Asthma - Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of a child presenting to an Emergency Department (ED) with asthma symptoms in Queensland. The management of children aged 1 to 5 years who present with a wheezing illness may is outlined in the Pre-school wheeze - Emergency management in children Guideline.

This guideline has been developed by senior ED clinicians across Queensland, with input from Paediatric Respiratory specialists, Queensland Children’s Hospital, Brisbane. It has been endorsed for use across Queensland by the Statewide Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Division.

Key points

- Asthma is a chronic inflammatory disorder of the airways involving reversible airway obstruction.
- Children with acute asthma usually present with cough, wheeze and/or difficulty breathing.
- Salbutamol and steroids are the first-line treatment for children > 5 years with additional medications given in more severe cases.
- A wheezing illness in children < 5 years is managed differently with steroids not routinely recommended (see Pre-school wheeze Guideline).
- A thorough assessment and continuous review is necessary for each child during their presentation.
- Acute asthma episodes can be life-threatening. Seek senior emergency /paediatric advice promptly for a child with severe symptoms or who is not responding to therapy.

Introduction

Asthma is a chronic inflammatory disorder of the airways involving reversible airway obstruction. It is estimated to affect 1 in 6 Australian children. Asthma is one of the most common paediatric ED presentations accounting for approximately 3.5% of ED presentations in Australia and New Zealand.

Children with asthma have sensitive airways which react to triggers (such as viral illnesses) causing airway inflammation, thickened mucous and bronchospasm leading to a narrowing of the airways, reduced airflow and air trapping. Children with acute asthma usually present with cough, wheeze and/or difficulty breathing. In an acute asthma episode, a wheeze may not always be heard but a prolonged respiratory phase of expiration may be present. Acute bronchospasm may lead to respiratory failure and life-threatening acute asthma if not identified and treated promptly. The diagnosis of asthma is confirmed by demonstrating reversible airway obstruction. Other diagnoses can also cause recurrent respiratory symptoms.
Assessment

Children with asthma may present with a range of symptoms and varying levels of severity. Initial assessment should be within the time frame recommended by the patient’s triage (ATS) category. The child’s general appearance or mental state and level of respiratory distress are the most important markers of severity.

The aim of the initial assessment is to:

- confirm an asthma episode
- identify symptom pattern, severity and possible trigger factors
- look for features suggestive of an alternative diagnosis or associated condition

History

History taking should include specific information on:

- signs and symptoms (including wheeze, cough and respiratory distress) and management to date for the current asthmatic episode
- history of previous wheezing episodes (including severity, previous management and hospitalisations, including PICU admission) and previous asthma diagnosis
- regular asthma management plan (if any)
- family history (including mother and sibling/s) of asthma and atopy
- smoking history of household members

All health professionals have a role in advocating for their patients by advising parents about the increased risk of wheezing associated with parental smoking.

Examination

ALERT – Wheeze may be absent in severe cases due to severe airway obstruction or extreme fatigue. A “silent chest” (chest with little or no breath sounds) is a warning sign of life-threatening respiratory failure and/or respiratory arrest.

The clinical assessment of an asthmatic child should include:

- respiratory rate and phases of respiration
- work of breathing and use of accessory muscles (nasal flaring, tracheal tug, intercostal or substernal recession)
- oxygen saturation (in room air or with supplemental oxygen)
- heart rate
- skin colour (pallor or cyanosis)
- blood pressure and pulse volume
- level of consciousness (irritability or drowsiness)

The modified version of the National Asthma Council Australia severity assessment criteria and the Australasian Triage Scale (ATS) is displayed in the table below.
Seek senior emergency/paediatric assistance as per local escalation protocols for a child with severe or life-threatening asthma. Consider contacting paediatric critical care specialists (onsite or via RSQ) for life-threatening cases.

### Initial assessment of acute asthma in children

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Life-threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal conscious state</td>
<td>Normal conscious state</td>
<td>Agitated Restlessness Distressed</td>
<td>Exhaustion Confused Altered level of consciousness</td>
</tr>
<tr>
<td>No accessory muscle use</td>
<td>Minimal accessory muscle use</td>
<td>Moderate muscle use Nasal flaring Tracheal tug Hyperinflated chest</td>
<td>Excessive muscle use Nasal flaring Tracheal tug Hyperinflated chest</td>
</tr>
<tr>
<td>Normal to a mild increase in respiratory rate</td>
<td>Tachypnoea</td>
<td>Tachypnoea Dyspnoea Prolonged expiration</td>
<td>Decreasing respiratory rate May only gasp occasionally</td>
</tr>
<tr>
<td>Normal pulse</td>
<td>Tachycardia</td>
<td>Tachycardia</td>
<td>Decreasing heart rate Pulse may be hard to feel</td>
</tr>
<tr>
<td>Pulsus paradoxus not present</td>
<td>Pulsus paradoxus may be palpable</td>
<td>Pulsus paradoxus palpable</td>
<td>Pulsus paradoxus palpable</td>
</tr>
<tr>
<td>Talks in sentences</td>
<td>Takes in phrases</td>
<td>Talks in 1 – 2-word gasps</td>
<td>Unable to talk</td>
</tr>
<tr>
<td>No central cyanosis</td>
<td>No central cyanosis</td>
<td>Cyanosis likely</td>
<td>Cyanosis</td>
</tr>
<tr>
<td>Variable wheeze</td>
<td>Moderate to loud wheeze</td>
<td>Often quiet wheeze Often quiet wheeze (silent chest)</td>
<td></td>
</tr>
<tr>
<td>SpO₂ &gt; 94%</td>
<td>SpO₂ 90 – 94%</td>
<td>SpO₂ &lt; 90%</td>
<td>SpO₂ &lt; 90%</td>
</tr>
</tbody>
</table>

Adapted from National Asthma Council Australia¹ and Department of Health and Ageing, Australian Government⁵

### Differential diagnosis

Alternative conditions which can present with clinical features of acute asthma include:
- inhaled foreign body
- gastro-oesophageal reflux
- diabetic ketoacidosis
- pneumonia
- croup
- anaphylaxis

### Investigations

Investigations (such as chest X-ray, blood gas analysis and serum electrolytes) are not routinely required in a child with acute asthma.⁵ They may be considered in specific situations such as life-threatening asthma or the child with severe asthma who is not responding to treatment.⁵
Management

For the management of asthma symptoms in pre-school children refer to the Pre-school Wheeze Guideline. Refer to the flowchart for a summary of the recommended emergency management of children with asthma. The initial management of acute asthma in children comprises of inhaled beta2-agonists (salbutamol) and steroids while maintaining adequate oxygenation. Other useful adjuncts for severe episodes or escalation of treatment may include inhaled anticholinergics (ipratropium bromide), magnesium sulphate IV, salbutamol IV and aminophylline IV.

Frequent repeated clinical assessment is the best indicator to guide management.

Inhaled salbutamol

Salbutamol may be effectively administered by nebuliser or by metered dose inhaler (MDI) with a spacer device. A spacer should always be used with a MDI.

<table>
<thead>
<tr>
<th>Inhaled salbutamol dosing for the treatment of asthma in children</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDI * 100mcg</td>
</tr>
<tr>
<td>Nebulised</td>
</tr>
<tr>
<td>Salbutamol burst</td>
</tr>
<tr>
<td>Continuous nebulised salbutamol</td>
</tr>
</tbody>
</table>

* Always use via spacer. Use mask also if unable to form a reliable seal on spacer

MDI and spacer vs nebuliser

- Both modes of administration are equally effective for acute asthma symptoms.
- MDI is preferred as faster (nebulisation requires a child to sit still for at least 10 minutes) and more efficient.
- Delivery of salbutamol by nebuliser results in greater facial and oropharyngeal deposition of medication delivering at best 10% of the prescribed drug to the lungs, with consequent systemic absorption and side effects such as tachycardia and tremor.
- Children who are struggling with their breathing and who are not able to co-ordinate taking a deep breath through the spacer should be given nebulised medication.

How to use a spacer

- Prime spacer before use to negate electrostatic charge (and optimise drug delivery) with 10 puffs of salbutamol.
- Shake MDI before each puff.
- Administer 1 puff at a time into the spacer.
- The medication is cleared from the spacer by the child taking 5 breaths following each puff of medication.
- If the child is unable to form a reliable seal around the spacer, a mask should be used.
Weaning salbutamol

Stretching the time between salbutamol doses should be based on an assessment on the child. This should be done in collaboration with the child and caregiver and include:

- **respiratory distress**: decreased work of breathing (subcostal & intercostal recession/tracheal tug/nasal flaring)
- **activity level**: decreasing lethargy, increasing alertness
- **respiratory rate**: decreasing to within normal limits for age
- **heart rate**: decreasing to within normal limits for age. Note bronchodilator therapy increases heart rate.
- **speech**: able to talk in sentences
- **auscultation**: air entry improved, wheeze reduced or appearance of wheeze in previously quiet chest (note wheeze alone is not an indication for giving salbutamol)
- **cough**: reduction or change in cough i.e. becomes looser
- **oxygen saturations**: increasing oxygen saturations and decreasing oxygen requirement.

**Alert** – Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension. Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.

Steroids

Corticosteroids are used to treat the airway oedema and increased mucous production associated with the inflammation in acute asthma.7

Corticosteroid therapy is recommended for moderate-to-severe acute asthma episode, or if there is incomplete response to inhaled beta2-agonists.8 A Cochrane review reported that hospital admission rates for children with acute asthma were significantly reduced for those who received corticosteroids within 1 hour of ED presentation.9 Oral corticosteroid treatment is particularly effective in children and has minimal side effects.9 Maximum benefit occurs within 4 to 6 hours after administration.

For pre-school children, particularly those with intermittent viral induced wheezing, corticosteroids should be limited to those with at least moderate but generally severe acute wheeze requiring hospital admission (see Pre-school wheeze Guideline).

<table>
<thead>
<tr>
<th>Steroid</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prednisolone (PO)</td>
<td>Day 1: 2mg/kg (max 50mg) Day 2 and 3: 1mg/kg Can extend course to 5 days if still symptomatic after 3-day course</td>
</tr>
<tr>
<td>Hydrocortisone (IV)</td>
<td>4mg/kg (max 200mg), 6 hourly</td>
</tr>
<tr>
<td>OR Methylprednisolone (IV)</td>
<td>Initial loading dose: 2mg/kg (max 60mg) Then: Day 1: 1mg/kg 6 hourly Day 2: 1mg/kg 12 hourly Day 3 onwards: 1mg/kg daily</td>
</tr>
</tbody>
</table>
While there is some evidence for the benefit of inhaled corticosteroids and leukotriene receptor antagonists in acute asthma, oral or intravenous corticosteroids remain the current treatment of choice.10

Ipratropium bromide (Atrovent)
Anticholinergics may be useful in combination with inhaled beta2-agonists in the early management of children presenting with moderate to severe acute asthma.15 The mechanism of action of anticholinergic bronchodilators remains unclear. However, it is thought that cholinergic pathways play an important role in the pathogenesis of asthma exacerbations.11

A number of studies show that combined ipratropium bromide and salbutamol therapy is superior to salbutamol therapy alone.12-15 There is good evidence to suggest that its use with salbutamol in the first 2 hours (ideally given with the first 3 doses) of treatment is safe and results in a significant improvement in the peak expiratory flow rate, ultimately decreasing hospitalisation rates.16 The benefits of ipratropium bromide are more apparent in the more severe presentations or those that have not had a response to inhaled salbutamol alone.5

**Ipratropium (INH) dosing for the treatment of asthma in children**

| < 6 years          | 4 puffs OR 250 mcg nebulized every 20 minutes x 3 doses  
|                   | Then 2 puffs (42 mcg) 6 hourly |
| > 6 years         | 8 puffs OR 500 mcg nebulized every 20 mins x 3 doses   
|                   | Then 4 puffs (42 mcg) 6 hourly |

**Magnesium sulphate**
Seek senior emergency/paediatric advice as per local protocols for a child requiring magnesium sulphate. Consider seeking paediatric critical care input (onsite or via RSQ).

Magnesium sulphate IV should be considered for children with severe acute asthma who are not responding to conventional bronchodilators used in the first hour.17 A meta-analysis on the use of magnesium sulphate IV for treating acute to moderate to severe asthma in ED found benefits in pulmonary function tests and hospitalisation rates.18 The action of magnesium sulphate remains unclear. It is thought that magnesium ions decrease the uptake of calcium by bronchial smooth muscle cells, which leads to bronchodilation.18,19 Magnesium may also have a role in inhibiting mast cell degranulation, which reduces inflammatory mediators.18,19

**Magnesium sulphate (IV) dosing for the treatment of asthma in children**

| Bolus dose     | 0.2 mmol/kg (equivalent to 50 mg/kg) infused over 20 minutes  
|                | (max 8 mmol = equivalent to 2000mg) |
| Side effects   | Usually minor, including:  
|                |  - epigastric or facial warmth and flushing  
|                |  - pain and/or numbness at infusion site  
|                |  - dry mouth  
|                |  - malaise  
|                | Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse |
| Monitoring     | Full cardiac monitoring with blood pressure every 5 minutes. Cease infusion if hypotension persists.  
|                | Monitor knee reflexes if repeating doses to assess for magnesium toxicity which can result in respiratory failure. Magnesium should be ceased/no further doses given if reflexes are absent. |
Magnesium sulphate should be administered using safety software syringe drivers with a standard concentration of 0.5 mmol/ml. e.g. If patient weighs 10 kg, the magnesium sulphate dose is 0.2mmol/kg = 2 mmol. This translates to 4ml of 0.5 mmol/ml solution, and must be administered through a safety software syringe driver over 10 to 20 minutes to minimise the risk of too rapid administration and dosing errors.

Currently, there is no good evidence to support using inhaled magnesium sulphate as an alternative to inhaled beta2-agonists. A preservative free preparation of magnesium sulphate suitable for nebuliser therapy is currently unavailable in Queensland.

**Intravenous salbutamol**

Contact paediatric critical care specialists (onsite or via RSQ) for children requiring salbutamol IV.

Salbutamol IV should be considered for children who present with severe or life-threatening acute asthma and who do not respond appropriately to initial continuous doses of inhaled beta2-agonists. Near or complete airway obstruction may be present in life-threatening asthma and can prevent effective aerosolised bronchodilator therapy.

A single bolus dose of salbutamol IV can be given as a standalone dose, or can be given prior to commencing an infusion. A single bolus of salbutamol IV administered over 10-20 minutes has been shown to shorten the duration of severe asthma attacks, improve recovery time and reduce the overall requirements for inhaled salbutamol.

The approach to salbutamol IV dose can vary between starting at the lower or higher end and adjusting according to response. Concerns have been expressed that the current recommendations for children may be excessive and may unnecessarily raise the potential for adverse reactions such as lactic acidosis and tachycardia, and through increasing respiratory workload, exacerbate respiratory fatigue.

The current recommended dosing practice is to use a higher rate initially and reduce thereafter e.g. 5 micrograms/kg/minute for the first hour, then 1–2 micrograms/kg/minute until symptoms improve.

### Salbutamol (IV) dosing for the treatment of asthma in children

<table>
<thead>
<tr>
<th>Bolus dose</th>
<th>100mcg/kg infused over 20 minutes (max 5 milligrams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion</td>
<td>1-10mcg/kg/min (max weight 50kg)</td>
</tr>
<tr>
<td>Side effects</td>
<td>Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension. Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Full cardiac monitoring Monitor venous potassium levels.</td>
</tr>
</tbody>
</table>

**Aminophylline**

Contact paediatric critical care specialists (onsite or via RSQ) prior to administering aminophylline IV.

Traditionally, aminophylline IV has been used in PICU to manage children with severe asthma unresponsive to maximum doses of bronchodilators and steroids. Aminophylline improves lung function within 6 hours of treatment, however there is limited improvement in symptoms, number of treatments and duration of hospital admission. It is also associated with numerous side effects including vomiting. Aminophylline should not be given as an intravenous infusion in the patient already taking oral theophylline.
High flow nasal cannula (HFNC) therapy and Non-invasive ventilation (NIV)

Contact paediatric critical care specialists (onsite or via RSQ) if commencing HFNC therapy or NIV.

NIV and HFNC therapy are usually well tolerated in children with acute respiratory insufficiency due to asthma who have not responded to standard medical therapies. Early use may prevent the requirement for intubation and mechanical ventilation. Consider HFNC therapy, CPAP or BiPAP for a child who

- is unable to maintain SaO2 > 93% despite high flow oxygen via a non-rebreather mask
- has deteriorating work of breathing with increasing fatigue, tachycardia, and tachypnoea

NIV should only be considered in a child with a normal level of consciousness. HFNC therapy may be valuable to provide pre-oxygenation while preparation for the intubation is underway in children with a deteriorating level of consciousness.

Potential concerns have been raised regarding the use of HFNC therapy. Follow local policies. For CHQ staff, in accordance with CHQ HFNC therapy protocols, the child:

- should be nursed at an appropriate (1:1 or 1:2) nurse to patient ratio
- should be in an acute area e.g. resuscitation room with continuous oximetry and ECG monitoring
- must have vascular access secured
- must remain nil by mouth with consideration given to the placement of a nasogastric tube to prevent gastric insufflation.

Contact paediatric critical care specialists (onsite or via RSQ) prior to intubation and ventilation.

When to escalate care

Follow your local facility escalation protocols for children of concern. Transfer is recommended if the child requires care beyond the level of comfort of the treating hospital. Clinicians can contact the services outlined below to escalate the care of a paediatric patient.

<table>
<thead>
<tr>
<th>Service</th>
<th>Reason for contact by clinician</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Paediatric service</td>
<td>For specialist paediatric advice and assistance with local transfers as per local arrangements.</td>
<td>As per local arrangements</td>
</tr>
<tr>
<td>Children’s Advice and Transport Coordination Hub (CATCH)</td>
<td>For access to specialist paediatric advice and assistance with inter-hospital transfer of non-critical patients into and out of Lady Cilento Children’s Hospital. For assistance with decision making regarding safe and appropriate inter-hospital transfer of children in Queensland.</td>
<td>(07) 3068 4510 24 hours <a href="https://catch.qld.gov.au">CATCH</a> website For QH staff, <a href="https://qh.health.qld.gov.au">click here</a> for the QH Inter-hospital transfer request form (access via intranet).</td>
</tr>
<tr>
<td>Telehealth Emergency Management Support Unit (TEMSU)</td>
<td>For access to generalist and specialist acute support and advice via videoconferencing, as per locally agreed pathways, in regional, rural and remote areas in Queensland.</td>
<td>TEMSU <a href="https://temsu.qheps.qld.gov.au">QHEPS website</a> 24 hours</td>
</tr>
<tr>
<td>Retrieval Services Queensland (RSQ)</td>
<td>For access to telehealth support for, and to notify of, critically unwell patients requiring retrieval in Queensland. For any patients potentially requiring aeromedical retrieval or transfer in Queensland.</td>
<td>RSQ <a href="https://qh.health.qld.gov.au">QHEPS website</a> 24 hours</td>
</tr>
</tbody>
</table>
When to consider discharge

Discharge can be considered for a child who

- can maintain SpO2 ≥ 93% in room air
- is not tachypnoeic
- no/mild work of breathing
- good air entry with minimal wheeze
- clinically stable on 3rd hourly bronchodilator
- has a parent/caregiver who can safely manage the child at home, return in event of deterioration and access further medication

Patients who are at high risk for deterioration with more severe disease or inadequate management in the community should be considered for a period of longer short stay or inpatient observation despite looking well. This includes:

- those with previous PICU admission
- non-English-speaking background
- families living > 30 minutes from a local hospital
- social factors impacting upon ability to monitor and supervise child at home

An assessment of the family’s ability to safely manage the child at home should be done as per the Asthma Disease Education Checklist (PDF) for all children with pre-school wheeze prior to discharge.

On discharge a child should be provided with:

- Discharge letter
- Asthma Action Plan – copies for family, general practitioner, and medical record
- Asthma Factsheet
- Puffers and Spacers Factsheet

Follow-up

- With GP or paediatrician within a week, depending upon the course of the illness

When to consider admission

Facilities without a Short Stay Unit (SSU)

Consider admission if:

- severe illness – defined as respiratory distress, failure to respond to initial bronchodilator and steroids or requiring oxygen
- unable to stretch bronchodilators and discharge by 4 hours

Despite meeting the clinical discharge criteria admission may be considered for the following patients:

- high risk including those with past PICU admission or previous sudden deterioration
- social issues including those who are geographically isolated from a hospital or have family issues affecting the ability to provide care at home

Facilities with a Short Stay Unit (SSU)

Consider admission to an SSU if:

- symptoms occur within 1-2 hours of initial treatment with bronchodilator/steroids AND
- no further investigations are required
Children who require bronchodilator therapy more frequently than 1 hourly require vigilant monitoring and regular review by medical staff. Unless specifically discussed with SSU medical and nursing staff, the child should remain in the acute assessment area of the ED.

During admission to SSU:
- vital signs and respiratory assessment should be recorded in line with bronchodilator frequency or hourly if requiring oxygen supplementation
- Salbutamol frequency can be weaned (“stretched”) by appropriately trained nursing or medical staff, depending on local protocols

**When to consider admission to inpatient ward from SSU**

Local protocols will dictate criteria for admission from SSU to an inpatient ward. Some general criteria to consider include:
- clinical deterioration with a need to escalate treatment
- failure to progress and wean bronchodilators to 3rd hourly after 12 – 24 hours (consider poor bronchodilator response, suboptimal administration or alternative diagnosis)
- persisting supplemental oxygen requirement

**Related documents**

**Guideline**
- Pre-school wheeze - Emergency management in children

**Forms and factsheets**
- Asthma Disease Education Checklist
- Asthma Action Plan
- Asthma Factsheet
- Puffers and Spacers Factsheet

**References**

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- knowledge and expertise, or medical advice.
- Variation from the guideline, taking into account individual circumstances may be appropriate.
- that the information is entirely complete, current, or accurate in every respect. The guideline is not a substitute for clinical judgement,
- materials within or referred to throughout this document being in any way inaccurate, out of context, incomplete or unavailable.

 Queensland Health disclaims, to the maximum extent permitted by law, all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs incurred for any reason associated with the use of this guideline, including the materials within or referred to throughout this document being in any way inaccurate, out of context, incomplete or unavailable.

### Guideline approval

<table>
<thead>
<tr>
<th>Document ID</th>
<th>CHQ-GDL-60002- Asthma</th>
<th>Version no.</th>
<th>Approval date</th>
<th>Effective date</th>
<th>Review date</th>
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</thead>
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<tr>
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<td>Executive Director Medical Services</td>
<td>1.0</td>
<td>13/8/18</td>
<td>13/8/18</td>
<td>13/8/21</td>
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<tr>
<td>Author/custodian</td>
<td>Statewide Emergency Care Children Working Group</td>
<td></td>
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<td>Supercedes</td>
<td>CHQ-GDL-00700 (CHQ Asthma Guideline)</td>
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<td>Applicable to</td>
<td>QH Medical and nursing staff</td>
<td></td>
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<tr>
<td>Authorisation</td>
<td>Executive Director Clinical Services LCCH</td>
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</table>

### Keywords

- Asthma, Wheeze, Emergency, 00700, paediatric, guideline

### Accreditation references

- NSQHS Standard: 1,4,9

### Disclaimer

This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect. The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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[References listed in the guideline text]
### Asthma - Emergency management in children – Medications

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<td><strong>Nebulised</strong></td>
</tr>
<tr>
<td>&lt; 20 kg: 2.5mg &gt;20kg: 5mg</td>
</tr>
<tr>
<td><strong>Salbutamol burst</strong></td>
</tr>
<tr>
<td>Administer 3 doses as above at 20-minute intervals</td>
</tr>
<tr>
<td><strong>Continuous nebulised salbutamol</strong></td>
</tr>
<tr>
<td>Neat salbutamol nebuliser solution (5mg/mL), replenish where reservoir empty</td>
</tr>
</tbody>
</table>

* Metered dose inhaler. Always use with a spacer. Also use a mask if unable to form a reliable seal around the spacer.

**Alert** - Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension.

Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.

### Steroid dosing for the treatment of asthma in children

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<td>Day 1: 2mg/kg (max 50mg) Day 2 and 3: 1mg/kg</td>
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<td>Can extend course to 5 days if still symptomatic after 3-day course</td>
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<td>4mg/kg (max 200mg), 6 hourly</td>
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**OR**

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<td>Initial loading dose: 2mg/kg (max 60mg)</td>
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<tr>
<td>Then: Day 1: 1mg/kg 6 hourly Day 2: 1mg/kg 12 hourly Day 3 onwards: 1mg/kg daily</td>
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</tbody>
</table>

### Ipratropium (INH) dosing for the treatment of asthma in children

<table>
<thead>
<tr>
<th>Ipratropium (INH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 years 4 puffs OR 250 mcg nebulised every 20 minutes x 3 doses Then 2 puffs (42 mcg) 6 hourly</td>
</tr>
<tr>
<td>&gt; 6 years 8 puffs OR 500 mcg nebulised every 20 minutes x 3 doses Then 4 puffs (42 mcg) 6 hourly</td>
</tr>
</tbody>
</table>

### Magnesium sulphate (IV) dosing for the treatment of asthma in children

<table>
<thead>
<tr>
<th>Magnesium sulphate (IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus dose</strong></td>
</tr>
<tr>
<td>0.2 mmol/kg (equivalent to 50 mg/kg) infused over 20 minutes</td>
</tr>
<tr>
<td>(max 10 mmol = equivalent to 2,000mg)</td>
</tr>
<tr>
<td><strong>Must be administered in syringe driver using safety software.</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Side effects</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually minor, including:</td>
</tr>
<tr>
<td>• epigastric or facial warmth and flushing</td>
</tr>
<tr>
<td>• pain and/or numbness at infusion site</td>
</tr>
<tr>
<td>• dry mouth</td>
</tr>
<tr>
<td>Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Monitoring</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full cardiac monitoring with blood pressure every 5 minutes.</td>
</tr>
<tr>
<td>Cease infusion if hypotension persists.</td>
</tr>
<tr>
<td>Monitor knee reflexes if repeating dose to assess for magnesium toxicity which can result in respiratory failure. Cease magnesium if reflexes absent.</td>
</tr>
</tbody>
</table>

### Salbutamol (IV) dosing for the treatment of asthma in children

<table>
<thead>
<tr>
<th>Salbutamol (IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus dose</strong></td>
</tr>
<tr>
<td>100mcg/kg infused over 20 minutes (max 5 milligrams)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Infusion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10mcg/kg/min (max weight 50kg)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Monitoring</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full cardiac monitoring, monitor venous potassium levels.</td>
</tr>
</tbody>
</table>

For more information refer to Statewide Paediatric Guideline: Asthma - Emergency Management in Children.