

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 one to five years who present with a wheezing illness may be 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 Queensland Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Queensland.

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 greater than five years with additional medications given in more severe cases.
- A wheezing illness in children less than five 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 treatment. .

Introduction

Asthma is a chronic inflammatory disorder of the airways involving reversible airway obstruction. It is estimated to affect one in six Australian children.¹ Asthma is one of the most common paediatric ED presentations.

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.³ 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.^{3,4} 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 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 practices for a child with severe or life-threatening asthma. Consider contacting paediatric critical care specialists (onsite or via Retrieval Services Queensland (RSQ)) for life-threatening cases.

Initial assessment of acute asthma in children			
Mild	Moderate	Severe	Life -threatening
Normal conscious state	Normal conscious state	Agitated Restlessness Distressed	Exhaustion Confused Altered level of consciousness
No accessory muscle use	Minimal accessory muscle use	Moderate muscle use Nasal flaring Tracheal tug Hyperinflated chest	Excessive muscle use Nasal flaring Tracheal tug Hyperinflated chest
Normal to a mild increase in respiratory rate	Tachypnoea	Tachypnoea Dyspnoea Prolonged expiration	Decreasing respiratory rate May only gasp occasionally
Normal pulse	Tachycardia	Tachycardia	Decreasing heart rate Pulse may be hard to feel
Pulsus paradoxus not present	Pulsus paradoxus may be palpable	Pulsus paradoxus palpable	Pulsus paradoxus palpable
Talks in sentences	Takes in phrases	Talks in 1 – 2-word gasps	Unable to talk
No central cyanosis	No central cyanosis	Cyanosis likely	Cyanosis
Variable wheeze	Moderate to loud wheeze	Often quiet wheeze	Often quiet wheeze (silent chest)
SpO ₂ more than 94%	SpO ₂ 90 – 94%	SpO ₂ less than 90%	SpO ₂ less than 90%

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

Differential diagnosis

Alternative conditions which can present with clinical features similar to acute asthma include:

- [inhaled foreign body](#)
- gastro-oesophageal reflux
- [diabetic ketoacidosis](#)
- pneumonia
- [croup](#)
- [anaphylaxis](#)



Investigations

Investigations are not routinely recommended in the initial management of acute asthma⁵. They may be considered in a child with life-threatening asthma or severe asthma who is not responding to treatment, or where alternate or concurrent diagnoses are being considered.⁵

Venous blood gas will allow monitoring of venous carbon dioxide, and serum potassium, lactate and glucose as markers of potential Salbutamol toxicity. CXR may assist if considering either alternate diagnosis or to exclude complications of acute asthma such as collapse or pneumothorax.

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.^{3,6} Other useful adjuncts for severe episodes or escalation of treatment may include inhaled anticholinergics (Ipratropium Bromide), Magnesium sulphate IV, Salbutamol IV and Aminophylline IV.^{3,6}

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.

Inhaled Salbutamol dosing for the treatment of asthma in children	
Metered dose inhaler (MDI)* 100 micrograms (spacer recommended)	Age 5 years: 6 puffs Age 6 years or more: 12 puffs
Nebulised	Age 5 years: 2.5 mg Age 6 years or more: 5 mg
Salbutamol burst	Administer three doses as above at twenty-minute intervals
Continuous nebulised Salbutamol	Neat Salbutamol nebuliser solution (5 mg/mL), replenish where reservoir empty. Use 5 mg/1 mL nebuliser or 30 mL multi-use bottle.

* Use mask also if unable to form a reliable seal on spacer

MDI and spacer vs nebuliser

- 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 one puff at a time into the spacer.
- The medication is cleared from the spacer by the child taking four 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 recommended to treat the airway oedema and increased mucous production in a child with a moderate-to-severe acute asthma episode, or with persistent symptoms following Salbutamol.^{7,8} A Cochrane review reported that hospital admission rates for children with acute asthma were significantly reduced for those who received corticosteroids within one hour of ED presentation.⁹ Oral corticosteroid treatment is particularly effective in children and has minimal side effects.⁹ Maximum benefit occurs within four to six 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](#)).



Steroid dosing for the treatment of asthma in children	
Prednisolone (oral)	Day 1: 2 mg/kg (maximum 50 mg) Day 2 and 3: 1 mg/kg Can extend course to five days if still symptomatic after three-day course
Hydrocortisone (IV)	4 mg/kg (maximum 200 mg) then every six hours on day one
OR Methylprednisolone (IV)	1 mg/kg (maximum 60 mg) then every six hours on day one

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)

Ipratropium bromide may be useful in combination with Salbutamol in the early management of children presenting with moderate to severe acute asthma.^{1,5} 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

There is good evidence to suggest that combined Ipratropium bromide and Salbutamol therapy is superior to Salbutamol therapy alone.¹²⁻¹⁵ It has been demonstrated that combined therapy given in the first two hours (ideally combining Ipratropium bromide with the first three Salbutamol doses) is safe and results in a significant improvement in the peak expiratory flow rate, ultimately decreasing hospitalisation rates.¹⁶ Ipratropium bromide has been shown to be of benefit in children that have not responded to inhaled Salbutamol alone.⁵

Ipratropium dosing for the treatment of asthma in children	
Age 5 years	4 puffs (84 micrograms) via spacer OR 250 micrograms nebulised every twenty minutes for three doses. Can be mixed in nebuliser with Salbutamol. Followed by 2 puffs (42 micrograms) every six hours
Age greater than 6 years	8 puffs (168 micrograms) via spacer OR 500 micrograms nebulized every twenty minutes for three doses. Can be mixed in nebuliser with Salbutamol. Followed by 4 puffs (84 micrograms) every six hours

Magnesium sulphate



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

Consider Magnesium sulphate IV 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 in 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} It 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 intravenously over twenty minutes (maximum 10 mmol = equivalent to 2,500 mg) Doses up to 0.4 mmol/kg (maximum of 8 mmol) have been used. Must be administered in syringe driver using safety software.
Side effects	Usually minor, including epigastric or facial warmth and flushing, pain and/or numbness at infusion site and dry mouth. Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse
Monitoring	Full cardiac monitoring with blood pressure every five minutes. Cease infusion if hypotension persists. Monitor knee reflexes if repeating dose to assess for magnesium toxicity which can result in respiratory failure. Cease magnesium if reflexes absent.



ALERT – Magnesium sulphate should **always** be prescribed in mmols and administered using safety software syringe drivers to avoid medication errors.

Administer Magnesium sulphate 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 0.2 mmol/kg = 2 mmol. This translates to 4 mL of 0.5 mmol/mL solution and must be administered through a safety software syringe driver over 10 - 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.^{17,20} 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. The near or complete airway obstruction that can occur in life-threatening asthma can prevent effective aerosolised bronchodilator therapy.²¹

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.²¹⁻²³

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.²⁴

The current recommended dosing practice is to use a higher rate initially and reduce thereafter.²⁵⁻²⁷



Salbutamol (IV) dosing for the treatment of asthma in children	
Bolus dose	100 microgram/kg infused over twenty minutes (maximum 5 milligrams)
Infusion	1-2 microgram/kg/min (to maximum weight 50 kg)
Side effects	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.
Monitoring	Full cardiac monitoring Monitor venous potassium levels.

Aminophylline



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

Traditionally, Aminophylline IV has been used in children with severe asthma who are unresponsive to maximum doses of bronchodilators and steroids in the critical care setting. Aminophylline improves lung function within six hours of treatment, however there is limited improvement in symptoms, and no reduction in duration of hospital admission.²⁸ It is also associated with numerous side effects including vomiting.⁵ 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)



Seek urgent paediatric critical care advice (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.^{29,30} Consider HFNC therapy, CPAP or BiPAP for a child who:

- is unable to maintain SpO₂ greater than 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 intubation is underway in children with a deteriorating level of consciousness.²⁵

[Potential concerns](#) (access via QH intranet) have been raised regarding the use of HFNC therapy.

Follow local policies and procedures for nursing ratios and ward location. View [CHQ Nasal High Flow Therapy Guideline](#).



Contact paediatric critical care specialists (onsite or via RSQ) **if considering** intubation and ventilation.



Escalation and advice outside of ED

Clinicians can contact the services below if escalation of care outside of senior clinicians within the ED is needed, as per local practices. Transfer is recommended if the child requires a higher level of care.



Child is critically unwell or rapidly deteriorating child

Includes the following children (as a guide)

- severe and not responding to treatment
- requiring respiratory support e.g. HFNC or NIV
- requiring Salbutamol IV
- if considering Aminophylline IV
- if considering intubation

5-11 years	Over 12 years
<ul style="list-style-type: none"> • RR >40 • HR <70 or >150 • sBP <75 • SpO2 <93% in oxygen or <85% in air • GCS ≤12 	<ul style="list-style-type: none"> • RR >30 • HR <50 or >130 • sBP <85 • SpO2 <93% in oxygen or <85% in air • GCS ≤12

Reason for contact	Who to contact
<p>For immediate onsite assistance including airway management</p>	<p>The most senior resources available onsite at the time as per local practices.</p> <p>Options may include:</p> <ul style="list-style-type: none"> • paediatric critical care • critical care • anaesthetics • paediatrics • Senior Medical Officer (or similar)
<p>Paediatric critical care advice and assistance</p>	<p>Onsite or via Retrieval Services Queensland (RSQ).</p> <p>If no onsite paediatric critical care service contact RSQ on 1300 799 127:</p> <ul style="list-style-type: none"> • for access to paediatric critical care telephone advice • to coordinate the retrieval of a critically unwell child <p>RSQ (access via QH intranet)</p> <p>Notify early of child potentially requiring transfer.</p> <p>Consider early involvement of local paediatric/critical care service.</p> <p>In the event of retrieval, inform your local paediatric service.</p>





Non-critical child

May include children with:

- previous admission requiring critical care
- history of sudden deterioration
- any other significant clinical concern

Reason for contact	Who to contact
Advice (including management, disposition or follow-up)	Follow local practice. Options: <ul style="list-style-type: none"> • onsite/local paediatric service • Queensland Children's Hospital experts via Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) (24-hour service) • local and regional paediatric videoconference support via Telehealth Emergency Management Support Unit TEMSU (access via QH intranet) on 1800 11 44 14 (24-hour service)
Referral	First point of call is the onsite/local paediatric service

Inter-hospital transfers

Do I need a critical transfer?	<ul style="list-style-type: none"> • discuss with onsite/local paediatric service • view Queensland Paediatric Transport Triage Tool
Request a non-critical inter-hospital transfer	<ul style="list-style-type: none"> • contact onsite/local paediatric service • contact RSQ on 1300 799 127 for aeromedical transfers • contact Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) for transfers to Queensland Children's Hospital
Non-critical transfer forms	<ul style="list-style-type: none"> • QH Inter-hospital transfer request form (access via QH intranet) • aeromedical stepdown (access via QH intranet) • commercial aeromedical transfers: <ul style="list-style-type: none"> ○ Qantas ○ Virgin ○ Jetstar



When to consider discharge from ED

Consider discharge for a child who has ALL of the following:

- maintain SpO₂ ≥ 93% in room air
- not tachypnoeic
- no/mild work of breathing
- good air entry with minimal wheeze
- clinically stable not requiring bronchodilator therapy more frequently than every three hours
- has a parent/caregiver who can safely manage the child at home, return in event of deterioration and access further medication

Consider a longer period of observation despite meeting the clinical discharge criteria for the following children:

- previous critical care admission or previous sudden deterioration
- unable to get to a hospital within 30 minutes
- 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 for the following children:

- severe illness (defined as ongoing respiratory distress, failure to respond to initial treatment or requiring oxygen)
- unable to stretch bronchodilators within four hours of ED presentation

Consider a longer period of observation despite meeting the clinical discharge criteria for the following children:

- previous critical care admission or previous sudden deterioration
- unable to get to a hospital within 30 minutes
- social factors impacting upon ability to monitor and supervise child at home

Facilities with a Short Stay Unit (SSU)

Consider admission to an SSU if:

- symptoms occur within one to two hours of initial treatment with bronchodilator/steroids **AND**
- no further investigations are required

Children who require bronchodilator therapy more frequently than one hourly require vigilant monitoring and regular review by medical staff.²³ 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 practices

When to consider admission to inpatient ward from SSU

Local practices 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 every three hours in 12 – 24 hours (consider poor bronchodilator response, suboptimal administration or alternative diagnosis)
- persisting supplemental oxygen requirement

Related documents

Guideline

- [Pre-school wheeze](#)

Forms and factsheets

- [Asthma Disease Education Checklist](#)
- [Asthma Action Plan](#)
- [Asthma factsheet](#)
- [Puffers and Spacers factsheet](#)

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Guideline approval

Document ID	CHQ-GDL-60002	Version no.	2.0	Approval date	26/09/2019
Executive sponsor	Executive Director Medical Services			Effective date	26/09/2019
Author/custodian	Queensland Emergency Care Children Working Group			Review date	26/9/2022
Supersedes	1.0				
Applicable to	Queensland Health medical and nursing staff				
Document source	Internal (QHEPS) + External				
Authorisation	Executive Director Clinical Services (QCH)				
Keywords	Asthma, Wheeze, Emergency, 00700, paediatric, guideline, children, CHQ-GDL060002				
Accreditation references	NSQHS Standard: 1, 4, 8				



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. We recommend hospitals follow their usual practice for endorsement locally including presenting it to their local Medicines Advisory Committee (or equivalent) prior to use.

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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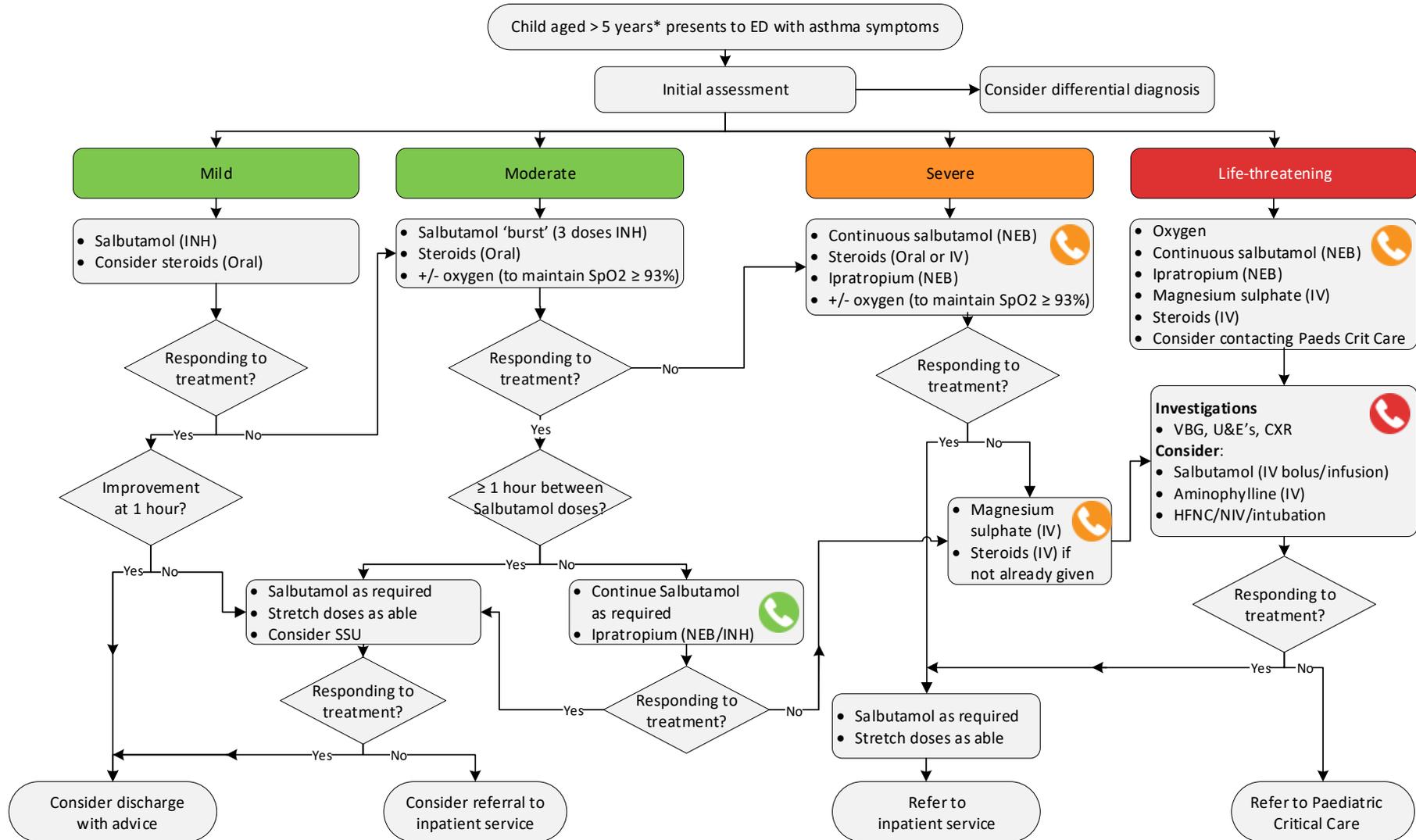


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*Refer to the *Pre-school wheeze Guideline* for children aged 1-5 years

 Consider seeking senior emergency/paediatric advice as per local practices

 Seek senior emergency/paediatric advice as per local practices. Consider contacting paediatric critical care.

 Seek urgent paediatric critical care advice (onsite or via Retrieval Services Queensland (RSQ) on 1300 799 127

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Asthma – Emergency management in children – Medications

Inhaled Salbutamol dosing for the treatment of asthma in children

Metered dose inhaler (MDI)* 100 micrograms	Age 5 years: 6 puffs	Age 6 years or more: 12 puffs
Nebulised	Age 5 years: 2.5 mg	Age 6 years or more: 5 mg
Salbutamol burst	Administer three doses as above at twenty-minute intervals	
Continuous nebulised Salbutamol	Neat salbutamol nebuliser solution (5 mg/mL), replenish where reservoir empty. Use 5 mg/1 mL nebulisers or 30 mL multi-use bottle.	

*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

Prednisolone (oral)	Day 1: 2 mg/kg (maximum 50 mg) Day 2 and 3: 1 mg/kg Can extend course to five days if still symptomatic after three-day course.
Hydrocortisone (IV)	4 mg/kg (maximum 200 mg) then every six hours on day one.
OR Methylprednisolone (IV)	1 mg/kg (maximum 60 mg) then every six hours on day one.

Ipratropium dosing for the treatment of asthma in children

Age 5 years	4 puffs (84 micrograms) via spacer OR 250 micrograms nebulised every twenty minutes for three doses. Can be mixed in nebuliser with Salbutamol. Followed by 2 puffs (42 micrograms) every six hours.
Age greater than 6 years	8 puffs (168 micrograms) via spacer OR 500 micrograms nebulised every twenty minutes for three doses. Can be mixed in nebuliser with Salbutamol. Followed by 4 puffs (84 micrograms) every six hours.

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

Bolus dose	0.2 mmol/kg (equivalent to 50 mg/kg) infused intravenously over twenty minutes (maximum 10 mmol = equivalent to 2,500 mg) Doses up to 0.4 mmol/kg (maximum of 8 mmol) have been used. Must be administered in syringe driver using safety software.
Side effects	Usually minor, including epigastric or facial warmth and flushing, pain and/or numbness at infusion site and dry mouth. Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse.
Monitoring	Full cardiac monitoring with blood pressure every five minutes. Cease infusion if hypotension persists. Monitor knee reflexes if repeating dose to assess for magnesium toxicity which can result in respiratory failure. Cease magnesium if reflexes absent.

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

Bolus dose	100 microgram/kg infused over twenty minutes (maximum 5 milligrams)
Infusion	1-2 microgram/kg/min (to maximum weight 50 kg)
Monitoring	Full cardiac monitoring. Monitor venous potassium levels.

