing Staff under direct supervision of the Medical Officer
Calcium gluconate 2.2 mmol (10mL from ONE vial) undiluted, administer by slow IV injection over 10 minutes.

NURSING PRACTICE POINTS

- **See Dosage and Administration section for detailed information on who can administer IV magnesium, where it can be administered and one to one nursing care requirements.**
- Administer via a CVC or a large peripheral vein. See Dosage and Administration.
- Medical staff must be present in the room for the duration of the loading dose.
- Report any signs of hypermagnesaemia (see Adverse Effects and above magnesium levels table) to the Medical Officer.
- Patellar reflexes require checking prior to magnesium administration, at the completion of the loading dose or any IV injection and then every hour until 4 hours after the last injection was given or infusion ceased, or as directed by the Senior Clinician. Report immediately to the Senior Clinician if the reflex is slow or absent.
- Strict fluid balance monitoring should occur with accurate documentation under the supervision of the senior clinician. Monitor urine output hourly and report to the Medical Officer if output is less than 30 mL/hr over 2 consecutive hours. Undertake four hourly testing of urinary protein.
- Cardiotocographic (CTG) monitoring – ensure monitoring commences before the administration of magnesium, and remains insitu until delivery, or as directed by the senior clinician. The record must be signed by the senior clinician and attached to the medical history.
- Observe for other clinical features of Pre-eclampsia and Eclampsia (*CPP0119 Hypertension Disorders in Pre-eclampsia/Eclampsia*).
- 2 hourly temperature.
- Blood tests as ordered by the Medical Officer – see Monitoring.
- The patient should be warned that they might experience transient hot flushing.
- Calcium Gluconate 2.2 mmol (10 mL), 10 mL syringe and 19 g needle must be available in the room for the duration of the infusion

- Blood pressure, heart rate, respiratory rate and SpO2 requires close monitoring as outlined in the box below, with results outside parameters set by the prescribing Medical Officer to be reported. Report immediately a respiratory rate less than 16 breaths/minute. Record results on the Midwifery Frequent Observations Chart MR/571.0.

Magnesium Sulfate IV Variable Maternal Observations Summary Table	
	Observations
For standard IV loading dose and rapid IV doses	▪ Supine blood pressure, heart rate, to be recorded immediately before the commencement of the dose. ▪ Blood pressure, heart rate, SpO_2 and respiratory rate to be recorded immediately following commencement of dose ▪ Repeat at 5 mins, 10 mins and 15 mins
During maintenance infusion	▪ Blood pressure, heart rate, SpO_2 and respiratory rate to be recorded ½ hourly until stable and then hourly for the duration of the infusion or if any change in clinical condition. ▪ If indicated, serum magnesium levels 6 hours post loading dose and then 6 hourly
At completion of the infusion	▪ Blood pressure, heart rate, SpO_2 and respiratory rate to be recorded hourly or if any change in clinical condition for 4 hours or a directed by the Senior Clinician.

ADVERSE EFFECTS

- **Related to hypermagnesaemia** – important signs are loss of deep tendon reflexes and respiratory depression. Common signs are flushing, nausea and vomiting. Other signs and symptoms include thirst, hypotension, muscle weakness or paralysis, renal failure, blurred vision, drowsiness, confusion, bradycardia, ECG changes, heart block, circulatory collapse, coma and cardiac arrest. May occur at serum magnesium levels above 2 mmol/L.

DRUG PRESENTATIONS AND STORAGE

Premixed bags: Magnesium sulfate 8 g in 100 mL water for injection minibags.
Store below 25°C. Do not refrigerate.

Ampoules/vials: Magnesium sulfate 2.5 g in 5 mL (50%) vials and 2.465 g in 5 mL (49.3%) ampoules. Contains 10.3 mmol of magnesium per 5 mL vial, and 10 mmol per 5 mL ampoule.
Store below 25°C. Do not refrigerate.
