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

<table>
<thead>
<tr>
<th>For Use in:</th>
<th>Paediatric High Dependency Unit or Intensive Care, Emergency Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>By:</td>
<td>Medical and Nursing Staff</td>
</tr>
<tr>
<td>For:</td>
<td>Children with Acute Life-Threatening Asthma</td>
</tr>
<tr>
<td>Division responsible for document:</td>
<td>Women and Children’s Services</td>
</tr>
<tr>
<td>Key words:</td>
<td>Magnesium sulphate, asthma, wheeze, status asthmaticus</td>
</tr>
</tbody>
</table>

| Name and job titles of document author: | Dr Imogen Rose, Paediatric Specialist Registrar  
Dr Caroline Kavanagh, Consultant Respiratory Paediatrician |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name and job title of document author’s Line Manager:</td>
<td>Dr Bina Mukhtyar, Consultant Paediatrician</td>
</tr>
</tbody>
</table>
| Supported by:                           | Children’s Critical Care group  
Regional High Dependency and Critical Care Forum |
| Assessed and approved by the:          | Clinical Guidelines Assessment Panel (CGAP)  
Chair’s action ✓ |
| Date of approval:                      | 04/05/2020 |

<table>
<thead>
<tr>
<th>Ratified by or reported as approved to (if applicable):</th>
<th>Clinical Safety and Effectiveness Sub-board</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be reviewed before:</td>
<td>This document remains current after this date but will be under review</td>
</tr>
<tr>
<td></td>
<td>04/05/2023</td>
</tr>
<tr>
<td>To be reviewed by:</td>
<td>Dr Imogen Rose and Dr Caroline Kavanagh</td>
</tr>
<tr>
<td>Reference and / or Trust Docs ID No:</td>
<td>13942</td>
</tr>
<tr>
<td>Version No:</td>
<td>1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compliance links:</th>
<th>NICE Quality standard for asthma. 2013 (NICE Quality Standard QS25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If Yes - does the strategy/policy deviate from the recommendations of NICE? If so why?</td>
<td>No</td>
</tr>
</tbody>
</table>

This guideline has been approved by the Trust's Clinical Guidelines Assessment Panel as an aid to the diagnosis and management of relevant patients and clinical circumstances. Not every patient or situation fits neatly into a standard guideline scenario and the guideline must be interpreted and applied in practice in the light of prevailing clinical circumstances, the diagnostic and treatment options available and the professional judgement, knowledge and expertise of relevant clinicians. It is advised that the rationale for any departure from relevant guidance should be documented in the patient's case notes.

The Trust's guidelines are made publicly available as part of the collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document.

---

**Version and Document Control:**

Clinical Guideline for: the use of Intravenous Magnesium Sulphate in Acute Severe Asthma in Children  
Author and title: Dr Caroline Kavanagh, Consultant Respiratory Paediatrician  
Approved by: CGAP  
Date approved: 04/05/2020  
Review date: 04/05/2023  
Available via Trust Docs  
Trust Docs ID: 13942 v1.1
Quick reference

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

This is a Controlled Document
Printed copies of this document may not be up to date. Please check the hospital intranet for the latest version and destroy all previous versions.

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick guide reference</td>
<td>3</td>
</tr>
<tr>
<td>Objectives</td>
<td>4</td>
</tr>
<tr>
<td>Broad recommendations</td>
<td>4</td>
</tr>
<tr>
<td>Background</td>
<td>4</td>
</tr>
<tr>
<td>Indications for use</td>
<td>5</td>
</tr>
<tr>
<td>Dosing of intravenous magnesium sulphate</td>
<td>5</td>
</tr>
<tr>
<td>Administration details</td>
<td>5</td>
</tr>
<tr>
<td>Monitoring of intravenous magnesium sulphate</td>
<td>5</td>
</tr>
<tr>
<td>Clinical audit standards</td>
<td>6</td>
</tr>
<tr>
<td>Summary of development and consultation process undertaken before registration and dissemination</td>
<td>6</td>
</tr>
<tr>
<td>References</td>
<td>7</td>
</tr>
</tbody>
</table>

Clinical Guideline for: the use of Intravenous Magnesium Sulphate in Acute Severe Asthma in Children
Author and title: Dr Caroline Kavanagh, Consultant Respiratory Paediatrician Approved by: CGAP
Date approved: 04/05/2020 Review date: 04/05/2023 Available via Trust Docs Trust Docs ID: 13942 v1.1 Page 2 of 7
Escalation of Care for Acute Severe or Life-Threatening Asthma

Objective

Clinical Guideline for the use of Intravenous Magnesium Sulphate in Acute Severe Asthma in Children
Author and title: Dr Caroline Kavanagh, Consultant Respiratory Paediatrician
Approved by: CGAP
Date approved: 04/05/2020   Review date:  04/05/2023   Available via Trust Docs   Trust Docs ID: 13942 v1.1
A Clinical Guideline for the use of Intravenous Magnesium Sulphate in Acute Severe Asthma in Children

- 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 $\beta_2$-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.
References

1. BNF for Children, January 2017


3. D Cheuk, T Chau, and S Lee
A meta-analysis on intravenous magnesium sulphate for treating acute asthma. Arch Dis Child. 2005 January; 90(1): 74–77


