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A Clinical Guideline for the use of Intravenous Magnesium Sulphate in Acute Severe Asthma in Children

For Use in:	Paediatric High Dependency Unit or Intensive Care, Emergency Department
By:	Medical and Nursing Staff
For:	Children with Acute Life-Threatening Asthma
Division responsible for document:	Women and Children's Services
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Version Number	Date of Update	Change Description	Author
1.1	04/05/2020	Reviewed with no clinical changes, as the drugs mentioned in document are specific, and unlikely to change.	Dr Caroline Kavanagh

This is a Controlled Document

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Quick reference

Escalation of Care for Acute Severe or Life-Threatening Asthma

Objective

- To ensure the safe use of intravenous magnesium sulphate in either the High Dependency Unit or Intensive Care Unit for children and resus in the Emergency Department with acute severe or life threatening asthma.
- To provide appropriate instruction for the preparation of intravenous magnesium sulphate solutions.
- To highlight problems with intravenous magnesium sulphate use and suggest solutions if problems arise.

Broad recommendations

- Intravenous magnesium sulphate should only be used if indicated, which will be informed by the patient's clinical condition. It can be used in patients with acute severe asthma or life-threatening asthma.
- Patients receiving intravenous magnesium sulphate should be nursed in either a high dependency unit or an intensive care unit.
- Patients receiving intravenous magnesium sulphate have continuous ECG monitoring and regular monitoring of electrolytes and blood gases.

Background

Magnesium sulphate has been shown to inhibit smooth muscle contraction, decrease histamine release from mast cells, and inhibit acetylcholine release.

Magnesium sulphate has been considered as an adjunct therapy for severe and life-threatening asthma exacerbation. It has been shown to induce bronchial smooth muscle relaxation in a dose-dependent manner by inhibiting calcium influx into the cytosol, histamine release from mast cells, and acetylcholine release from cholinergic nerve endings. It also may increase the bronchodilator effect of β_2-agonist by increasing the receptor affinity.

Studies both in children and adults have shown variable improvement in patients with severe airflow limitation who are unresponsive to standard treatment with beta agonist, anticholinergic, and corticosteroid medications.

It provides relief of severe bronchospasm associated with asthma and for the treatment of status asthmaticus. It must be prescribed and monitored carefully.

In cases of acute severe or life threatening asthma it can be given as a slow bolus or intravenous infusion. This must only occur in a high dependency unit or an intensive care unit. It may be used as a treatment modality to try to avoid the need for ventilation.

This policy offers advice on intravenous magnesium sulphate dosing and monitoring in patients with life threatening asthma.

Indications for Use

Intravenous magnesium sulphate should only be prescribed in acute severe asthma unresponsive to nebulised bronchodilators and life threatening asthma (See flowchart on page 3). Care should be taken in patients with renal failure.

Dosing of Magnesium Sulphate

Recommended dosing would be:

- A bolus intravenous infusion of Magnesium Sulphate 40mg/kg (maximum 2g) over 20 minutes.
- This can be repeated in 1-2 hours if necessary.
- The safety and efficacy of repeated intravenous doses have not been assessed. Repeated doses could cause hypermagnesaemia with muscle weakness and respiratory failure.

Administration Details for Intravenous Magnesium Sulphate

Magnesium Sulphate for peripheral administration:

Intravenous Magnesium Sulphate can be diluted with either 5% glucose or 0.9% sodium chloride solutions.

For peripheral administration, dilute to a maximum of 200mg/ml with 0.9% saline or 5% dextrose

Dose = Magnesium Sulphate 40mg/kg to a maximum of 2g.

This equates to 0.08ml/kg of a 50% magnesium sulphate solution.

50% magnesium sulphate solution = 500mg/ml = 2mmol/ml.

Magnesium sulphate for central venous administration:

For central administration, Magnesium Sulphate can be given neat over 20 minutes.

Nurses should state on the drug chart the exact time of administration.

Administration of infusion should be via a syringe pump or slow bolus over 20 minutes.
Set the volume to be infused on the syringe pump to prevent overdose.
The line must always be primed with the magnesium sulphate infusion to prevent any delay in the patient receiving the medication.

Monitoring of Intravenous Magnesium Sulphate

- Patient needs to be nursed in a High Dependency unit or Intensive Care Unit.
- Continuous cardiac ECG monitoring is needed.

- Initial observations every 5 minutes for the first 10 minutes (pulse, respiratory rate, BP, oxygen saturation).
- Observations every 15 minutes thereafter.
- Adverse effects include: hypotension and bradycardia.
- Magnesium is excreted mainly by the kidneys and is therefore retained in renal failure, but significant hypermagnesaemia (causing muscle weakness and arrhythmias) is rare.
- Repeated doses could cause hypermagnesaemia with muscle weakness and respiratory failure.
- Magnesium is contraindicated in patients with heart block, since magnesium may exacerbate this condition.
- Hypermagnesaemia may occur when large doses of magnesium are given, especially in patients with renal failure. Signs of hypermagnesaemia include: nausea, vomiting, flushing, hypotension, muscle weakness, muscle paralysis, blurred or double vision, CNS depression and loss of reflexes. More severe hypermagnesaemia may result in respiratory depression, respiratory paralysis, renal failure, coma, cardiac arrhythmias and cardiac arrest.
- If given peripherally, the insertion site should be monitored closely for phlebitis using a recognised infusion phlebitis scoring tool.

Clinical audit standards

- All children over the age of 2 years with acute severe or life threatening asthma should receive intravenous magnesium sulphate as a slow intravenous bolus or infusion if needed.
- Patients requiring intravenous magnesium sulphate are nursed in a High Dependency unit or Intensive Care Unit.
- Patients requiring intravenous magnesium sulphate have continuous cardiac ECG monitoring.
- Patients requiring intravenous magnesium sulphate have a minimum of 12 hourly U&Es.
- Medical notes should reflect review of the dosing regimen.

Summary of Development and Consultation Process Undertaken Before Registration and Dissemination

The authors listed above drafted this guideline on behalf of the regional High Dependency Care Forum and the Children's Critical Care Group who have agreed the final content. During its development, the guideline has been circulated for comment. Comments were addressed and incorporated if appropriate.

This version has been endorsed by the Clinical Guidelines Assessment Panel.

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