Magnesium sulphate Intravenous for Adults

Who can administer

May be administered by registered competent doctor or nurse/midwife (see below re restrictions for pain management)

Important information

- **Dilute the 50% ampoules** before use - see below re maximum concentrations advised for Central vs Peripheral use
- Up to 50% of an IV dose may be eliminated in the urine, therefore, **slower administration may improve retention**[(ref 1)]
- In patients not in cardiac arrest, **hypotension and asystole may occur with rapid** administration [(ref 1)]
- **Take care when calculating doses, rates and volumes** [(ref 2)]
- For Y-site compatibility see below

Available preparations

Magnesium sulphate	50%	1g	2ml	4mmol Mg in 2ml	
Magnesium sulphate	50%	5g	10ml	20mmol Mg in 10ml	
Magnesium sulphate infusion bag	8%	4g	50ml	16mmol Mg in 50ml	Stocked in Maternity for use as per Q pulse guidelines (loading doses) Also available for use in Haematology/Oncology wards
Magnesium sulphate infusion bag	4%	20g	500ml	80mmol Mg in 500ml	

Reconstitution

Already in solution

Glass ampoules: Draw up using a 5 micron filter needle

Infusion fluids

Sodium Chloride 0.9% or Glucose 5 [(ref 2)]

Methods of intravenous administration

Intermittent intravenous infusion (administer using an electronically controlled infusion device)

- The 50% solution **MUST** be further diluted before use - invert the bag at least 5 times when adding magnesium to ensure that the drug is evenly distributed[(ref 2)]
- Add required dose to a suitable volume of infusion fluid (see below re dilutions for central/peripheral line)
- **If a 50ml volume** is used, the residual volume in the infusion line **must be flushed through at the same rate** to avoid significant underdosing

- Various regimens are used - depending on indication see under 'dose' for examples

Intravenous injection

- For use in resus situations and Pre-eclampsia CLN LW 032)

Rate of administration

- Usual maximum rate of administration: 1g per hour [ref 1]
  - **Slower administration may improve retentionÂ** as up to 50% of a dose administered IV may be eliminated in the urine[ref 1] - See 'Inefficiency of intravenous magnesium supplementation' below
- Higher rates of administration (up to 9g (36mmol) per hour) have been used in critical care or emergencies. ECG and close monitoring of adverse reactions is required [ref 2]

Peripheral line [ref 2]

- **Usual maximum concentration 5%** i.e. 5g (20mmol) in at least 100ml
- **Suggested practice:**add 1 to 2g to 100ml, or 5g to 250ml infusion fluid
- **Usual maximum rate:** 1g per hour[ref 1]
- **Slower administration may improve retention** as up to 50% of a dose administered IV may be eliminated in the urine [ref 1]
- **Fluid restriction:** see table below

Central line

- In most situations, use either 5% (e.g. 5g in 100ml) or 10% (e.g. 10g in 100ml) solution
- **Usual maximum rate:** 1g per hour[ref 1]
- **Slower administration may improve retention** as up to 50% of a dose administered IV may be eliminated in the urine [ref 1]
- **Fluid restriction:** see table below

Fluid restriction [ref 2,4]		
Peripheral line	Concentrations above 5% have a high osmolarity. Therefore, before PERIPHERAL administration of concentrations above 5% assess the following • clinical need (e.g. emergency or fluid restriction) • venous access • the ability to deliver the monitoring (phlebitis) required	If **fluid restricted,** can use a concentration of 10% (5g (20mmol) in 50ml) While a central line is preferred for this concentration, a large peripheral line may be used if central line access is unavailable Monitor for phlebitis Resite cannula at first signs of inflammation [ref 2]
Central line	Â	If required, the maximum concentration is 20%- each 1ml of 50% injection solution with 1.5ml diluent (e.g. 4g (16mmol) diluted to 20ml)

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Dose in adults

<table>
<tr><td rowspan="5">Hypomagnesaemia
ASYMPTOMATIC patients
• Dose is guided by daily magnesium levels
• Dose given depends on the amount required to replace the deficit (allowing for urinary losses) (ref 3)
• For typical initial doses see next columns</td><td colspan="2">Initial doses based on levels(ref 1)</td></tr>
<tr><td>Magnesium level</td><td></td></tr>
<tr><td>0.6 to 0.7mmol/L</td><td>Give 1 to 2g (4 to 8mmol)
Administer 1g over one hour, 2g over 2 hours</td></tr>
<tr><td>0.4 to 0.6mmol/L</td><td>Give 2 to 4g (8 to 16mmol)
Administer over 4 to 12 hours</td></tr>
<tr><td>less than 0.4mmol/L</td><td>Give 4 to 8g (16 to 32mmol)
Administer over 12 to 24 hours and repeat as needed
Can give over 4 hours if essential (ref 1) - but note that slower administration may improve retention - see below regarding inefficiency of intravenous magnesium administration
Subsequent doses: guided by levels and the patient's clinical condition.
Repeated doses may be needed - up to 40g (160mmol) may be needed
over up to a five day period
(allowing for urinary losses) (ref 3,5)</td></tr>
<tr><td rowspan="3">Hypomagnesaemia
SYMPTOMATIC, haemodynamically STABLE patients (severe symptoms - tetany,arrhythmias or seizures)</td><td colspan="2">Continuous cardiac monitoring STRONGLY recommended</td></tr>
<tr><td>If Mg level <0.4mmol/L:</td><td>Initially, give 1 to 2g as an intermittent infusion 30 to 60 minutes
Follow with an additional 4 to 8g over 12 to 24 hours
Repeat dose as necessary</td></tr>
<tr><td>Mg level 0.4mmol/L or more</td><td>Give 4 to 8g over 12 to 24 hours
Repeat dose as necessary</td></tr>
<tr><td>Hypomagnesaemia - SYMPTOMATIC, haemodynamically UNSTABLE, patients (severe symptoms - tetany,arrhythmias or seizures)</td><td colspan="2">Continuous cardiac monitoring STRONGLY recommended
Initially, give 1 to 2g as an intermittent infusion over 2 to 15 minutes (may be best to give as small volume infusion to avoid inadvertently giving too rapidly)
May repeat as necessary if patient remains unstable
Once patient is stable, administer an additional 4 to 8g over 12 to 24 hours.
Repeat dose as necessary</td></tr>
<tr><td>Severe acute asthma or continuing respiratory deterioration in anaphylaxis (ref 3,8)</td><td colspan="2">Give 1.2 to 2g over 20 minutes (should only be used following consultation with senior medical staff)</td></tr>
<tr><td>Emergency treatment of severe arrhythmias(ref 3)</td><td colspan="2">Give 2g over 10 to 15 minutes
Dose may be repeated once if necessary</td></tr>
<tr><td>Eclampsia, Fetal neuroprotection</td><td colspan="2">See Q pulse document: CLN LW 032, CLN LW 0055</td></tr>
<tr><td rowspan="2">For use in pain management (Prescribed by Anaesthetics or Pain team only) (ref 6,7)</td><td colspan="2">Intermittent infusion dose (ref 6):
• Up to 2g over 30 minutes (critical care areas only for this rate)
• Up to 2g over 60 minutes (all ward areas)
Subsequent doses (all ward areas)(ref 6)
• Repeat doses of 1g every eight hours as required, while monitoring magnesium levels</td></tr>
<tr><td colspan="2">Monitor blood pressure, heart rate, respiratory rate and saturations
Patient must be on bedrest for the duration of the infusion</td></tr>
</table>

Inefficiency of intravenous magnesium supplementation[ref 1]

- Plasma magnesium concentration inhibits magnesium reabsorption in the loop of Henle, the major site of active magnesium transport
- Thus, when an IV magnesium infusion is given, an abrupt but temporary elevation in the plasma magnesium concentration will partially inhibit the stimulus to magnesium reabsorption in the loop of Henle.
- Thus, up to 50 percent of the infused magnesium will be excreted in the urine.
- In addition, magnesium uptake by the cells is slow, and therefore adequate repletion requires sustained correction of the hypomagnesemia

Renal dose [ref 5]

- Doses may need to be reduced in renal impairment
- Monitor magnesium levels closely

Hepatic impairment

- Hepatic coma: Do not use in hepatic coma if there is a risk of renal failure [ref 3]

Monitoring

- Monitor blood pressure, respiratory rate, heart rate, urinary output and for signs of overdose [ref 2]
- Monitor magnesium and other electrolyte levels

Storage

Store below 25^{0}C

References

1: Uptodate, accessed online 9th Oct, 2024 (note- there are two separate monographs in UpToDate - Hypomagnasaemia and Magnesium - slightly different we have amalgamated them with our best efforts)

2: Injectable medicines administration guide Medusa, accessed online 9th Oct, 2024

3: BNF accessed online 9th Oct, 2024

4 .Injectable drugs guide, downloaded from medicinescomplete Oct 22nd 2024

5: Martindale accessed online 9th Oct, 2024

6. Expert opinion Dr Olivia Finnerty, Anaesthetics Oct 1st 2019

7. Magnesium - a versatile drug for anesthesiologists, Korean j Anaesthesiol 2013 July 65

8: BTS guidelines on Asthma 2019

Therapeutic classification

Electrolyte