the children's hospital at Westmead

ASTHMA - ACUTE MANAGEMENT - CHW

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

The following guidelines focus on acute asthma management at The Children's Hospital at Westmead (CHW):

- Definition of Asthma and Wheeze
- Assessment and Management
- Education
- Discharge Planning

The guidelines for assessing severity and initial treatment of an acute asthma exacerbation in children are based on the guidelines from Australian Asthma Handbook 2015. These guidelines can be used by accredited CHW Nurse Practitioners.

CHANGE SUMMARY

- On eMM bronchodilator doses ordered by age instead of weight, as recommended in the revised Australian Asthma Handbook 2015
- Nebulised magnesium sulfate added as a therapeutic option to consider

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:	1st March 2017	**Review Period**: 3 years
Team Leader:	CNC	**Area/Dept**: Respiratory Medicine

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This Guideline may be varied, withdrawn or replaced at any time.

READ ACKNOWLEDGEMENT

- Clinical staff [Emergency Department, Respiratory and General Ward areas] caring for children with asthma should read and acknowledge they understand the contents of this document.

ABBREVIATIONS

AAH: Australian Asthma Handbook

AAP: Asthma Action Plan

CHW: The Children's Hospital at Westmead

CMP: Calcium, magnesium and phosphate

CPAP: Continuous Positive Airway Pressure

CO_2: Carbon Dioxide

Exacerbation: Flare-up and or episode

EUC: Electrolytes urea and creatinine

ETT: Endotracheal tube

HFNP0_2: Humidifed High Flow Nasal Prong Oxygen

IV: Intravenous

IVC: Intravenous cannula

IO: Intraosseous

FBC: Full blood count

NAC: National Asthma Council

NIV: Non-invasive ventilation

PEA: Pulseless Electrical Activity

PICU: Paediatric Intensive Care Unit

pMDI: pressurised metered dose inhaler (commonly known as puffer)

PEEP: Positive End Expiratory Pressure

RSI: Rapid sequence induction

RMP: Reducing Medication Plan

SIMV: Synchronised Intermittent Mandatory Ventilation

SPOC: Standard Paediatric Observation Chart

SaO_2: Oxygen saturation measurement

VBG: Venous blood gas

TABLE OF CONTENTS

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1 Definition of Asthma

Asthma is a chronic lung disease which can be controlled but not cured. Asthma is defined clinically as the combination of variable respiratory symptoms (e.g. wheeze, shortness of breath, cough and chest tightness) and excessive variation in lung function, i.e. variation in expiratory airflow that is greater than that seen in healthy children ('variable airflow limitation')".**The clinical diagnosis of asthma in children involves the consideration of:**

- History of recurrent or persistent wheeze.
- Presence of allergies or family history of asthma and allergies.
- Absence of physical findings that suggest an alternative diagnosis.
- Tests that support the diagnosis (e.g. spirometry in children if able to perform the test).
- A consistent clinical response to an inhaled reliever (bronchodilator) or preventer.

Poor asthma control is a well-recognised risk factor for asthma exacerbation. Assessing control outside the acute exacerbations is an important part of overall management. **If the child has poor control and or there are concerns about asthma management, should consider a referral to either Paediatrician or Respiratory Paediatrician.**

2 Early childhood wheeze

"Wheezing in infancy and childhood is a common condition; however it is not a single disorder and can be due to other causes other than asthma". **It can be difficult to diagnose asthma with certainty in children aged 0–5 years. When formulating a diagnosis and management plan it is important to consider:**

- Episodic respiratory symptoms such as wheezing and cough are very common in children, particularly in children under 3 years.
- Objective lung function testing by spirometry is usually not feasible in this age group.
- A high proportion of children in this age group who respond to bronchodilator treatment do not go on to have asthma in later childhood (e.g. by primary school age).

A diagnosis of asthma should not be made if cough is the only or predominant respiratory symptom and there are no signs of airflow limitation (e.g. wheeze or breathlessness):

- http://www.nationalasthma.org.au/health-professionals/information-papers
- http://www.asthmahandbook.org.au/diagnosis/children

Acute Management based on current evidence for this age group:

- Acute exacerbations of wheeze should be managed with short acting bronchodilators (via spacer/ face mask &/or nebuliser) according to clinical signs and symptoms.
- Avoid the use of systemic corticosteroids if mild to moderate wheeze responses to bronchodilator management.
- On discharge is to be given an electronic Pre-School Wheeze Action Plan (ePSWAP) and this is available in Powerchart.

3 Assessment of Asthma

History is an important step in assessing severity but should not delay the administration of treatment, particularly if the child is distressed. The following information should be sought:

1. The likely trigger of the acute exacerbation.
2. The duration of the acute exacerbation.
3. Prior medication including the dose used, method of delivery, frequency of use and time of last dose, and response to treatment.
4. Interval severity of asthma and prior hospitalisations or ED visits.
5. Previous life threatening episodes including PICU history.
6. Co-existing medical conditions.
7. Known allergies.

Clinical Assessment and Observations:

Serial clinical assessments and observations trends give a more complete picture than single observations in monitoring a response to management:

- Regularity of clinical observations is dependent of frequency of medications.
    - Refer to Signs & Symptoms Acute Severity Table 1
- Regular respiratory assessment especially with the stretching of salbutamol- Asthma Management: Stretching of Inhaled Salbutamol Practice Guideline: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2009-8060.pdf
- Regular checking and correcting of technique associated with the use of delivery device/s:
    - Refer to spacers and nebulisers

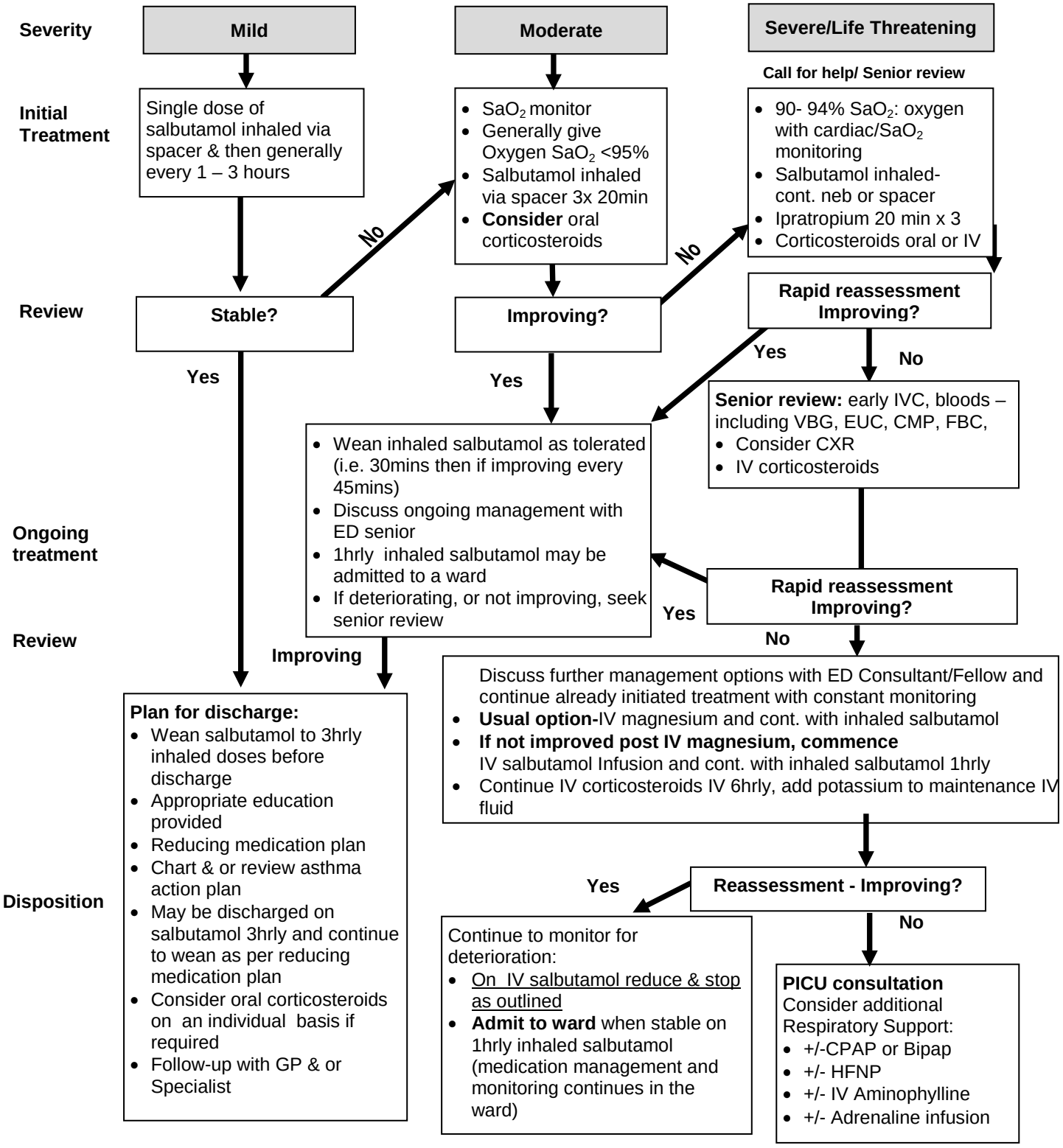
Table 1: Signs & Symptoms Acute Severity

PRESENTATION	MILD	MODERATE	SEVERE & LIFE THREATENING
Altered consciousness	No	No	Agitated ***Life threatening- confused, drowsy
Physical exhaustion	No	No	Yes
Talks in...(consider developmental stage)	Sentences	Phrases	Words
Accessory muscle use	Normal	Mild (Blue Zone)	Moderate(Yellow Zone) ***Life threatening- severe(Red Zone)
Pulsus paradoxus*	Not palpable	May be palpable	Palpable
Wheeze intensity	Variable	Moderate - loud	Often quiet *** Life threatening- silent chest
Pulse rate	Within normal range for age (White/ Blue Zone)	Tachycardia (Blue/Yellow Zone)	Marked tachycardia(Red Zone) ***Life threatening- Marked tachycardia or bradycardia
Central cyanosis*	Absent	Absent	Likely to be present
Oximetry on presentation ($Sa0_2$)	>95% (White/ Yellow Zone)	90-95% (Yellow Zone)	<90% (Red Zone)

Cyanosis and paradoxical pulse may be absent, but when present indicate severe obstruction. ***** Life Threatening:** The child should be assigned to the most severe grade in which any feature occurs. If the child has received treatment prior to arrival, manage as more severe than the clinical signs indicate. **Note: colours refer to SPOC**

4 Acute Asthma Management

Further information on drug doses and administration go to Additional Drug Information



5 ED approach to Management (Pre Arrest)

The following information and flowchart is for Use at the bedside in ED .It contains some dosing for quick reference

Initial rapid assessment using DRSABCDE approach
Identify pre-arrest/arrested patient with asthma. **Arrest call**, and call for senior ED, PICU and Anaesthetic support. **Assess ABCDE**

AIRWAY- open and clear

- **Apnoea**
  - Support with bag mask ventilation
  - Prepare for intubation , use ED intubation checklist
  - Use cuffed ETT, end tidal CO_2 monitoring
  - RSI drugs are ketamine and suxamethonium for induction, and avoid morphine, pancuronium, cisatracurium and rocuronium as can lead to histamine release.
  - If patient in cardiopulmonary arrest induction drugs may not be needed
  - Adrenaline dose and fluid bolus available for induction
  - Prepare adrenaline infusion (preferred over salbutamol in this situation as alpha effects provide some mucosal vasoconstriction reducing bronchial wall oedema)
- **Inadequate respirations in spontaneously breathing patient**
  - Sit patient up
  - Apply CPAP 5-10 cmH_2O - black anaesthetic bag with manometer or laerdel bag with PEEP valve
  - Prepare ventilator in SIMV- CPAP/BiPAP mode
  - 12-15 Litres high flow oxygen
  - Use in line t-piece device in CPAP circuit to provide inhaled salbutamol either with nebuliser or inhaler

BREATHING

- Assess for evidence of tension pneumothorax/ air leak (subcutaneous emphysema).
- Assess for air entry, wheeze, and degree of chest expansion

CIRCULATION

- Assess pulse and rhythm
- If asystole,PEA or severe bradycardia for age initiate CPR and follow cardiac arrest algorithm for non-shockable rhythm
- Cardio-respiratory monitor
- IV/IO access
- Bloods including VBG, EUC, CMP, FBC, blood culture and BSL

TREATMENT ASTHMA in Pre-Arrest/Arrest patient

- Consider anaphylaxis- if suspected give IM adrenaline 0.01mL/kg of 1:1000 (maximum dose 0.5mL)
- Commence intravenous adrenaline infusion 0.1mcg/kg/min (preferred to IV salbutamol in this situation as theoretical benefit with vasoconstriction and mucosal oedema– see PICU Asthma guideline: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2007-0031.pdf)
- Methylprednisolone 2 mg/kg IV/IO(first dose)(Maximum 60mg)
- Magnesium sulfate 0.2mmol/kg IV infusion over 20 minutes (max dose 8mmol).
- Consultation with PICU to discuss use of aminophylline IV. Also consult with PICU for sedation of the intubated patient. A ketamine infusion IV , midazolam and/or fentanyl may be required to provide adequate sedation.
- Avoid morphine due to the histamine release.
- Hand ventilate with a rate 5-10 breaths/minute with prolonged expiration- consider chest squeezing during exhalation of intubated patient to aid expiration.

This Guideline may be varied, withdrawn or replaced at any time.

Suggested initial ventilator settings- tidal volume 6mL/kg, inspiratory time 0.7sec (infant) to 1.2 sec (teenager),resp rate 50% usual vent rate for age, PEEP 5cm H_2O.

DRSABCDE
Call for Help- 444 arrest call
Get SENIOR ED staff /PICU support as required

AIRWAY- OPEN AND CLEAR
Assess Breathing

Note if breathing adequate, revert to **use of severe/ life threatening asthma protocol**

APNOEA

-Bag mask ventilation with high flow oxygen (+ PEEP if possible)
-In line circuit delivery of salbutamol via continuous nebuliser or inhaled MDI

BREATHING but inadequate

-Sit upright
-CPAP 5 cm-10cm H_2O with high flow oxygen
-In line circuit delivery of salbutamol via continuous nebuliser or inhaled MDI

Notes for BREATHING
Assess for tension pneumothorax and air leak
Assess degree of chest expansion and aeration

CIRCULATION
Assess pulse and rhythm
Start CPR if no signs of life or no pulse and follow appropriate arrest algorithm.
IV/IO access and Bloods

CONTINUOUS REASSESSMENT: May at any point need intubation. Seek senior advice, call for HELP early and prepare for acute deterioration

Consider anaphylaxis- if suspected
Give IM adrenaline 1:1000, 0.01mL/kg (max 0.5mL)

Further asthma management
- Adrenaline infusion 0.1 microg/kg/min IV/IO
- Methylprednisolone IV/IO 2mg/kg
- Magnesium Sulfate 0.2mmol/kg IV/IO over 20 mins (max dose 8mmol). Discuss ongoing management with PICU staff
- See PICU document on asthma management
- Consider Aminophylline IV 10mg/kg load dose over 60mins followed by IV infusion or intermittent injection
- If intubated, consider ketamine infusion IV starting at 5mcg/kg/min along with midazolam and/or fentanyl
- Ventilation strategies and further information refer Asthma Management in PICU

Notes for INTUBATION-
- Use a cuffed ETT
- If RSI, ketamine +/- midazolam and suxamethonium.
- Adrenaline and fluid bolus ready to give on induction if hemodynamic collapse
- Monitor end tidal CO_2
- Hand bag once intubated and chest squeeze to enhance expiration
- Ongoing sedation with ketamine and midazolam infusions
- Muscle relaxation as needed to optimize ventilation

This Guideline may be varied, withdrawn or replaced at any time.

Use of oxygen

- Oxygen should be given to relieve hypoxemia
- Appropriate action should be undertaken for a Clinical Review or Rapid Response when observations fall into the yellow or red zones of the SPOC
- Oxygen is therefore likely to be required initially in any child with moderate to severe acute asthma:
  - **Oxygen Therapy and Devices** http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2015-9085.pdf
  - ***Recognition and Management of a Patient who is Clinically Deteriorating***: http://chw.schn.health.nsw.gov.au/o/documents/policies/policies/2012-9003.pdf Duration & method of oxygen therapy will depend on response to treatment and the need for oxygen should be monitored by oximetry.

There are no current guidelines for the use of high flow nasal **cannulae in an exacerbation of asthma.** Consider on an individual patient basis in conjunction with PICU medical staff. Refer to CHW Humidifed High Flow Nasal Prong Oxygen Administration in wards & ED CHW: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2010-8044.pdf

7. Additional Drug Information

CHW Drug Dosage Guidelines: http://chw.schn.health.nsw.gov.au/o/apps/picu/drug_doses/

Salbutamol

- Salbutamol may be administered via spacer or nebuliser. The frequency will depend on the severity of the presentation for example administration can vary from continuous, every 30minutes - 45minutes - 60 minutes - 90 minutes -2 hours - 3 to 4 hours.
- Pressurised metered dose inhaler (pMDI) = 100 microg/puff
- For more information on delivery devices see spacers and nebuliser

Dose via spacer:

- 0 - 5 years: 6 puffs
- 6 years & over: 12 puffs

Dose via nebuliser:

- 0 - 5 years: 2.5 mg
- 6 years & over: 5 mg

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Dose via continuous nebulisation:

- 0 - 5 years: 2 x 2.5mg
- 6 years & over: 2 x 5mg
- Add dose to nebuliser chamber
- Restart inhaled salbutamol via spacer once child is clinically improving
- In general the minimum fill volume in the nebuliser chamber is 4mL and the maximum is 6mL

Dose via intravenous infusion

Only to be given in ED or PICU

Presentation: salbutamol 1mg/mL (1000micrograms/mL) 5mL ampoules

- Loading dose 5microg/kg/min for 2 hours (max dose 200microg/min)

  Use a maximum weight of 40kg for calculating IV salbutamol doses

- If improvement sustained after 1 hour, salbutamol infusion can be reduced down to 1mcg/kg/min and or ceased. Continue to monitor carefully for deterioration and salbutamol toxicity.
- If no improvement after 2 hours then consider PICU admission

  Administration Practice Points

  Draw up the neat solution to give salbutamol 50mg in 50mL (10 x 5mL ampoules)

  Using the above concentration: Weight (kg) x 0.06mL/hr =1microg/kg/min

Salbutamol Intravenous Bolus

- Previous individual studies have shown some benefit from an early intravenous loading dose or "bolus "of salbutamol. Also this can be considered as an early option in the treatment of a child with moderate or severe asthma not responding to frequent inhaled salbutamol. Discuss with ED Consultant/Fellow if using bolus treatment
- Dose 15microg/kg over 10 minutes (maximum 600micrograms)

Ipratropium

Ipratropium may be administered via spacer or nebuliser. The frequency will depend on the severity of the presentation:

- Usually given as 3 doses given 20minutes apart in severe/life-threatening exacerbations
- Depending on clinical need, frequency can be increased to every 4 to 6 hours
- pMDI puffer = 21 micrograms/puff

This Guideline may be varied, withdrawn or replaced at any time.

Dose via spacer:

- 0 - 5 years: 4 puffs
- 6 years & over: 8 puffs

Dose via nebuliser:

- 0 - 5 years: 250microg
- 6 years & over: 500microg

Corticosteroids

Oral prednisolone

- Maximum dose 50mg prednisolone per day
- Usual dose is 1mg/kg/day for a total of 3-5 days.
- 2mg/kg/day may be given on Day 1 in severe and or life threatening episode.
- If there is clinical improvement, subsequent dose is 1mg/kg/day for total 3-5 day course (including the initial dose).
- Subsequent weaning of corticosteroid dose during the admission may reveal the underlying severity and degree of airway obstruction.
- In severe cases, BD dosing may be required beyond the first day of admission and a longer total duration of corticosteroid treatment may be required (e.g. 7 days).

Methylprednisolone IV

- Maximum 2mg/kg up to 60mg methylprednisolone
- 2mg/kg first dose severe and life threatening
- 1mg/kg/dose every 6 hours day 1
- 1mg/kg/dose every 12 hours day 2
- 1mg/kg/dose once a day from day 3 onwards for total 5 days if required

Hydrocortisone IV

- Is an alternative to Methylprednisolone
- IV 4 mg/kg (maximum 100 mg) every 4–6 hours for 24 hours, then reduce over next 24 hours
- If weight unknown, use the following and base subsequent doses on weight as above:
- <2 years: IV 25 mg
- 2–5 year: IV 50 mg
- 5–18 years: IV 100 mg

This Guideline may be varied, withdrawn or replaced at any time.

Magnesium Sulfate

Intravenous dose

- 0.2mmol/kg/dose over 20 min

(maximum dose 8 mmol)

- If given outside ED and /or PICU required to be under supervision of PICU

Note: IV salbutamol and IV magnesium sulfate cannot be given in the same line

Dose via nebulisation

- There is limited information to suggest benefit. Discuss with ED Consultant/ Fellow if considering nebuliser treatment.
- Presentation: 2.5mmol magnesium sulphate in 10mL WFI pre-filled syringe from pharmacy
- Dose: nebulised dose is 2.5mL (0.625mmol) administered every 20minutes for a maximum of 3 doses
- Not compatible with salbutamol and ipratropium

Aminophylline

- Only give in conjunction with PICU
- Loading dose : 10mg/kg over 60 min, unless markedly improved following loading dose, give continuous infusion:
    - For patients aged 9 years or less: 0.9mg/kg/hour
    - For patients aged greater than 9: 0.7mg/kg/hour

    OR
- IV intermittent bolus: 5mg/kg/dose (maximum dose 500mg) every 6 hours

Note: Continuous infusion to be given only in PICU. Monitor levels 6 hrs after commencement of infusion, or 1 hr before next dose: TR 55-110 (asthma). NB: Loading dose may not be needed if the patient has been taking oral theophylline (Nuelin®). See Asthma Management in PICU

8 Background drug information of asthma medications

Salbutamol

- Salbutamol remains first–line bronchodilator therapy in the management of acute asthma in children. Delivery via metered dose inhaler and spacer has been demonstrated to be equally effective to nebuliser delivery provided that sufficient medication is provided (approximately 1/4 nebuliser dose).
- It is recommended that spacers be used initially in children with mild to moderate asthma and nebuliser delivery be reserved for those with severe or life threatening asthma especially when oxygen requirement, or those with mild to moderate asthma responding poorly to spacer delivery.
- When salbutamol intravenous infusion is required, monitor for adverse effects such as hypokalaemia and metabolic acidosis.

Ipratropium

- Efficacy of frequent nebulised ipratropium added to frequent nebulised salbutamol is well established in childhood asthma. It appears to be most effective in those with moderate - severe acute asthma. One study has also demonstrated that benefit persists with concurrent administration of systemic corticosteroids. Ipratropium should be used in conjunction with salbutamol in initial treatment of severe asthma and can also be used via the spacer in children with moderate asthma responding poorly to the initial dose of salbutamol.

Systemic Steroid Therapy

- The effectiveness of systemic steroid therapy in acute asthma has been well established. Early use has been shown to reduce the need for hospitalisation in children with asthma in the hospital setting although not in either the emergency department or the community setting in children with viral induced wheezing. Systemic corticosteroids are generally considered the preferred option in the management of acute asthma in children, particularly in those presenting to hospital. Systemic corticosteroids should be administered early in children with moderate and severe asthma and should be considered in children with mild asthma if the response to salbutamol alone is suboptimal.

Aminophylline

- Generally been shown to provide only modest additional benefit to salbutamol and corticosteroids in children with acute asthma and to significantly increase the risk of vomiting. It has recently been shown to provide additional benefit (but with a high incidence of nausea and vomiting) in patients in the intensive care setting already on frequent nebulised bronchodilator (salbutamol) and systemic corticosteroids and should generally be reserved for this situation.

This Guideline may be varied, withdrawn or replaced at any time.

Magnesium Sulfate

- A single IV dose has been shown in meta-analysis to provide additional benefit in children with moderate to severe asthma treated with inhaled bronchodilators and systemic corticosteroids.
- Magnesium sulfate is now part of first line IV bronchodilator management for this group of children:
    - Its relative efficacy compared to intravenous salbutamol has not been studied
- Nebulised Magnesium Sulfate:
    - Recently the benefits of nebulised magnesium sulfate **in severe asthma exacerbations has been investigated,** given as three doses(2.5mL of 2.5mmol in 10mL nebulising solution) at 20 minute intervals in conjunction with initial salbutamol and ipratropium bromide.
    - Had only a modest clinical benefit in severe acute asthma exacerbations, with greatest clinical response seen in the more severe subgroup with initial SaO_2 <92% and duration of symptoms <6 hours.
    - At present nebulised magnesium sulfate can be considered as an option but further studies are required.
    - **Note: use of nebulised magnesium sulfate is at the discretion of ED Consultant**

This Guideline may be varied, withdrawn or replaced at any time.

9 Spacers and Nebuliser

Many factors need to be considered in selecting an appropriate inhaler device include the age of the child, the medication to be used and the child's preference (particularly in the older child where a variety of delivery systems are potentially available) and the cost to parents:

- http://chw.schn.health.nsw.gov.au/ou/asthma/
- http://www.asthmahandbook.org.au/management/devices/spacers

Spacers:

The most common spacer used in paediatrics is the small volume spacer either with or without a face mask:

- < 4 years old to use a small volume spacer with face mask.
- ≥ 4 years and or at school, a small volume spacer can be used without a face mask OR if the child would prefer, to use a large volume spacer.
- Use a suitable size face mask for overnight use and/or during acute exacerbation (for all ages).
- Any medication delivered via spacer should be administered one puff at a time with 4 to 6 breaths in between each puff.

Spacers are now used in the majority of children for administration of reliever medications, even in acute severe asthma. It is important to continue to check and re-check technique to address any issues poor technique/ lack of understanding of how to use the device, check the state of spacer eg: the valve is moving and address to any issues with adherence.

- The puffer, when used with a spacer produces outcomes that are at least equivalent to nebuliser delivery.
- Spacers could have some advantages compared to nebulisers for children with mild to moderate acute asthma including compliance, shorter length of stay in emergency and lower pulse rates. Any medication delivered via spacer should be administered one puff at a time.
- The previous advantages of large volume spacers in older children in terms of better medication delivery are no longer significant following the introduction of chlorofluorocarbon (CFC) free aerosols.

Nebuliser:

In the hospital, nebulisers deliver the medication by pushing compressed oxygen through the medication converting it into a fine mist. The medication can then be absorbed in the lungs while giving oxygen. This remains the preferred option for delivery for severe & or life threatening exacerbations of asthma

http://chw.schn.health.nsw.gov.au/ou/asthma/resources/asthma_inhalation_devices_information/nebuliser%20.pdf

10 Decision for admission

This Guideline may be varied, withdrawn or replaced at any time.

- The decision to admit the child will be based on the initial assessment of severity (as previously outlined) and the subsequent response to treatment in those with mild to moderate asthma.
- Those children felt to have severe or life threatening acute asthma will definitely need admission and may need PICU transfer depending on their response to initial treatment.
- Indications for Consult and/or Referral to PICU Asthma Management in PICU Practice Guideline: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2007-0031.pdf.
- For ED patients, discuss with ED senior registrar regarding appropriate admitting team.
- **For admission to ward the child must be on bronchodilator nebulisers or spacers at least hourly**
- **Criteria Led Discharge in Emergency and Hunter Baillie:** Registered Nurses who can stretch inhaled salbutamol and discharge children with asthma.
    - Hunter Baillie:

      http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2013-0005.pdf
    - ED:

http://chw.schn.health.nsw.gov.au/o/forms/emergency/criteria_led_discharge_-_asthma-Wheeze.pdf

11 Other investigations

Chest X-Ray

- **Rarely necessary in the management of acute asthma in children** but may be indicated in the presence of focal signs (crackles, bronchial breathing, and differential air entry) or subcutaneous emphysema to exclude a significant complication such as pneumothorax, pneumonia or lung collapse.
- Chest x-ray should be considered in new onset wheezing of undetermined aetiology or chronic persistent wheezing not responding to treatment to exclude other diagnoses including foreign body or mediastinal mass. In ED discuss with supervising consultant or fellow.

Lung Function

- Routine measurement of Forced Expiratory Volume in first second (FEV1) or Peak Expiratory Flow (PEF) are not recommend in the acute asthma setting: http://www.asthmahandbook.org.au

Pulse Oximetry

- Pulse oximetry is used in the clinical assessment of children and may be a better index of outcome than lung function tests. It has also meant that measurement of arterial blood gases is generally unnecessary unless there is evidence of significant hypoxemia and ongoing respiratory distress: http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2015-9055.pdf

Blood Gases

Arterial blood gases are generally not useful in children with acute asthma as pulse oximetry gives information on hypoxaemia. Venous blood gases can be used if intravenous cannulation is necessary for intravenous bronchodilators.

12 Interval Patterns and Asthma Control

Patterns of Asthma determines the need for commencement and or review of preventive therapy in children and the patterns are divided into the following:

- **Infrequent asthma**: Children are generally symptom-free for at least 6 weeks at a time but no symptoms between flare-ups.
- **Frequent asthma**: Children generally have more than once exacerbation every 6 weeks on average but no symptoms between flare-ups
- **Persistent asthma**: This group divides into mild, moderate and persistent where there is increasing symptoms during day and night time with generally limitations on the child's daily activities.
- **Refer to** http://www.asthmahandbook.org.au/management/children

Poor asthma control is a well-recognised risk factor for asthma exacerbation. Assessing control outside the acute exacerbations is an important part of overall management. **If the child has poor control and or there are concerns about asthma management, should consider a referral to either Paediatrician or Respiratory Paediatrician.**

- Assessment of control (when assessing to start on preventer therapy and or if reassessing for a change in preventer therapy) can be based on symptoms +/- lung function.
- Asthma Control Questionnaires can be used to determine the need for step up or step-down treatment according to the level of control (good, partial or poor).
- The following 2 tables provide a guide for the differences in good- partial-poor control in children and adolescents: http://www.asthmahandbook.org.au/management/children

Children

Good Control	Partial Control	Poor Control
All of: - Daytime symptoms+ ≤2 days per week(lasting only a few minutes & rapidly relived by bronchodilator) - No limitations of activities - No symptoms during night or when wakes up - Need for reliever ≤2days per week+	**Any of:** - Daytime symptom s+ >2days per week(lasting only a few minutes & rapidly relived by bronchodilator) - Any limitation of activities+ - Any symptoms during night or when wakes up+ - Need for reliever > 2days per week+	**Either of:** Daytime symptoms+ >2days per week(lasting from minutes to hours or recurring, and partially or fully relived by bronchodilator OR ≥ 3 features of partial control within the same week

+ wheezing or breathing problems OR wheeze or breathlessness during exercise, vigorous play or laughing; waking with symptoms of wheezing or breathing problems. Note: Recent asthma control is based on symptoms over the previous 4 weeks. Each child's risk factors for future asthma outcomes should also be assessed and taken into account in management. AAH (2015) ID 23

Adolescents

Good Control	Partial Control	Poor Control
All of: -Daytime symptoms ≤2 days per week -Need for reliever ≤2days per week AND -No limitations of activities -No symptoms during night or on waking	One or two if: - Daytime symptom >2days per week - Need for reliever > 2days per week AND - Any limitation of activities - Any symptoms during night or on waking	Three or more of: - Daytime symptoms >2days per week - Need for reliever>2days per week AND - Any limitation of activities - Any symptoms during night or on waking

+ Not including SBA taken prophylactically before exercise Note: Recent asthma symptom control is based on symptoms over the previous 4 weeks. Source AAH (2015) ID 33

13 Reducing Medication and Asthma Action Plans

The purpose of discharge plans is to provide parents and/ or carers with short and long term management plans:

- Discharge planning should commence on admission.
- RMP provides short term instructions on use of reliever, oral corticosteroids and or preventer medications immediately post discharge from hospital.
- AAP provides information to identify the early or worsening signs of asthma with how to manage with reliever medications.
- Current practice is to develop the RMP and/ or AAP in Powerchart. Refer to Asthma Page under Resources http://chw.schn.health.nsw.gov.au/ou/asthma/

14 Ongoing Management and Discharge

Clinical Criteria for Discharge

Clinical criteria for admission to hospital for children presenting with acute asthma are well established:

- In contrast clinical criteria for discharge remain somewhat ad-hoc, and generally involve assessment of clinical signs of airway obstruction, frequency of bronchodilator need and level of oximetry. Outcomes when discharged on 3hrly salbutamol appear to equivalent to 4hrly.
- "Satisfactory" oximetry is often included in discharge criteria; SaO_2 tend to recover more slowly than the airway obstruction.

Recommendations

- Children with acute asthma should be considered ready for discharge when clinically stable on 3rd hourly bronchodilator.
- Oximetry should not be used as the primary criterion for discharge as it remains unclear what is a "satisfactory" level.
    - An oxygen saturation in room air >90% could be considered a minimum "safe" level and refer to SPOC

15 Education and Discharge Planning

Education

Admission to hospital is an opportunity to provide asthma management/education & or smoking cessation interventions. **The provision of asthma education is the responsibility of all health professionals.**

- Review parental, and where appropriate the child's, asthma knowledge, skills and confidence, including a review of the child's inhaler technique and AAP.
- This process should commence as soon as feasible to avoid unnecessary delays to discharge and should involve both medical, nursing and pharmacist staff on the ward area.
- Referral to Complex Asthma Service. Referral criteria are listed at: http://chw.schn.health.nsw.gov.au/ou/asthma/

Education for children with non-complex asthma:

- Asthma DVD (inpatients), asthma fact sheets and
- Open Airway Sessions for parent, refer to http://chw.schn.health.nsw.gov.au/ou/asthma/

Further information refer to educational checklists:

- http://www.asthmahandbook.org.au/management/children/education
- http://www.asthmahandbook.org.au/clinical-issues/troubleshooting

Discharge Planning

Discharge planning to identify/address potential barriers should be performed as early as possible. At the time of discharge all children with asthma should receive:

- Discharge medications/ summary and follow-up arrangements
- RMP and or AAP
- Written information on asthma from the below suggested sites
  - http://www.schn.health.nsw.gov.au/parents-and-carers/fact-sheets
  - http://www.nationalasthma.org.au/kidsandparents

Smoking Cessation

Smoking Cessation Brief Intervention is opportunistic advice from a health professional to parent, carer or adolescent re: smoking cessation options.

- Smoking Cessation Documentation in Powerchart Adhoc Charting
- The 5A's provide an evidence based framework for structuring smoking cessation interventions in the health care setting refer to https://kidshealth.schn.health.nsw.gov.au/kidsquit-smoking-cessation-brief-interventions OR
- Refer to AAH http://www.asthmahandbook.org.au/clinical-issues/smoking/management
- Refer parents to NSW QUIT Line13 QUIT (13 7848) or http://www.quitnow.gov.au/

This Guideline may be varied, withdrawn or replaced at any time.

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