COMPLICATIONS OF PREGNANCY

HYPERTENSION IN PREGNANCY

MAGNESIUM SULPHATE ANTICONVULSANT THERAPY

Keywords: Magnesium sulphate, MgSO4, eclampsia, anticonvulsant, seizure, deep tendon reflexes

AIMS

• To prevent eclamptic seizures
• To treat eclamptic seizures

BACKGROUND INFORMATION

Magnesium sulphate (MgSO4) more than halves the risk for eclampsia, and probably reduces the risk of maternal death.1-3 The Magpie Trial6, 7 indicated that the use of prophylactic MgSO4 reduced the risk of eclampsia and caused no harmful effects to the mother or baby in the short term. A follow-up study also found that its use caused no associated mortality or morbidity to the woman after 2 years.8 Exposure of the fetus to MgSO4 in utero is not associated with a clear difference in the risk of morbidity or disability for children at 18 months of age after use.9

The mode of action of MgSO4 is unclear, but it is believed to have a neuromuscular blocking action10 which relaxes smooth muscles including the vasculature, thereby reducing cerebral ischaemia. The blocking of aspartate receptors in the brain reduces calcium influx which is responsible for causing cell injury in the neurones. MgSO4 is mostly excreted in urine.10

KEY POINTS

1. MgSO4 should be considered for women with pre-eclampsia for whom there is concern about the risk of eclampsia.4, 5 This is usually in the context of severe pre-eclampsia once a delivery decision has been made and in the immediate postpartum period.4 In women with less severe disease the decision is less clear and will depend on individual case assessment. Magnesium Sulphate should not be prescribed for the prevention of eclampsia without discussion with the Consultant Obstetrician on call11, unless in an urgent situation of imminent eclampsia.

2. MgSO4 has been demonstrated to reduce the risk of eclamptic seizures and is also the medication of choice to control eclamptic seizures.1, 2, 7 See KEMH Clinical Guideline Section P- Magnesium Sulphate Infusion Loading Dose - page 2.

3. When MgSO4 is administered it should be continued for 24 hours following birth, or for 24 hours after the last seizure.5, 7, 11

4. During use of MgSO4, Calcium Gluconate 1g in 10 mL (2.2mmol Calcium in 10mL) should be available to give as an antidote for magnesium toxicity,10 which can produce respiratory depression.11

5. Regular assessment of blood pressure, urine output, maternal deep tendon reflexes, respiratory rate and oxygen saturation may indicate the development of MgSO4 toxicity.5, 12

6. Serum magnesium levels are not routinely measured unless renal function is compromised.5 Monitoring of plasma concentrations becomes important where tendon reflexes are absent or in the presence of renal dysfunction.13 However, if the woman has reduced renal function then plasma magnesium should be closely monitored5 6 hourly (or more frequently if signs of oliguria).

7. If deep tendon reflexes are diminished or absent, the infusion must be stopped and a Magnesium level performed.14

8. All MgSO4 solutions must be given via an infusion pump.15

9. Do not use IV line to inject other drugs.15 4
### PROCEDURE

1. Prior to the commencement of MgSO₄

1.1 Obtain a medical history and provide information to the woman about the use of MgSO₄.

Obtain verbal consent, where appropriate.

If the typical features of severe pre-eclampsia are not present, consider further investigation of other medical problems.

1.2 Two Registered Midwives must:

- Check correct the medication, dose and infusion rate. See Clinical Guideline Checking and the Administration of Intravenous Drugs by Medical and Nursing / Midwifery Staff.
- Set up the infusion line and pump.

1.3 Before commencement check and document that:

- The deep tendon reflex is present
- The respiratory rate is > 12 respirations per minute
- Urine output >100ml during previous 4 hours
- Document a baseline set of vital signs, deep tendon reflexes, urine output and conscious state.

To detect deviations from normal.

Urine output should be >25ml/hr.

1.4 Commence the infusion.

2. IV Magnesium Sulphate (MgSO₄)

2.1 **Loading dose:**

MgSO₄ LOADING DOSE REGIMEN

Infuse 4g of MgSO₄ over 20 minutes.

This equates to an infusion rate of 150mL per hour for 20 minutes (ie. the woman receives only 50mL).

A solution of 8g of MgSO₄ in 100mL bag is used at KEMH.

Conduct an electrocardiogram (ECG) during the loading dose and for one hour afterwards.

The loading dose is given for:

- prophylaxis to prevent seizures or
- treatment of an initial seizure where no prior Magnesium Sulphate has been administered.

**NOTE: ALL INFUSIONS MUST BE GIVEN VIA AN INFUSION PUMP.**

Ensure the MgSO₄ solution has no particulate matter or cloudy appearance.

2.2 **Maintenance infusion:**

MgSO₄ MAINTENANCE REGIMEN

The dose for maintenance infusion is 1g of MgSO₄ per hour.

This equates to an infusion rate of 12.5mL per hour where a solution of 8g of MgSO₄ in 100mL bag is used at KEMH.

When changing from the loading dose to the maintenance dose, this must be checked and performed by 2 Registered Midwives and documented that the correct rate has been commenced on the patient observation chart.
### PROCEDURE

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Treatment for eclampisia/seizures which recur or occur during propylactic treatment.</td>
</tr>
</tbody>
</table>

#### MgSO₄ REGIME FOR RECURRENT SEIZURES

2 - 4g of MgSO₄ is given over 5⁴ - 10 minutes⁵,⁶

This equates to an infusion rate of 300mL per hour for 5 minutes (i.e. the woman receives 25mL) where a solution of 8g of MgSO₄ in 100mL bag is used.

If recurrent seizures occur a further dose of MgSO₄ may be prescribed.⁴

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Monitoring during administration</td>
</tr>
</tbody>
</table>

As the woman is cared for in ASCU (Adult Special Care Unit) or Labour and Birth Suite - use an ‘MR731 Adult Special Care Observation Summary’ chart to record observations¹⁷

#### 4.1 Deep Tendon Reflexes (DTR)

Elicit, grade, and record every:
- 15 minutes during the first 2 hours of therapy, then
- hourly thereafter.

**Deep Tendon Reflex Grading Scale:**

- 4+ Hyperactive; very brisk, jerky - includes clonus if present ; abnormal
- 3+ Brisker than average; may not be abnormal
- 2+ Average response, normal
- 1+ Diminished response; low normal
- 0 No response; abnormal

Magnesium sulphate is a smooth muscle relaxant.⁷ Reduction or loss of tendon reflexes precedes respiratory depression⁷, and should be immediately notified to the medical staff⁷. Cease the infusion immediately¹⁸.

**Deep tendon reflexes can be used to determine need for magnesium therapy, evaluate efficacy of magnesium therapy, and detect developing toxicity from magnesium therapy¹⁹.**

#### 4.2 Respiratory rate

Take and record:
- every 15 minutes during the first 2 hours of therapy, then
- hourly thereafter

If respiratory rate is less than 12 respirations/minute notify the medical staff, and cease the infusion until medical review⁷,¹⁵.

The Medical Officer may administer Calcium Gluconate 1g in 10mL (2.2mmol Calcium in 10mL) if there is concern for respiratory function.¹¹

If Calcium gluconate is administered apply ECG monitoring.²⁰

Magnesium sulphate is a smooth muscle relaxant and can cause respiratory depression; a decreasing respiratory rate may indicate Magnesium Sulphate toxicity⁷. If it is not recognised and managed immediately the woman is at risk for respiratory/cardiac arrest.
<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>ADDITIONAL INFORMATION</th>
</tr>
</thead>
</table>
| **4.3 Oxygen saturation** | Apply continuous pulse oximetry. Measure and record the oxygen saturation hourly. 
Cyanosis is an important sign of cardio-respiratory failure, and should be monitored visually and electronically. Cyanosis is an indication for the administration of oxygen. Notify the Medical Officer if the oxygen saturation is less than 95%. |
| **4.4 Blood pressure** | Take and record:
- every 15 minutes during the first 2 hours of therapy, then
- hourly thereafter. 
Frequency of BP on maintenance therapy will depend on the maternal clinical condition and stability of BP. |
| **4.5 Fetal heart rate** | The woman should have continuous CTG monitoring initially. On-going monitoring in the following 24 hours will depend on the maternal and fetal clinical condition. The decision regarding fetal surveillance should be made in liaison with the Consultant Obstetrician. 
To monitor FHR for signs of placental abruption or onset of labour- which may go unnoticed. A sudden or rapid decrease in blood pressure may cause poor uteroplacental circulation, and therefore signs of fetal compromise. 
Fetal surveillance |
| **4.6 Fluid Balance Management** | Maintain a strict fluid balance chart. 
Fluid restriction is advisable to reduce the risk of fluid overload in the intrapartum and postpartum periods. In usual circumstances, total fluids should be limited to 80 mL/hour or 1 mL/kg/hour. 
The regime of fluid restriction should be maintained until there is a postpartum diuresis, as oliguria is common with severe pre-eclampsia. If there is associated maternal haemorrhage, fluid balance is more difficult and fluid restriction is inappropriate. 
Increased peripheral resistance leads to generalised vasospasm and hypertension. The intravascular compartment is reduced, and endothelial damage leads to increased vascular permeability and oedema. Women with pre eclampsia have leaky capillary membranes and a predisposition to low albumin levels: therefore if fluid administration is excessive or unmonitored, they are prone to developing pulmonary oedema. |
| **4.7 Urinary output** | Record the urine output hourly via an IDC with a urometer measuring bag. 
Report urine output to medical staff if below 25mL/hour and request review. 
The MgSO₄ therapy may need to be reduced or ceased if there is <25mL of urine output in 1 hour. 
MgSO₄ is eliminated via the renal system. Toxicity can occur in the presence of oliguria. The infusion should be discontinued if signs of toxicity become evident. Calcium Gluconate (see point 5.2 below) may be required in addition, if toxicity is severe. |
## PROCEDURE

<table>
<thead>
<tr>
<th>5</th>
<th>Magnesium sulphate toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe for signs of MgSO₄ toxicity:</td>
<td></td>
</tr>
<tr>
<td>• Nausea, hot flushes, weakness</td>
<td></td>
</tr>
<tr>
<td>• Slurred speech / Confusion / Blurred vision</td>
<td></td>
</tr>
<tr>
<td>• Loss of DTR / Absent patellar reflexes</td>
<td></td>
</tr>
<tr>
<td>• Hypotension / Pulse oximetry &lt;95%</td>
<td></td>
</tr>
<tr>
<td>• Respiratory depression &lt; 12 breaths /min</td>
<td></td>
</tr>
<tr>
<td>• Respiratory arrest</td>
<td></td>
</tr>
<tr>
<td>• Cardiac arrhythmia / ECG changes (e.g. widened QRS complex, increased PR interval, prolonged QT interval, heart block)</td>
<td></td>
</tr>
<tr>
<td>• Chest pains</td>
<td></td>
</tr>
<tr>
<td>• Oliguria / Urine output less than 25mL/hour</td>
<td></td>
</tr>
</tbody>
</table>

If signs of magnesium toxicity develop, stop the magnesium sulphate infusion. Because of the slow elimination, if signs of moderate toxicity are apparent, discontinuing the magnesium may not be sufficient. Intravenous Calcium gluconate (see 5.2 below), which quickly reverses the effects of magnesium toxicity, may be required when moderate to severe toxicity occur.

### ADDITIONAL INFORMATION

Therapeutic magnesium concentration range is 1.7 - 3.5 mmol/L.

## 5.1 Absent / reduced patella reflexes

- Stop the infusion
- Notify the Medical Officer
- Collect blood for serum levels

Cease the infusion until reflexes return and the blood results are in the therapeutic range.

## 5.2 Respiratory depression

- Stop the infusion
- Place the woman in the recovery position
- Maintain airway
- Administer O₂ at 6-8L/min via a face mask
- Notify the Medical Officer urgently

**IV Calcium Gluconate** must be administered by the Medical Officer diluted or undiluted (in a compatible fluid) slowly over 3 to 10 minutes into a large vein. Calcium gluconate opposes the action of magnesium.

**Note:**
- Calcium gluconate 1g in 10ml (2.2mmol Calcium in 10mL) should be available at all times when Magnesium sulphate is in use.
- If Calcium gluconate is administered apply ECG monitoring. Rapid intravenous injection may cause vasodilatation, bradycardia, decreased BP, arrhythmias, syncope and cardiac arrest. Overdose can be rapidly fatal.

## 5.3 Respiratory arrest

- Stop the infusion
- Summon emergency medical assistance by pressing the yellow assist bell, dial 55 stating 'Code Blue Medical', your identity & location.
- Initiate respiratory support until the woman is intubated and ventilated.
<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>ADDITIONAL INFORMATION</th>
</tr>
</thead>
</table>
| **6** Ongoing management | **When the management above has resulted in birth of the neonate(s), continuous BP monitoring and hourly pulse, oxygen saturation, respiration, urine output and reflexes should continue in ASCU for 24-48 hours, or until the woman’s condition improves, and she is transferred to the postnatal ward.**12  
*Often one to two days after the birth the woman's thrombocytopenia and liver enzyme elevations worsen before improving.*5 |
| **6.1** Women on Magnesium Sulphate therapy should be cared for in the Adult Special Care Unit (ASCU) until therapy has ceased, which is normally 24 hours following the last seizure17 or after the birth.11, 12  
Parameters to monitor are, a return to normal blood pressure and an increase in urine output.26 | **Pre-eclampsia is a major risk factor for venous thrombotic embolism (VTE), and the reduced mobility (such as while on anticonvulsant therapy or hospitalised) contributes to an increased risk of DVT.**5 |
| **6.2** Consider anti-thrombotic agents and the use of anti-embolic (TED) stockings to reduce the risk associated with deep vein thrombosis (DVT).5 | **Most antihypertensive drugs are compatible with breast feeding.**26  
Encourage the woman to see her GP by 2 weeks (earlier as required) to continue the management of anti-hypertensive therapy. |
| **6.3** Anti hypertensive therapy should be maintained and gradually reduced6 to be followed up by GP. | **Therapeutic magnesium concentration is 1.7–3.5 mmol/L.**6 |
| **6.4** In the presence of reduced renal function and/or oliguria (urine output <100 mL over 4 hours), regularly monitor the plasma magnesium concentration (e.g. 6 hourly).6 Reduce the dose if necessary (seek specialist advice).6, 12 | **Side Effects of Magnesium Sulphate**7, 27, 28  
Approximately 25% of women experience side effects from MgSO₄. These may include:  
- Sensation of pain and warmth in arms  
- Disruption to sensation, particularly in extremities  
- Flushing6 of face, neck and hands  
- Thirst, headache6, dizziness6, itching  
- Nausea and vomiting6  
- Loss of patellar reflexes- absent well before toxic serum levels are reached  
- Muscle weakness, slurring of speech, drowsiness and visual disturbances  
- Irritation at the injection site  
**Major side effects include:**  
- Respiratory depression which may lead to respiratory/cardiac arrest  
**The use of MgSO₄ is contraindicated and should be avoided in women with:**  
- Heart block,6 hypermagnesaemia,4 or renal failure. |
REFERENCES / STANDARDS

1. Duley L, Gülmezoglu AM, Henderson-Smart DJ, Chou D. Magnesium sulphate and other anticonvulsants for women with pre-eclampsia The Cochrane Database of Systematic Reviews., 2010 (11).
REFERENCES / STANDARDS Cont.


National Standards – 1- Care Provided by the Clinical Workforce is Guided by Current Best Practice; 4- Medication Safety; 9- Recognising and Responding to Clinical Deterioration in Acute Health Care

Legislation – Poisons Act 1964


Other related documents –
- KEMH Clinical Guidelines: Hypertension in Pregnancy; Magnesium Sulphate Anticonvulsant Therapy; Magnesium Sulphate Infusion; Calcium Gluconate; Checking and the Administration of Intravenous Drugs by Medical and Nursing / Midwifery Staff.
- E-learning: Global Voices: Pre-eclampsia and Eclampsia modules; K2 Pre-eclampsia

RESPONSIBILITY

Policy Sponsor | Nursing & Midwifery Director OGCCU / Pharmacy
Initial Endorsement | October 2003
Last Reviewed | December 2014
Last Amended | Review date

Do not keep printed versions of guidelines as currency of information cannot be guaranteed. Access the current version from the WNHS website.