

ASTHMA – ACUTE MANAGEMENT - SCH

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- The most important parameters in the assessment of the severity of acute childhood asthma are general appearance/mental state and work of breathing (accessory muscle use, recession)
- In an acute asthma episode a wheeze may not be heard and is not a good marker of severity. Prolonged respiratory phase of expiration tends to be an earlier sign.
- In children less than 12 months of age presenting with wheeze consider the diagnosis of bronchiolitis
- **Risk Factors**
 - Previous ICU admission
 - Poor compliance to asthma therapy
 - Poorly controlled - significant interval symptoms

CHANGE SUMMARY

26/06/2017 Minor changes:

- changing the salbutamol MDI dose in SCH acute asthma management guideline from weight base to age based to be consistent with National asthma handbook and CHW guideline
- changed to 0-5 years – 6 puffs and 6 years and over to 12 puff
- Ipratropium MDI doses changed so that each puff is 21microg.

Changes approved by SCH Drug Committee June 2017 and noted at PPGC

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st October 2015	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Respiratory SCH

READ ACKNOWLEDGEMENT

- Clinical staff caring for children with acute asthma should read and acknowledge they understand the contents of this document.

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Background

Asthma is an inflammatory condition of the airways characterised by reversible airways obstruction and bronchospasm. In children, it is one of the most common causes for presentation to Emergency Departments and admission to hospital.

The diagnosis of asthma should be considered in children who present with cough, wheeze or difficulty breathing.

Treatment of acute asthma not only involves appropriately timed bronchodilators and corticosteroid medication. An acute presentation with asthma provides an opportunity to identify the possible need for preventer therapy, an asthma plan and asthma education. For all acute presentations, problems should be identified and arrangements made for follow up and continuing care.

The diagnosis of asthma should be reconsidered if the child is less than one year, has a high fever or responds poorly to asthma treatment.¹

Patient History

A thorough clinical history should be taken including:¹

- Duration and nature of acute episode
- Likely trigger of acute episode (viral URTI, allergy, passive smoking, exercise)
- Drug treatment - dosages, delivery method, frequency, time of last dose and response to treatment
- Interval severity of asthma (level of control): See [Classification of Interval Severity of Asthma in Childhood](#):
 - Infrequent intermittent asthma
 - Frequent intermittent asthma
 - Persistent asthma
- Regular drug treatment (relievers/ preventers)
- Previous ED visits/ hospitalisations/ ICU admissions
- Past medical history including history of allergic rhinitis and eczema
- Allergies
- Family history (particularly history of atopy) and social history including smoking history

Risk factors for serious illness include:

- History of brittle asthma or significant interval symptoms
- Previous ICU admission for asthma
- Representation very soon after discharge from hospital
- Recurrent admissions
- Poor compliance

Examination

In an acute asthma episode a wheeze may not be heard and is not a good marker of severity. Prolonged respiratory phase of expiration tends to be an earlier sign. The most important markers of severity are:

- General appearance/ mental state
- Work of breathing (accessory muscle use, recession)

Initial O₂ saturations in air, tachycardia (may be due to B agonist treatment) and ability to talk are helpful but less reliable signs.

Assessment and Initial Management of Acute Asthma¹

Initial Severity Assessment			
Treat in the highest category in which any symptoms occurs			
Symptoms	Mild Likely to go home	Moderate Possible admission	Severe and Life Threatening Will be admitted
Oximetry in Air	>94%	90-94%	<90%
Heart rate	Close to normal range for age	Mild- moderate Tachycardia for age	Marked tachycardia – beware bradycardia
(Age Appropriate) Ability to talk in:	Sentences or long vigorous cry	Phrases or Shortened Cry	Words/ Weak Cry or Unable to Speak/ Cry
Accessory Muscle Use	None or very mild	Mild to moderate	Moderate to Severe
Altered Consciousness	Alert Age Appropriate	Easily engaged Age appropriate	May be Agitated, Confused or Drowsy
Cyanosis in Air	None	None	May be Cyanosed
Treatment Options (Treatments to be considered)			Notify Consultant/ Fellow 
Oxygen	No	To maintain SaO ₂ >94%	To maintain SaO ₂ >94% Consider High Flow Oxygen
Salbutamol 100 micrograms Metered Dose Inhaler (MDI) & spacer	Single dose Review frequently and repeat when required	20 min x 3 Repeat as required	20 min x 3 Reassess
Salbutamol Nebulised	No	No	OR Continuous nebulised Salbutamol Reassess
Systemic Corticosteroids	Consider oral prednisolone depending on history and response to treatment	Oral prednisolone	IV Hydrocortisone or IV Methylprednisolone
Ipratropium (Atrovent) 20 micrograms (3 doses always with Salbutamol)	No	Consider – 20 min x 3	Consider –20 min x 3
No or Poor Response to Treatment	Check diagnosis and treat as per Moderate	Check diagnosis and treat as per Severe and Life Threatening	Immediate Senior Review – Notify Consultant/ Fellow
IV Magnesium Sulfate	Not applicable	Not applicable	Give IV magnesium sulfate +/- Consider in consultation with ED Consultant / Fellow if: No or poor response to Nebulised Salbutamol Consult ICU
IV Salbutamol IV Aminophylline	Not applicable	Not applicable	
Investigations	Nil (routinely) required	Nil (routinely) required	UEC, VBG, CMP, FBC Consider CXR
Intravenous Fluids	Not required	Not usually required	Maintenance IV fluids with potassium added
Observation and Review	Observations (HR, RR & O ₂ Sats) pre and post treatment – minimum hourly for 3 hours. MO review prior to discharge.	Continuous observations (HR, RR and O ₂ Sats). Observations pre and post treatment –initially Q 30min then MO review within 1 hour	Continuous cardiorespiratory monitoring (HR, RR and O ₂ Sats) Regular medical review
Disposition	Home if Salbutamol required less frequently than 3 hourly. See “ Discharge Criteria ” below.	Home if Salbutamol required less frequently than 3 hourly. See “Discharge Criteria”. If not suitable for discharge then admit to ward. See “ Admission ” below.	Admit to HA ward bed or CICU.

For drug doses and summary see: [Medications in Acute Asthma](#)

Admission

Children unable to be weaned to ≥ 3 hourly salbutamol will require admission to the ward.

- Notify admitting Consultant
 - Children on inhaled salbutamol should be admitted under a general paediatrician.
 - Children on IV salbutamol (not being admitted to CICU) should be admitted under a respiratory physician. Appropriate medical and nursing review needs to be considered.
 - Children on IV Aminophylline should receive a respiratory team consult on the ward.
 - If the child has a paediatrician/ respiratory physician that manage their asthma they should be notified.
- Transfer to ward once stable on 1 hourly salbutamol.
- The ward registrar should be notified prior to transfer to the ward.
- Consider Criteria Led Discharge by the admitting consultant unless contraindicated once on the ward.

Observations and Assessment

- Respiratory assessment on admission.
- Frequency of observations will vary with degree of severity of illness as per table: Assessment and initial management of acute asthma.
- More frequent observations are indicated with increased severity (1/2 – 1 hourly)
- As the patient's condition improves and following medical review decrease frequency of observations. Observations on the ward including respiratory assessment a minimum of 4 hourly unless patient is high acuity.

Pulse oximetry should be continuous for first 24hrs or until 2nd hourly inhalations or off supplemental oxygen.

Classification of Interval Severity of Asthma in Childhood

Signs	Infrequent Intermittent Asthma	Frequent Intermittent Asthma	Persistent Asthma*
Symptom frequency between exacerbations	Symptom free	Symptom free	Symptoms most days
Exacerbation frequency	6 or more weeks apart (usually triggered by URTI)	Less than 6 weeks apart	Frequent; activities limited by symptoms
Need for preventer	No	Yes (may be seasonal)	Yes

Indications for CICU Consultation/ Referral

- Life threatening asthma requiring CPAP or other ventilation.
- Notify CICU Fellow/Consultant of potential admission if starting IV aminophylline/ IV salbutamol infusion.
- CICU review if not improving after administration of IV Aminophylline/ IV Magnesium Sulfate or 2 hours after starting IV salbutamol infusion.
- Earlier CICU consult depending on department activity levels.

Medications in Acute Asthma ^{1,3}

Drug doses in Acute Asthma	
Oxygen	To maintain SpO ₂ ≥94%
Salbutamol (MDI/Spacer) plus mask for younger children	0 to 5 years: 6 puffs (600 microg) 6 years and over: 12 puffs (1200 microg)
Salbutamol (Continuous Nebulised)	2 x 5mg/2.5 ml neat solution administered over 15 mins with minimum oxygen flows of 6-8 L. Consider second dose if required.
Salbutamol (IV)	Bolus: 15microg/kg over 10 minutes Infusion: Draw up 50mL of Salbutamol 1mg/mL IV solution undiluted (<i>Ventolin Obstetric®</i>) Start at 5microg/kg/min (wt (in kg) x 0.3)mL/hr for 1 hour then reduce to 1microg/kg/min (Wt (kg) x 0.06) mL/hr For patients >40kg do not exceed starting rate of 12mL/hr
Steroids (Oral)	Prednisolone 1-2mg/kg (maximum 50mg)
Steroids (IV)	Methylprednisolone 1mg/kg/dose (maximum 40mg/dose) <ul style="list-style-type: none"> • 6 hourly day 1 • 12 hourly day 2 • once daily from day 3 for total 5 days (if required)
Ipratropium (MDI/spacer)	0-5 years- 4 puffs (84microg) 6 years and over- 8 puffs(168microg)
Ipratropium (Nebulised)	0-5 years - 250microg 6 years and over - 500microg
Magnesium Sulfate (IV)	0.2 mmol/kg/dose(up to 10mmol) diluted in compatible fluid over 20 mins
Aminophylline (IV)	1 to 10 years 5mg/kg over 1 hour 6/24 >10 years 4mg/kg over 1 hour 6/24 If on oral theophylline - check level first and consult on call respiratory fellow/ specialist

Medications, Care and Considerations

Oxygen

- Should be given for hypoxaemia ($\text{SpO}_2 < 94\%$) and monitored by oximetry. Duration of oxygen therapy depends on response to treatment¹.
- There is a lack of evidence for the use of humidified high flow nasal prong oxygen (HHFNPO₂) in asthma. It can be considered in severe asthma in consultation with the on duty consultant/ fellow. See SCH Humidified High Flow Nasal Prong Oxygen

Salbutamol

- Inhaled B₂ agonists are the first-line bronchodilator therapy in the management of children with acute asthma. In mild- moderate asthma, delivery should be by a MDI and spacer. Delivery via nebuliser should be used in children with severe/ life threatening asthma and those children with moderate asthma responding poorly to spacer delivery.



Alert: *There is no evidence that intravenous salbutamol offers any advantage over inhaled salbutamol. Its use should be limited to the child who has severe/ life threatening asthma and in consultation with the Consultant/ Fellow on and CICU.*

- **NOTE:** When IV salbutamol infusion is commenced inhaled salbutamol should be stopped.
- IV salbutamol can also be given as a bolus loading dose although this has not consistently been shown to be any more effective than nebulised salbutamol.
- These patients should be high acuity (HA) patients and under the care of the respiratory team.
- ED Fellow/Consultant should be aware of all patients being considered for IV Salbutamol in ED.
- CICU Fellow/Consultant should be aware of all patients receiving IV Salbutamol.

Common side effects:

- Salbutamol toxicity can occur with both inhaled and intravenous therapy. Signs include tachycardia, tachypnoea and metabolic acidosis – high lactate. This can occur with both inhaled and IV therapy. Consider stopping or reducing as a trial if this is believed to be a problem.
- Hypokalaemia, tremor and nausea/vomiting.

Less common side effects:

- O₂ desaturation, headache, muscle cramps and dizziness.
- Beware potential for respiratory depression and dehydration.

Nursing considerations

Patients receiving IV salbutamol should have:

- Continuous observations including cardiac monitoring and regular medical review.
- Insertion of a sampling line for accessing blood for investigations.
- Check serum potassium at commencement IV Salbutamol infusion, repeated at 2 hours then 12 hourly.
- IV Salbutamol must only be administered using a syringe infusion pump.
- The drug name must be entered digitally in to the infusion pump and always displayed.
- The medication and administration line must be labelled according to the [National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines](#).
- The infusion must be connected to a chooks foot at insertion site. Maintenance fluids should include potassium.

IV Salbutamol Administration

Draw up 50mL of Salbutamol 1mg/mL solution undiluted
 Weight (kg) X 0.06mL/hour = 1microgram/kg/minute
 Start infusion as prescribed, usually 5microgram/kg/minute
 For patients greater than 40kg maximum 5micrograms/kg/minute rate is = 12mL/hour

- IV salbutamol infusions must be prescribed in accordance with [Safe Prescribing Guidelines - SCH](#). The prescription must document the dose of IV salbutamol in microgram/kg/minute.

Steroids

- The effectiveness in the use of systemic steroid therapy is well established. They should be administered early in moderate- severe asthma and considered in children with mild asthma who have had a limited response to salbutamol alone.
- Systemic steroids have not been shown to be effective in acute preschool wheeze and should be reserved for children with a history of atopy or family history of atopic asthma or with severe bronchodilator–unresponsive wheeze.

Ipratropium¹

- Ipratropium is most effective in children with moderate-severe asthma when added to frequent nebulised salbutamol.

IV Magnesium Sulfate

Intravenous magnesium sulfate should be given in addition to bronchodilators and steroids to all children presenting with severe asthma.

Use of IV magnesium sulphate in under 2 years is generally not recommended. However, use in this age group may be prescribed after careful consideration by senior clinicians.

It should also be considered in those presenting with moderate-severe asthma.

Magnesium ion decreases the uptake of calcium by bronchial smooth muscle cells, which in turn leads to bronchodilation. It may also have a role in inhibiting mast cell degranulation, thus reducing the inflammatory mediators such as histamine, thromboxanes and leukotrienes.

Common side effects

- Magnesium is well tolerated. Minor side effects include epigastric or facial warmth; flushing, pain and numbness at the infusion site; dry mouth and malaise.
- Rapid IV infusion may precipitate hypotension, nausea, respiratory depression and cardiac arrhythmias.
- ED Fellow/Consultant should be aware of all patients receiving IV Magnesium sulphate in ED. In the case of ward patients CICU Fellow/Consultant should be consulted.
- These patients should be high acuity (HA) patients and the Respiratory team consulted during the admission.

Nursing considerations

- Patients receiving IV magnesium sulfate should have:
 - Documented hourly observations including HR, RR, BP and continuous SpO₂. Consider continuous cardiac monitoring.
 - Regular medical review.
 - Blood pressure required and recorded at commencement, midway and end of infusion.
 - IV magnesium sulfate is administered as an IV infusion over 20 minutes.

- Use 49.3% magnesium sulphate ampoule (= 10mmol/5mL)
 - Dilute magnesium sulfate to a concentration of 0.8mmol/mL or weaker, with glucose, or 0.9% sodium chloride.⁵
 - Infuse the dose (0.2mmol/kg/dose) over 20 minutes.
 - Magnesium Sulfate must be given separately to IV salbutamol and IV aminophylline.
- Magnesium sulfate example:
- e.g. child 35kg*
- Magnesium Sulfate available as 2mmol/mL*
- Dose required : 0.2mmol/kg = 7mmol*
- Volume to withdraw: 7mmol (dose) divided by 2mmol/mL (concentration) =3.5mL*
- To calculate the final volume: 7mmol (dose) divided by 0.8mmol/L (max concentration) = 8.75mL*
- i.e. take 3.5mL and make up to 8.75mL with compatible solution*

IV Aminophylline

Aminophylline has a place in the management of children with severe acute asthma. It provides additional benefit to children already on large doses of nebulised salbutamol and systemic steroids. The therapeutic effects of aminophylline in asthma include bronchodilation and improved diaphragmatic contraction.

- Aminophylline is the intravenous (IV) form of theophylline. 1mg of aminophylline = 0.8mg of theophylline.
- Theophylline is a drug with a narrow therapeutic range and requires careful administration as side effects can occur even at therapeutic levels.
- Therapeutic range: 10-20mg/L (55-110micromol/L)
- Check for interactions or previous doses of aminophylline, doses should be adjusted based on drug levels of theophylline.
- 0.6 mg/kg aminophylline is expected to raise plasma theophylline concentration by 1 microgram/mL (5.5micromol/L).
- Overweight or obese patients should be dosed according to ideal body weight (50th percentile or appropriate weight for age and height according to growth charts).
- Check theophylline level 30 minutes after the initial dose, and every 12 hours if continuing (prior to giving next dose) ^[4]

Common side effects:

- High incidence of nausea and vomiting even at therapeutic levels and should not lead to a discontinuation of therapy
- Sinus tachycardia

Rare side effects:

- Other dysrhythmias are rare unless there is concurrent hypokalaemia (salbutamol can exacerbate)
- Seizures are rare with therapeutic levels
- Diuresis

Nursing considerations:

- Patients receiving IV Aminophylline should have:
 - Documented observations including HR, RR, BP and continuous SpO₂ at commencement and half hourly intervals during drug administration. Then hourly documentation on completion of infusion. Consider continuous cardiac monitoring.
 - Regular medical review.
 - IV Aminophylline must only be administered using an IV infusion over 1 hour.
 - These patients should be high acuity (HA) patients and the Respiratory team consulted.
 - ED Fellow/Consultant should be aware of all patients receiving Aminophylline in ED.
 - CICU Fellow/Consultant should be aware of all patients receiving Aminophylline on the wards.

Aminophylline Administration⁵

- Use 250mg/10mL ampoule.
- Dilute aminophylline to a concentration of 1mg/mL or weaker, with glucose 5% or NaCl 0.9%.
- Infuse the dose over 1 hour.

Discharge Planning

Discharge Criteria

Children with acute asthma should be considered ready for discharge when:

- clinically stable on three-hourly bronchodilator
- Adequate parental education provided and ability to administer salbutamol via spacer

Discharge Requirements

At the time of discharge all patients/ parents should have had asthma education and receive:

- A discharge summary
- Discharge medication
- Demonstrated correct use of asthma delivery device
- An Asthma Action Plan
- A Reducing Medication Plan
- Information outlining follow up arrangements with a paediatrician and/or GP.

Note: A child who has required admission to CICU should be followed up in the High Risk Asthma Clinic by the Respiratory team.

- An Asthma Resource Pack
- Information regarding smoking cessation

Related Documents

- NSW Kids and Families: **Infants and Children – Acute Management of Asthma**
PD2012_056: http://www0.health.nsw.gov.au/policies/pd/2012/pdf/PD2012_056.pdf
- **Inhaled Medication: Administration – SCH:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2013-7043.pdf>
- **Intravenous Fluid and Electrolyte Therapy – SCH:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2013-7033.pdf>
- **Medications – Administration and Handling (Non-Cytotoxic) – SCH:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2015-7011.pdf>
- **Oxygen Therapy and Delivery Devices – SCH:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2013-7019.pdf>
- **Pulse Oximetry:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2015-9055.pdf>
- **Safe Prescribing Guidelines – SCH:**
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2012-7007.pdf>

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2. Australian Medicines Handbook 2015 <https://amhonline.amh.net.au.acs.hcn.com.au/>
3. RCH Melbourne Clinical Practice Guideline “Asthma Acute”
http://www.rch.org.au/clinicalguide/guideline_index/Asthma_Acute/ (accessed 29/7/2015)
4. Society of Hospital Pharmacists Australia (SHPA). Australian Injectable Drugs Handbook. 6th ed. Collingwood, Australia. 2014

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