ASTHMA – ACUTE MANAGEMENT

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

Related Information

- **Australian Asthma Handbook**: http://www.asthmahandbook.org.au/diagnosis/children

CHANGE SUMMARY

- Revision of the Asthma flow chart in line with the Australian National Asthma Handbook Version 1.2
- One page flow chart for the management of the pre-arrest / arrested asthmatic child
- Updating of the dose and administration instructions for medications used in the management of asthma.

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.

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This Guideline may be varied, withdrawn or replaced at any time.

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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1 Background

This document aims to outline management pathways for acute asthma. Further background and links to other reading resources (e.g. the relevant sections of the Australian Asthma Handbook) are provided in the latter part of the document.

Asthma is an inflammatory condition of the airways characterised by reversible airways obstruction and bronchospasm. The diagnosis of asthma should be considered in children who present with wheeze, cough or difficulty breathing.

It can be difficult to diagnose asthma with certainty in children aged 1–5 years[1].

- Episodic respiratory symptoms such as wheezing and cough are very common in children, particularly in children under 3 years.
- A third of preschool children are affected by recurrent wheeze yet most do not go on to have asthma in later childhood (e.g. by primary school age asthma incidence 8-10%). Recurrent viral induced wheeze is the most common phenotype seen during the preschool years.

Specific resources may be available for use in this younger age range

- Pre-school Wheeze Action Plan (available in Powerchart at CHW)
- Australian Asthma Handbook: Assessing the pattern of symptoms in children 0-5 years
- Australian Asthma Handbook: Managing acute wheezing episodes in children 0–5 years.
    - Response to treatment may differ, and should not be extrapolated from older asthmatics.

Every acute presentation with asthma or childhood wheeze provides an opportunity to assess underlying asthma control, whether preventer therapy is indicated, and provide an asthma plan and asthma education. For all acute presentations, problems should be identified and arrangements made for follow up and continuing care.

2 Assessment of Asthma/ Childhood wheeze

History[1]:

- Duration and nature of acute episode
- Likely trigger of acute episode (viral URTI, allergy, passive smoking, exercise)
- Medication received as part of treatment of the acute episode - dosages, delivery method, frequency, time of last dose and response to treatment
- Assess baseline interval asthma severity (if not taking a regular preventer) using AAH criteria:
    - Infrequent intermittent asthma
    - Frequent intermittent asthma

  - Persistent asthma (mild/moderate/severe)
- Assess asthma control prior to exacerbation onset using AAH criteria:
  - Regular medications (relievers/ preventers), modes of delivery, and compliance.
  - Previous Emergency Department visits/ hospitalisations/ ICU admissions
  - Note if the patient has a Severe Asthma Action Plan which should be used if they present with a severe exacerbation
- 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 a serious exacerbation include:

- History of poorly controlled 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 expiratory phase of respiration 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 O_2 saturations in air, tachycardia (may be due to β agonist treatment) and ability to talk are helpful but less reliable signs.

3 Assessment and Initial Management of Acute Asthma[1]

Initial Severity Assessment Treat in the highest category in which any symptoms occurs			
Symptoms	**Mild** Likely to go home	**Moderate** Possible admission	**Severe / 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	Sentences or long vigorous cry	Phrases or Shortened Cry	Words/ Weak Cry or Unable to Speak/ Cry
Wheeze Intensity	Variable	Moderate to loud	Often quiet Life threatening – silent chest
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** **(ED, Medical or Respiratory)** ↓
Oxygen	To maintain SpO_2 >94%	To maintain SpO_2 >94%	To maintain SpO_2 >94%
Salbutamol **Metered Dose Inhaler (MDI) & spacer**	*< 6 years*: 6 puffs *≥ 6 years*: 12 puffs **Review frequently and repeat when required**	*< 6 years*: 6 puffs / *≥ 6 years*: 12 puffs Every 20 min x 3 **Repeat as required**	*< 6 years*: 6 puffs / *≥ 6 years*: 12 puffs Every 20 min x 3 **Reassess** **OR**
Salbutamol nebulised	If child does not tolerate MDI & spacer or co-condition prevents use of spacer	If child does not tolerate MDI & spacer or co-condition prevents use of spacer	Continuous nebulised salbutamol **Reassess**
Systemic corticosteroids	Consider oral prednisolone depending on history and response to treatment	Consider oral prednisolone	Oral Prednisolone or IV methylprednisolone or IV hydrocortisone if above unavailable
Ipratropium (3 doses always with salbutamol)	No	Consider 3 doses at 20 minute intervals	Consider 3 doses at 20 minute intervals
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	Consider IV magnesium sulfate	Give IV magnesium sulfate
IV aminophylline or **IV salbutamol**	Not applicable	Not applicable	Consider either as 3rd line agent. Consult ICU
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
Observation and Review	HR, RR & SpO_2 pre and post treatment. MO review prior to discharge.	HR, RR and SpO_2 monitoring pre and post treatment Regular medical review as clinically indicated	Continuous cardiorespiratory monitoring (ECG, RR and SpO_2) Regular medical review as clinically indicated
Disposition	Home if salbutamol required less frequently than 3 hourly. See Ongoing Management and Discharge" below.	Home if salbutamol required less frequently than 3 hourly. See "Discharge Criteria". If not then admit to ward. See Admission below.	Notify / consult ICU Admit to ward bed or ICU

For drug doses and summary see: Medications in Acute Asthma

4 Admission

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

- Transfer to ward once stable on 1 hourly salbutamol
- The ward registrar must be notified prior to transfer to the ward
- Consider Criteria Led Discharge
- At CHW, children with asthma can be admitted to the short stay EMU unit in ED. Discuss with ED senior at time as to whether a patient is suitable for EMU admission.

Notify admitting Consultant

- Children on inhaled salbutamol should be admitted under a General Paediatrician
- If the child is known to a Respiratory Physician, the patient should be discussed with the Respiratory team
- At CHW:
  - Children on IV bronchodilators can only be admitted to PICU and are usually admitted under a General Paediatrician and a Respiratory Team consultation requested. If the child is known to a Respiratory Physician, the patient should be discussed with the Respiratory team
- At SCH:
  - Children on IV bronchodilators (not being admitted to ICU) should receive a Respiratory team consult on the ward or be admitted under a Respiratory Physician
- If the child has a Paediatrician/ Respiratory Physician who manages their asthma they should be notified.

5 ED Management – Child Presenting with Life Threatening Asthma

DRSABCDE approach
Call for Help CHW call 444 ask for arrest team **OR** SCH call 777 Code Blue
Get SENIOR ED STAFF / ICU SUPPORT as required

AIRWAY	• Ensure open and clear
BREATHING ADEQUATE	• Use "severe asthma" protocol
BREATHING INADEQUATE	• Sit upright • **CPAP 8-10cm H_2O with oxygen and inline salbutamol nebuliser** • Assess degree of chest expansion and aeration
APNOEA	• Bag Mask Ventilation (with anaesthetic circuit or laerdal bag with peep valve) with PEEP of ~10cm H_2O while preparing for intubation with inline salbutamol nebuliser **NB.** *Intubating the airway may worsen bronchospasm, and muscle relaxant will definitely impair expiration, therefore, intubation should generally be reserved for apnoeic patients.* **Intubation guide** • Use an appropriately-sized cuffed ET tube if available to minimise leakage. **Induction drugs** • ketamine (some bronchodilatory properties, haemodynamically-stable) +/- midazolam or fentanyl and suxamethonium or rocuronium • Generally avoid morphine and pancuronium as these may cause histamine release • Hand-bag once intubated • Assess degree of chest expansion, aeration and time for expiration • Chest may become extremely overinflated and non-compliant - placing hands either side of the chest and actively squeezing ('decompressing') the chest on expiration will enhance expiration • Ongoing sedation – ketamine infusion or midazolam • Monitor end tidal CO_2, however this may under-read due to delay to reaching 'end-expiration' **Suggested starting ventilator settings** • Ventilating patients with severe airway obstruction is notoriously difficult – consult an expert (ED/ICU/Anaesthetic consultant) early • An initial tidal volume of 6 mL/kg is a reasonable starting point • Aim to limit PIP < 30cm H_2O • Increased airway resistance will require a longer-than-usual inspiratory and expiratory time (with a slower respiratory rate). These times are best adjusted using the flow graph on the ventilator display (or auscultating the chest). • RR ~50% of usual for age • PEEP may be set from 0cmH_2O (to encourage expiratory flow) to 10-15cmH_2O (to overcome 'auto-PEEP')
CIRCULATION	• Assess pulse and rhythm • Gas-trapping can lead to over-distension and elevated intrathoracic pressure, with potential decreased venous return. Patients may become haemodynamically unstable with positive-pressure ventilation. • Have bolus dose of adrenaline (0.01 - 0.1 mL/kg 1:10,000) and fluid bolus prepared and ready to give in case of haemodynamic collapse • Intraosseous / IV access • Cardiac compressions if no output

FURTHER ASTHMA MANAGEMENT
• Assess for air leak and tension/simple pneumothorax • Consider anaphylaxis/food allergy and, if suspected, give IMI adrenaline 1:1,000, 0.01ml/kg (max 0.5mL) • Have a low threshold for commencing an adrenaline infusion 0.1 mcg/kg/min IV / Intraosseous as bronchodilator • Methylprednisolone 2mg/kg (IV/Intraosseous) • Magnesium sulfate 0.2mmol/kg IV/Intraosseous over 20 min (Max dose 8mmol) • Aminophylline IV 10mg/kg loading dose over 30 – 60 minutes +/- infusion

6 Medications in Acute Asthma [1-6]

Medication	Dose/Directions
Oxygen	To maintain SpO_2 >94%
Salbutamol (MDI) 100microg/Puff	• *< 6 years*: 6 puffs (600 micrograms) • *≥ 6 years*: 12 puffs (1200 micrograms) **Spacer plus mask for children aged 4 years and younger**
Salbutamol Nebules **(Continuous nebulised)**	• *<6 years*: 2.5mg/2.5mL • *≥ 6 years*: 5mg/2.5mL Place 5mls of undiluted solution into the nebuliser with minimum oxygen flow of 6 – 8L/min and top up when nearing completion. This process is repeated for approximately 1 hour and then review management.
Salbutamol (IV) 1mg/mL(=1000micrograms/mL 5mL ampoules (*Ventolin Obstetric®)*	• IV Infusion: Draw up 50mL of salbutamol 1mg/mL IV solution undiluted (10x5mL ampoules) Start at 5microg/kg/min (weight (in kg) x 0.3) mL/hr for 1 hour then reduce to 1microg/kg/min (Weight (kg) x 0.06) mL/hr) or cease. **For patients >40kg (max weight for dose calculation) do not exceed starting rate of 12mL/hr** OR • IV bolus: 15microg/kg over 10 minutes **Note: IV salbutamol and IV magnesium sulfate cannot be given in the same line**
Steroids (Oral) Prednisolone 5mg/mL liquid 1mg,5mg and 25mg Tablets	• Prednisolone 1-2mg/kg (maximum dose 60mg/ day) Mild / moderate: Usual dose 1mg/kg/day for a total of 3-5 days Severe and life threatening: 2mg/kg/day on Day 1, then 1mg/Kg for the remainder of the 3 to 5 day course. In severe asthma, increased doses and duration can be considered and the dose may need to be weaned more slowly.
Steroids (IV) **Methylprednisolone sodium succinate** (40mg, 125mg, 500mg, 1000mg vials) **OR** **Hydrocortisone** (100mg, 250mg vials)	Methylprednisolone 2mg/kg/dose (maximum 60mg/dose) first dose then: 1mg/kg/dose • 6 hourly day 1 • 12 hourly day 2 • once daily from day 3 for total 5 days (if required) or change to oral prednisone **OR** Hydrocortisone 4mg/kg/(max 100mg) every 4-6 hours for 24 hours, then reduce over next 24 hours as with methylprednisolone . Change to oral prednisone as soon as tolerated.
Ipratropium (MDI) 21 micrograms/Puff	• *< 6 years*: 4 puffs (84 micrograms) • *≥ 6 years*: 8 puffs (168 micrograms) **Spacer plus mask for younger children** Usually given as 3 doses, 20 minutes apart in severe/ life-threatening exacerbations Based on clinical need, frequency can be increased to every 4-6 hourly
Ipratropium (Nebulised) 250 micrograms/mL 500micrograms/mL	• *< 6 years*: 250microg (added to nebulised salbutamol) • ≥ 6 years: - 500microg (added to nebulised salbutamol) Usually given as 3 doses, 20 minutes apart in severe/ life-threatening exacerbations Based on clinical need, frequency can be increased to every 4-6 hourly
Magnesium sulfate (IV) 2 mmol/mL, 5 mL, 10mL	• 0.2 mmol/kg/dose(up to 8mmol) diluted in compatible fluid (1/2 NS, G10W, G5/NS, NS) over 20 mins

Magnesium sulfate concentrated	**Note: IV salbutamol and IV magnesium sulfate are not compatible and need to be administered in separate lines.**
Magnesium Sulfate (Nebulised) 2.5mmol/10mL WFI pre-filled Syringe from Baxter® (CHW only)	• 2.5mL(0.625mmol) nebulised every 20minutes for a maximum of 3 doses in addition to treatment with nebulised salbutamol and ipratropium **Note : Compatible with Salbutamol and Ipratropium only if the single dose preservative free preparations are used. Multi-dose nebulising solutions contain benzalkonium chloride which may cause precipitation of the solution.**
Adrenaline 1:1000 **1 mg/mL**	If anaphylaxis suspected: • Give IM adrenaline (1:1000): 0.01mL/Kg(max 0.5mL) • Commence intravenous adrenaline infusion 0.1microgram/kg/min (ED / ICU only)
Aminophylline (IV) 25mg/mL, 10mL ampoule Dilute to a concentration of 1mg/ml or weaker with 5% glucose or 0.9% sodium chloride.	**Loading** If child is already on theophylline, check plasma concentration first; if unable to do so, omit loading dose.. • *1–18years*: IV 5–10mg/kg (maximum 500mg). Younger children are more likely to require doses at the upper end of the range due to increased clearance. **Maintenance: intermittent IV boluses** *ED/ ICU only at CHW, Medical ward C3W/MAU/ED/ICU at SCH* • *1–9 years*: IV 6mg/kg (maximum 500 mg) every 6hours. • *9–12 years*: IV 5mg/kg (maximum 500 mg) every 6hours. • *12–18 years*: IV 3–4mg/kg (maximum 500 mg) every 6hours. **Maintenance: continuous IV infusion** *ED / ICU only* • *1–9years*: IV infusion 0.9–1.1mg/kg/hour. • *9–12years*: IV infusion 0.7mg/kg/hour. • *12–18years*: IV infusion 0.5–0.7mg/kg/hour.

7 Medications: Information and Considerations

7.1 Oxygen

- Should be given to maintain oxygen saturations > 94% and monitored by continuous oximetry. Duration of oxygen therapy depends on response to treatment[1].

7.2 Salbutamol

- Inhaled β-2 agonists remain the first-line bronchodilator therapy in the management of children with acute asthma. In mild, moderate and severe asthma, delivery should be by a MDI and spacer (4 years and under require a mask). 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: Inhaled salbutamol vs IV salbutamol

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 on-call Consultant/ Fellow (ED, General Medicine or Respiratory) and ICU.

- **NOTE**: When IV salbutamol infusion is commenced inhaled salbutamol should be continued hourly
- 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.
- The consultant of the primary treating team, ED Fellow/Consultant and / or ICU Fellow / Consultant should be aware of all patients being considered for IV salbutamol.
- Patients receiving IV salbutamol should be cared for by an experienced appropriately skilled registered nurse. At CHW this is in ED or ICU and at SCH in the Medical ward C3W, MAU, ED or ICU.
- The Respiratory team should be consulted during the admission if the child has required intravenous salbutamol.
- When receiving intravenous salbutamol, monitor for common side effects such as: tachycardia, tachypnoea, metabolic acidosis – high lactate, hypokalaemia, tremor and nausea/vomiting. If these side effects occur the child should be reviewed with consideration given to reducing/stopping the infusion.
- Less common side effects of intravenous salbutamol include oxygen desaturation, headache, muscle cramps, dizziness and potential for respiratory depression and dehydration.
- IV salbutamol infusions must be prescribed in accordance with Safe Prescribing Guidelines – SCHN. The prescription must document the dose of IV salbutamol in microgram/kg/minute.

Nursing considerations

Patients receiving IV salbutamol must have:

- Continuous observations and regular medical review as clinically indicated.
- Consider insertion of a sampling line if requiring regular blood investigations.
- Serum potassium checked at commencement of IV salbutamol infusion, repeated at 2 hours then12 hourly.
- IV salbutamol must only be administered using a syringe infusion pump.
- The drug name must be entered digitally into the infusion pump and always displayed. Where available, pre-programmed infusion drug libraries must be used.
- The medication and administration line must be labelled according to the NSW Health Labelling Injectable Medicines, Fluids and Lines Policy Directive [PD2016_058].

7.3 Corticosteroids

- The effectiveness of systemic corticosteroid therapy in asthma is well established. They should be administered early in moderate- severe / life-threatening asthma and considered in children with mild asthma who have had a limited response to salbutamol alone.
- Systemic corticosteroids 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.

7.4 Ipratropium

- Ipratropium is most effective in children with moderate-severe asthma when added to frequent nebulised salbutamol.
- Ipratropium can also be used via the spacer in children with moderate asthma responding poorly to the initial dose of salbutamol.

7.5 Magnesium Sulfate

Intravenous magnesium sulfate

- Intravenous magnesium sulfate can be given in addition to bronchodilators and corticosteroids in children presenting with moderate – severe / life-threatening asthma not responding to inhaled bronchodilators
- Use of IV magnesium sulfate in under 2 years is generally not recommended. However, use in this age group may be prescribed after careful consideration by a consultant.
- 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.
- The consultant of the primary treating team, ED Fellow/Consultant and / or ICU Fellow / Consultant should be aware of all patients receiving IV magnesium sulfate.
- Patients receiving IV magnesium sulfate should be cared for by an experienced appropriately skilled registered nurse. At CHW this is in ED or ICU and at SCH in the Medical ward C3W, MAU, ED or ICU.
- The Respiratory team should be consulted during the admission.

Nursing considerations

- Patients receiving IV magnesium sulfate must have:
  - Continuous cardio respiratory monitoring (ECG, SpO2 and respiratory rate)
  - Regular medical review as clinically indicated.
  - Blood pressure recorded at commencement, midway and end of infusion.
  - IV magnesium sulfate is administered as an infusion over 20 minutes.

Nebulised Magnesium Sulfate (at CHW)

Note: Use of nebulised magnesium sulfate is at the discretion of ED Consultant. It should not be used in patients who have been given IV magnesium sulfate.

- Given as three doses (2.5mL of 2.5mmol in 10mL water for injection nebulising solution) at 20 minutely intervals in conjunction with initial salbutamol and ipratropium bromide.
- Recently the benefit of nebulised magnesium sulfate in severe asthma exacerbations has been investigated. Only a modest clinical benefit in severe acute asthma exacerbations was found, with greatest clinical response seen in the more severe subgroup with initial SpO_2 <92% and duration of symptoms <6 hours [7, 8].
- At present nebulised magnesium sulfate can be considered as an option in severe asthma when administration IV is not possible but further studies are required to assess the benefit before its place in guidelines can be formally established.

7.6 Aminophylline[3]

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 corticosteroids. The therapeutic effects of aminophylline in asthma include bronchodilation and improved diaphragmatic contraction.

- Aminophylline is the 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
- Check for previous interactions and recent doses of aminophylline - doses should be adjusted based on drug levels of theophylline.
- 0.6mg/kg aminophylline is expected to raise plasma theophylline concentration by 1microgram/mL.
- Overweight or obese patients should be dosed according to ideal body weight (50th percentile weight for age or appropriate weight for age and height according to growth charts).
- Check theophylline level 4-6 hours after the initial intermittent dose, and every 12 hours if continuing (prior to giving next dose)

- Common side effects include a high incidence of sinus tachycardia, nausea and vomiting even at therapeutic levels. This should not lead to discontinuation of therapy.
- Dysrhythmias other than sinus tachycardia are rare unless there is concurrent hypokalaemia (salbutamol can exacerbate). Seizures are rare with therapeutic levels. Diuresis can occur.
- Patients receiving aminophylline infusions should be cared for by an experienced appropriately skilled registered nurse. At CHW this is in ED or ICU and at SCH in the Medical ward C3W, MAU, ED or ICU.
- The Respiratory team should be consulted during the admission.
- The consultant of the primary treating team, ED Fellow/Consultant and / or ICU Fellow / Consultant should be aware of all patients receiving aminophylline infusions.

Nursing considerations:

- Patients receiving IV aminophylline must have:
  - Continuous cardio respiratory monitoring (ECG, SpO2 and respiratory rate) during drug administration. Then hourly documentation of HR, RR, BP and continuous SpO_2 on completion of infusion until Medical review and patient considered stable.
  - Monitoring of the infusion site regularly for signs of extravasation
  - Regular medical review as clinically indicated.
  - Intermittent doses of IV aminophylline must only be administered as an infusion over 1 hour.

8 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[1].

Continuous Pulse Oximetry

- Can be a valuable adjunct to clinical assessment and in children may be a better index of outcome than lung function. It has also meant that measurement of arterial blood gases is generally unnecessary unless there is evidence of significant hypoxemia and ongoing respiratory distress. See SCHN Pulse Oximetry Practice Guideline.

9 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 one 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** formal criteria in the Australian Asthma Handbook.

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, consider a referral to either Paediatrician or Respiratory Physician.**

- Assessment of control (when assessing to start on preventer therapy or if reassessing for a change in preventer therapy) can be based on symptoms +/- lung function. Use of 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[1]

9.1 Children (6 years and older)

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

9.2 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 symptoms >2 days 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 >2 days per week • Need for reliever >2days per week *AND* • Any limitation of activities • Any symptoms during night or on waking

***** *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*

 # 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

10 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.
- Reducing or Weaning Medication Plan provides short-term instructions on use of reliever, oral corticosteroids and or preventer medications immediately post discharge from hospital.
- Asthma Action Plan (AAP) provides information to identify the early or worsening signs of asthma with how to manage with reliever medications.
- Current practice at CHW is to complete the Reducing Medication Plan and/ or AAP in Powerchart.

11 Ongoing Management and Discharge

11.1 Clinical Criteria for Discharge

- Consider Criteria Led Discharge which can be initiated in ED, EMU at CHW and on the ward.
- 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.

11.2 Discharge Requirements

At the time of discharge all patients/ parents should have had asthma education and demonstrated correct use of asthma delivery device.

They should also receive:

- A discharge summary
- Discharge medication
- An Asthma Action Plan
- A Reducing Medication Plan
- Children’s Asthma Resource Pack for parents and carers
- Information outlining follow-up arrangements with General Practitioner and / or a Paediatrician or Respiratory Physician.
- Consider lung function testing as an outpatient.

Note: A child who has required admission to ICU should be referred to in the High Risk Asthma Clinic at SCH and the Chest and Asthma Clinic at CHW if not already known to a Respiratory Physician and depending on their place of residence.

12 Education

12.1 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 Asthma Action Plan.
- This process should commence on admission. Education resources for children with asthma include:
    - Asthma and your child: A resource pack for parents and carers
    - Asthma DVD (inpatients), asthma fact sheets
    - Open Airway Sessions for parents (CHW)
    - Parent/Carer Education sessions (SCH)
    - Asthma Action plan and resource pack available in other languages

- **CHW**: Refer to the Asthma Service intranet page
- **SCH**: Refer to Aiming for Asthma Improvement in Children

Note: Schools and child services action plan for asthma flare up available in resource pack

Further information; refer to educational checklists in the Australian Asthma Handbook:

- Childhood Asthma Education Checklist
- Troubleshooting Checklist

12.2 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 at CHW)
- The 5A's provide an evidence based framework for structuring smoking cessation interventions in the health care setting.
    - Refer to SCHN KidsQuit Smoking Cessation internet page

    OR

    - Refer to Australian Asthma Handbook on Smoking and Asthma Management.
- Refer parents to NSW QUIT Line13 QUIT (13 7848) or the National QUITLINE web site.

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