



## CLINICAL PRACTICE GUIDELINE - ACUTE PAEDIATRIC ASTHMA ON THE WARDS

### Preface:

This guideline provides evidence based recommendations on the diagnosis, assessment and management for children with acute asthma admitted to the wards at Princess Margaret Hospital for Children

### DIAGNOSIS OF ASTHMA

The diagnosis of asthma is not always straightforward and a therapeutic trial of asthma treatment sometimes may be needed to help support or negate a diagnosis of asthma<sup>1,2,3</sup>. In these cases, it is important that the treating doctor, referring doctor *and* the parents/patient realise that the treatment is a trial and that a label of asthma is not inappropriately applied. In most cases the diagnosis of asthma in young children is a **clinical diagnosis** made on an assessment of symptoms and clinical findings<sup>3</sup>. Diagnosis is supported by a finding of as many of the following features as possible:

#### A history of fluctuating wheeze

In young children the diagnosis of asthma can be confirmed by a clinical response to inhaled bronchodilator<sup>1,2,3</sup>

#### Recurrent episodes of wheeze<sup>2</sup>

Particularly if the episodes are *not only* viral induced, occur in older children (> 2-3 years of age) and symptoms occur in the interval period<sup>1</sup>. The first episode of wheeze in infants or toddlers may be difficult to distinguish from acute bronchiolitis or viral bronchitis<sup>1,2</sup>.

#### Abnormal Airway Function

Bronchoconstriction<sup>2</sup>  
Reversibility<sup>2</sup>  
Variability<sup>2</sup>

#### Clinical features

More than one of:  
Wheeze<sup>1,2</sup>  
Shortness of breath<sup>1,2</sup>  
Chest tightness<sup>1,2</sup>  
Cough<sup>1,2</sup>

#### Physical signs of airways obstruction

In the acute setting, these include tachypnoea, hyperinflation, prolonged expiration, recession and accessory muscle use along with wheeze<sup>3</sup>

**Pre-disposing factors where asthma is more likely**

Individuals with atopic disease (allergic rhinitis, eczema)<sup>1,2</sup>  
First degree relatives with asthma or atopic disease (especially maternal)<sup>1,2</sup>

**Common triggers**

Upper respiratory tract infections<sup>1,2</sup>  
Allergen exposure<sup>1,2</sup>  
Exercise<sup>1,2</sup>  
Exposure to cold air<sup>1,2</sup>

**Age**

Asthma can rarely be confidently diagnosed in children less than 1 year of age.

**FEATURES SUGGESTIVE OF A DIAGNOSIS OTHER THAN ASTHMA**

Although a dry, irritating or tight cough can be one of the cardinal symptoms of asthma, cough alone, without wheeze, chest tightness and/or shortness of breath is rarely due to asthma<sup>2,4</sup>.

While wheeze is a key feature of asthma, there are a number of other causes for wheeze in children, particularly in children under 3 years where wheeze is common, and more likely to be due to small airway calibre in association with viral respiratory infection rather than asthma<sup>2,5</sup>. If in doubt, ask your consultant.

**OTHER CAUSES OF WHEEZE IN YOUNG CHILDREN**

<b>Condition</b>	<b>Characteristics</b>
Transient infant wheezing <sup>2</sup>	Onset in infancy, no associated atopy <sup>2</sup> Association with maternal smoking <sup>2</sup>
Cystic Fibrosis <sup>2</sup>	Recurrent wheeze, cough, and failure to thrive <sup>2</sup>
Inhaled Foreign Body <sup>2</sup>	Sudden onset localised wheeze <sup>2</sup>
Milk aspiration/cough during feeds <sup>2</sup>	Especially liquids, associated with developmental delay <sup>2</sup>
Structural abnormality <sup>2</sup>	Onset at birth <sup>2</sup>



Cardiac Failure <sup>2</sup>	Associated with congenital heart disease <sup>2</sup>
Suppurative lung disease <sup>2</sup> (chronic bronchitis & bronchiectasis) <sup>2</sup>	Presence of an early morning wet/moist cough <sup>2</sup>

## MEDICAL HISTORY

Inquire specifically about the following:

- Duration and symptoms of current episode<sup>2</sup>
- Treatments used (relievers, preventers, complementary therapies used)<sup>2</sup>
- Recent changes in treatment and the effect of those changes<sup>2</sup>
- Trigger factors (including URTI, allergy, passive smoking)<sup>2</sup>
- Frequency, pattern and course of previous acute episodes (e.g. ED visits, hospital or ICU admissions)<sup>2</sup>
- Parental understanding of the management of asthma<sup>2</sup>
- Presence and frequency of interval symptoms (sleep disturbance due to asthma symptoms, early morning symptoms, exercise-induced cough or wheeze, and frequency of  $\beta_2$ agonist use)<sup>2</sup>
- Atopic disorders<sup>2</sup>

Consider other causes of wheeze (e.g. viral bronchiolitis)

## PHYSICAL EXAMINATION

Important parameters in the assessment of the severity of acute childhood asthma are:

- **General appearance/mental state**<sup>2,3</sup>
- **Work of breathing** (accessory muscle use/recession/respiratory rate)<sup>2,3</sup>
- **Initial Arterial Oxygen Saturation on presentation**<sup>1,3,6</sup>

An initial O<sub>2</sub> saturation of < 92% on presentation to the Emergency Department is a good predictor of the need for hospitalisation<sup>6</sup>. Oxygen therapy in children is recommended if O<sub>2</sub> saturation is < 92%<sup>1</sup>.

Please note O<sub>2</sub> saturation of > 92% does not exclude deterioration in ventilation (with CO<sub>2</sub> retention). Pulse oximetry (SpO<sub>2</sub>) should not be used as the sole indicator of a child's condition. Assessment of other parameters, such as work of breathing, should form part of the assessment.



The following signs provide helpful additional information when assessing the severity of acute asthma in children, but are *less reliable* features:

**Heart rate**

Increasing tachycardia generally denotes worsening asthma<sup>1,2</sup>.

Influenced by respiratory compromise of any cause. Also influenced by systemic effect of bronchodilators as well as anxiety.

**Ability to talk**

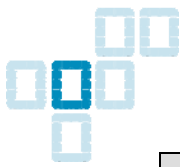
Usually reduced in severe asthma<sup>2</sup>.

Wheeze intensity, pulsus paradoxus, and peak expiratory flow rate are **not** reliable in assessing the severity of acute childhood asthma. Asymmetry of breath sounds is often found in mucus plugging.

**INPATIENT MANAGEMENT**

Select the highest category that matches patients’ symptoms to establish severity and treatment required. Modify management as patients’ asthma improves, as per guideline below.

<b>ASSESSMENT:</b> Reassess severity on arrival to ward		
<b>MILD ASTHMA</b>	<b>MODERATE ASTHMA</b>	<b>SEVERE ASTHMA</b>
Normal mental state Subtle or no accessory muscle use O <sub>2</sub> saturation > 95% Talks in sentences Wheeze + normal breath sounds	Normal mental state Some accessory muscle use O <sub>2</sub> saturation 92 - 95% Tachycardia Talks in phrases Wheeze ± reduced breath sounds	Agitated Moderate-marked accessory muscle use O <sub>2</sub> saturation < 92% Tachycardia Talks in single words Wheeze ± reduced breath sounds
<b>MEDICAL REVIEW</b>		
Reviewed by registrar on admission  Consultant notified at end of duty  Medical review at least daily	Reviewed by registrar on admission  Consultant notified at end of duty period or earlier if indicated  Medical review at least daily	Immediate review by registrar on admission  Consultant notified ASAP  Review at least 3 hourly to reassess severity & ensure management remains appropriate



<b>TREATMENT</b>		
<b>Oxygen</b> Via face mask if O <sub>2</sub> saturations < 92%, or otherwise clinically indicated		
<p><b>Short acting β<sub>2</sub> agonist 3 to 4 hourly</b></p> <p>salbutamol inhaler (100mcg) via spacer: Dose: &lt; 6 years - 6 puffs ≥ 6 years - 12 puffs</p> <p><b>Oral Corticosteroid</b></p> <p>Prednisolone 1mg/kg daily (50mg max.)</p> <p><b>Review/recommence inhaled Prophylaxis</b> See section on long term asthma control</p>	<p><b>Short acting β<sub>2</sub> agonist 2 to 4 hourly</b></p> <p>salbutamol inhaler (100mcg) via spacer: Dose: &lt; 6 years - 6 puffs ≥ 6 years - 12 puffs</p> <p style="text-align: center;"><b>Consider switching to nebulised salbutamol:</b> If patient unable to cooperate with spacer or is deteriorating despite appropriate use of spacer. Nebs driven with O<sub>2</sub> at 8L/min Dose: &lt; 6 years - 2.5 mg/2.5 mL salbutamol nebule (do not dilute) ≥ 6 years – 5 mg/2.5 mL salbutamol nebule (do not dilute)</p> <p style="text-align: center;"><b>Oral Corticosteroid</b></p> <p>Prednisolone 1mg/kg daily (50mg max.)</p> <p><b>Review/recommence inhaled Prophylaxis</b> See section on long term asthma control</p>	<p><b>Short acting β<sub>2</sub> agonist ½ to 2 hourly</b></p> <p>salbutamol inhaler (100mcg) via spacer: Dose: &lt; 6 years - 6 puffs ≥ 6 years - 12 puffs</p> <p style="text-align: center;"><b>Oral/IV Corticosteroid</b></p> <p><b>Oral</b> Prednisolone 1mg/kg once daily (50 mg max.)</p> <p style="text-align: center;"><b>OR</b></p> <p><b>IV</b> Hydrocortisone 4mg/kg 6 hourly until condition improved and able to tolerate oral medication</p>

**Oral corticosteroids:** given daily for 3 days (up to 5 days in severe exacerbations)<sup>1,2,3,7</sup>.

**IV corticosteroids:** for children with severe exacerbations where there may be doubts about the administration, absorption or retention of oral medication<sup>1,3</sup>. The intravenous route should be considered in any child with an IV in situ.

**Short acting β<sub>2</sub>agonists:** are given PRN as assessed by nursing staff and according to above guidelines/ medication chart.

**Nursing Staff:** Frequency of patient observations depend on patients' clinical status. Inform medical staff of clinical deterioration as indicated by one or more of the following:

- Increased work of breathing
- Increasing β<sub>2</sub>agonist requirement
- Decreasing oxygen saturations / increasing oxygen requirement



**Medical staff:** Should be available to promptly assess patients at the request of nursing staff.

## CHILDREN NOT RESPONDING TO STANDARD ASTHMA TREATMENT

Any child on ½ hourly inhaled  $\beta_2$  agonist requires medical review every 2 -3 hours. If a child is not responding to ½ hourly inhaled  $\beta_2$  agonist therapy and oral/IV steroids:

### Nursing Staff:

Contact ward medical staff for urgent review. If medical staff unable to attend, make a MET call (LAN page 8918, stating ward and extension number), for immediate review by PICU registrar and PICU nurse coordinator.

### Medical Staff:

Consider changing to continuous nebulised salbutamol and adding one or both of the treatments described below. The on call consultant must be notified at this stage to discuss treatment options.

## Inhaled Ipratropium Bromide (*Atrovent*)

Use of ipratropium with salbutamol for the treatment of moderate-severe paediatric asthma in the ED is supported by studies<sup>2,3,8,9</sup>. There is no evidence supporting its continued use once admitted to the ward<sup>3,9</sup>.

### Salbutamol & Ipratropium Regimen:

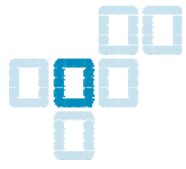
- Give continuous nebulised salbutamol driven oxygen at 8L/minute
- Add nebulised ipratropium every 20 minutes for 1 hour
- Then, if needed, give ipratropium 6 hourly

Dose:	<6 years	≥6 years
salbutamol ( <i>Ventolin</i> )	2.5 mg nebule	5mg nebule
ipratropium ( <i>Atrovent</i> )	125mcg neb solution	250mcg neb solution

## IV Aminophylline

### IMPORTANT:

- PICU must review all children who need IV aminophylline. The loading dose can be commenced while waiting PICU review (as long as PICU has been informed).
- Serum potassium level must be checked before commencement in case supplemental potassium is required.
- If on oral theophylline, **do not** give IV aminophylline - take serum level first<sup>10,11,13</sup>. Avoid or modify loading dose according to blood levels.
- Consider dose reduction in obese patients (consult with pharmacy).



**IV Aminophylline regimen:** 10mg/kg IV (maximum dose 500mg) over 1 hour as loading dose<sup>3</sup>

**Response to loading Dose:**

Good: Stop infusion after loading dose completed

No Improvement: **Contact PICU for review regarding transfer to PICU**

**Administration:** Paediatric Nursing Practice Manual [Protocol 2.6.4](#) outlines the requirements for the administration of Aminophylline.

**Monitoring a child on IV Aminophylline on the ward:**

- There must be adequate nursing staff on the ward to allow close monitoring of the patient. The medical team needs to discuss this with the nurse coordinator on the ward.
- All children on IV aminophylline must have cardiac monitoring and this is to be commenced as quickly as possible. IV aminophylline can be commenced without a cardiac monitor insitu, as long as arrangements for cardiac monitoring are being made (this may require transfer to another ward or PICU where cardiac monitoring is available). Potential cardiac adverse reactions include tachycardia, extrasystoles, atrial and ventricular arrhythmias<sup>10</sup>.
- Other potential adverse reactions include nausea and vomiting
- Medical staff:
  - Should remain on the ward during commencement of IV aminophylline to monitor patients' response, and then assess the need for their presence during the infusion. If medical staff make the decision to leave the area they must be immediately available to review the patient on request of the nursing staff.
- Nursing staff:
  - Should check and record pulse, respirations, and pulse oximetry every 15 minutes for the duration of the loading dose. Inform medical staff immediately of any adverse reactions. Frequency of continuing observations will depend on the child's condition.

**REQUEST REVIEW FOR TRANSFER TO ICU IF CHILD:**

- a) in impending respiratory failure (drowsy or confused, paradoxical thoraco-abdominal movement, absence of wheeze, bradycardia, breathlessness severe enough to preventing feeding)<sup>3,11</sup>, and/or
- b) has required continuous nebulised salbutamol for > 1 hour, and/or
- c) has required salbutamol more frequently than every 30 minutes for more than 2 hours, and/or
- d) has not shown any improvement 1 hour after commencement of an IV aminophylline loading dose

**Nursing staff:** If medical staff unable to attend immediately make a MET call (LAN page 8918, stating ward and extension number), for immediate review by PICU registrar and PICU nurse coordinator.



## INVESTIGATIONS

### Spirometry with bronchodilator response:

Spirometry is useful in assessing the degree of airways obstruction (which may be unrecognised from history or physical examination) and its reversibility<sup>2,13,14</sup>. It is a useful tool that can confirm a clinical diagnosis of asthma and assist in monitoring response to treatment<sup>2</sup>.

- Consider spirometry with bronchodilator response at least once prior to discharge for patients > 5 years in the Respiratory Function Laboratory.
- An FEV<sub>1</sub> < 80% predicted is considered abnormal. The lower limit of normal for FEV<sub>1</sub>/FVC is 70-75%<sup>15</sup>.
- The bronchodilator response is considered significant if:  
Baseline FEV<sub>1</sub> > 1.7L **and** post-bronchodilator FEV<sub>1</sub> at least 12% higher than baseline<sup>2,15</sup>.  
Baseline FEV<sub>1</sub> ≤ 1.7L **and** post-bronchodilator FEV<sub>1</sub> at least 200mL higher than baseline<sup>2,15</sup>.
- There is a high variation of normal for FEF<sub>25-75%</sub> measurements, and as a result using this to assess bronchodilator response is complex<sup>14</sup>. Advice regarding interpretation of FEF<sub>25-75%</sub> can be sought from a respiratory paediatrician.

Spirometry should be routinely performed for children >5 years as part of their follow-up in order to achieve accurate and objective assessment and management of their asthma<sup>2</sup>. To arrange this, document a request for follow up “with RFT” on the patients’ appointment card and complete a Respiratory Function Request form. Give both of these to the ward clerk, who will book the test with the follow up appointment.

### Allergy Testing:

Skin Prick Test **or** RAST and total IgE may be indicated in:

- Definite patient/family history of atopy. Particularly in patients with both asthma and allergic rhinitis<sup>2</sup>.
- Atypical asthma (e.g. history of: ventilation/ICU, anaphylaxis, or sudden onset severe episodes).
- Recurrent asthma with no obvious viral trigger.

### Chest X-rays:

Not generally required for the assessment of acute asthma<sup>1,2,3</sup>. However it may be required if evidence of a complication (e.g. pneumothorax), not responding to treatment or concerns regarding deterioration<sup>2,3</sup>. Discuss with registrar/consultant if considering.

### Nasopharyngeal Aspirate (NPA):

Only when a specific viral diagnosis needs to be considered and if it will alter management.

### Arterial Blood Gas (ABG):

Rarely required in the assessment of acute asthma in children<sup>1,3</sup>.



### Peak Expiratory Flow (PEF) Readings:

The usefulness of peak flow measurements in the initial assessment of acute asthma in children is limited, as they are effort dependent and can give inconsistent and inaccurate results, and so is not recommended<sup>2,14</sup>.

At home, the regular use of peak flow readings in children is generally not recommended as it is often limited by poor technique, poor compliance, adds little to the recognition of symptoms and may result in inappropriate treatment<sup>14,16,17,18,19</sup>.

Please note peak flow meters are single patient use items and should not be reprocessed<sup>20</sup>.

## DISCHARGE

The patient is medically fit for discharge if respiratory status has improved as evidenced by:

- no significant audible wheeze with good air entry
- tolerating 3-4 hourly bronchodilator via spacer and metered dose inhaler
- observations within acceptable range (including SaO<sub>2</sub>, heart rate, respiratory rate)

All discharge education and planning should be completed prior to discharge

## DISCHARGE PLANNING AND EDUCATION

Commences on admission. The following should be completed prior to discharge, and should be completed for all children who present to PMH with acute asthma.

### MEDICAL:

- **Complete and Explain Asthma Action Plan<sup>2,3</sup>**
  - Give clear advice regarding ongoing management of the current episode and for future exacerbations. Either use the PMH action plan or a handwritten plan tailored to the child's needs and family's level of understanding. Ideally a copy should be made for the child's medical file and one posted to the child's GP with the child's discharge letter. Symptom based asthma action plans are preferred in children<sup>2</sup>.
  - Please note, doubling the maintenance dose of ICS is **not effective** in managing exacerbations of asthma in children<sup>1,2</sup>.
- **Order Discharge Medications:**
  - Complete oral corticosteroid course<sup>2,3</sup>.
  - Consider prescribing and including instructions on action plan to commence oral steroid 1mg/kg at home for up to 3-5 days for acute asthma exacerbations requiring short acting  $\beta_2$  agonist more than 3-4 hourly<sup>3,7</sup>.
  - Bronchodilator PRN<sup>3</sup>
  - Review prophylaxis<sup>3</sup>(see Long Term Control)
- **Complete discharge letter.**
  - If possible, a phone call to the GP should be made, as this has been shown to improve communication between hospitals and doctors in the community<sup>21</sup>.



- **Arrange Follow – Up<sup>3</sup>**

- Explain and arrange follow up with GP/in OPC/in Consultant Rooms as appropriate.
- Parents should be encouraged to seek medical review (preferably from their GP) if no significant improvement within 48 hours of discharge.

***Indications for follow up by paediatrician:***

- Asthma not controlled by Inhaled Corticosteroids (ICS) in doses  $\geq$  Fluticasone 250 mcg per day (or equivalent)<sup>2</sup>.
- Atypical or severe asthma<sup>2</sup>
- Commencement of preventive treatment during admission
- Patients whose treatment required admission to the PICU. Consider referral to respiratory medicine for children who have required repeat admissions to PICU<sup>2</sup>.
- Frequent asthma presentations to the ED or hospitalisations for asthma<sup>2</sup>.
- Frequent courses of oral corticosteroids<sup>2</sup>
- Other medical or psychosocial issues that complicate asthma management

## **NURSING:**

- **Give written asthma information**

- For children with a confirmed asthma diagnosis, give “Caring For Your Child’s Asthma” booklet
- For children with viral induced wheeze, query asthma give “The Wheezing Child” Parent Information Sheet
- Asthma brochures in languages other than English are on wards 4E and 9A or visit [Asthma UK – FAQ](#) page and select the language you require.

- **Demonstrate and check spacer technique, and explain how to wash spacer**

- **Show parents Asthma video**

- **Offer Follow up with Asthma Foundation of Western Australia (AFWA)**

- Parents/teenagers who would like follow up with an AFWA Asthma Education Officer need to complete and sign the Asthma Foundation referral form. Nursing staff then forward the completed form to the Asthma Liaison Nurse via the internal mail.

- **Ensure discharge medications given and explained**

- This Includes spacer device +/- mask for home. New spacers and masks are kept on wards 9A, 8A, and in ED/4E, which can be used by the child during their admission and then taken home on discharge. Spacers are ordered from PMH pharmacy.

- **Ensure parents are aware of their child’s follow-up**

## **REFERRALS TO ASTHMA CLINICAL NURSE SPECIALIST (CNS)**

The CNS provides asthma education and follow up support/contact for children with asthma and their families, and liaises with medical, nursing and allied health staff regarding the child’s ongoing care/needs. The CNS will liaise with the child’s school and community agencies as appropriate



Referrals are prioritised in order of **need**. Patients to be considered for referral:

- Non-compliance with asthma treatment or who are mismanaging asthma care.
- Poorly controlled asthma.
- Children with newly diagnosed asthma. This **does not include** infants with first presentation of viral induced wheeze, query asthma. Routine education performed by medical and nursing staff should be adequate for these families.
- Severe Asthma (eg. ICU admission).

The CNS will see patients while in hospital and continue follow up/support as needed, including OPC follow up in conjunction with their medical team.

**Asthma CNS Contact Details:**

Page: 8435 Ext: 8713

Available Monday – Friday 0900-1700 hrs

**After Hours:**

For children admitted and discharged after hours (ie weekend/public holidays/ before 0900hrs/ after 1700 hrs), complete a consult form and send to ALN via internal mail. The CNS will contact the family, and arrange follow up as appropriate.

**LONG TERM CONTROL**

**Signs of well controlled asthma:**

- Asymptomatic for  $\geq 3$  months<sup>11</sup>.
- If on ICS, consider gradually back titrating treatment to the lowest dose at which effective control of asthma is maintained<sup>2,11</sup>.

**Signs of poor asthma control:**

These signs indicate a need to commence or review prophylaxis

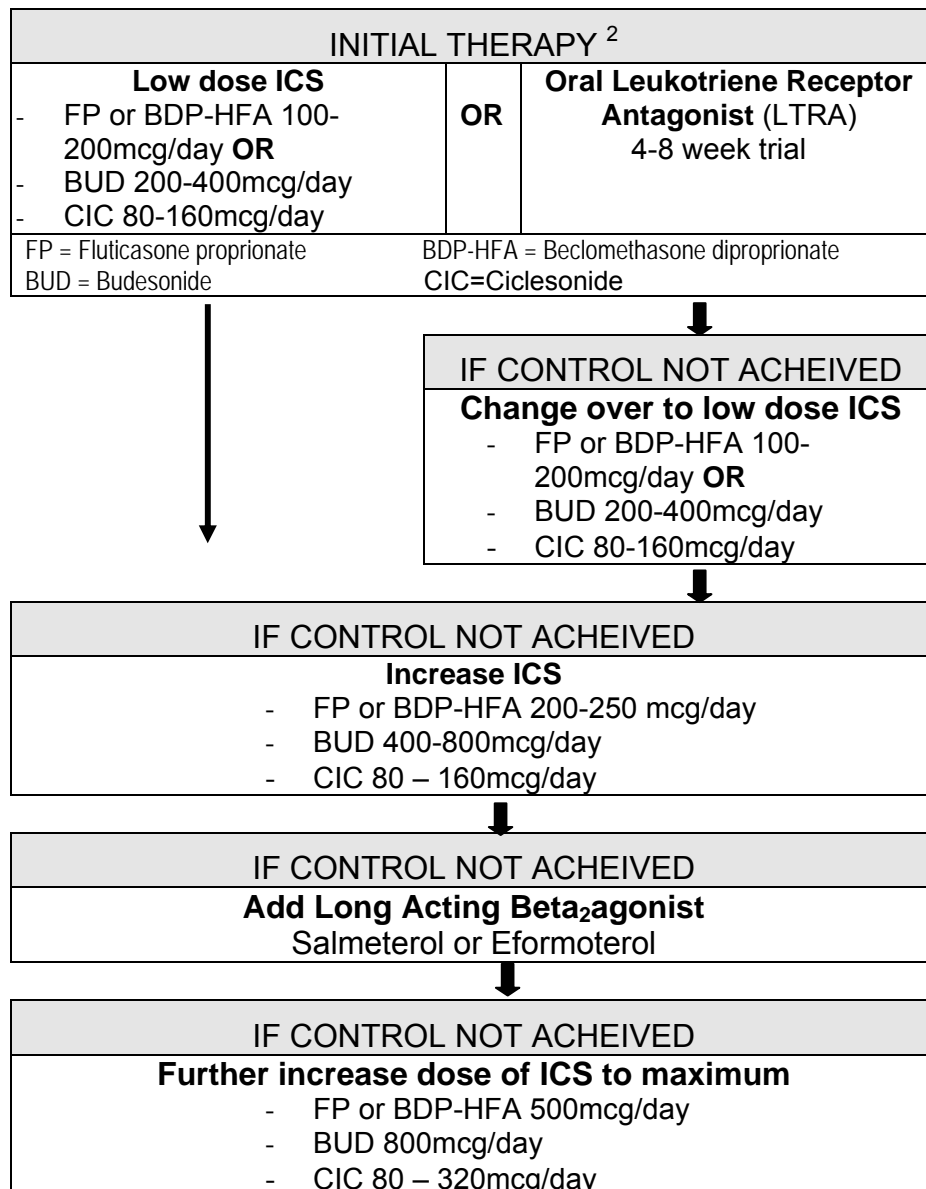
- Abnormal spirometry result showing persisting airway obstruction and/or bronchodilator response (at least 12% increase in FEV<sub>1</sub>) in the interval period<sup>2</sup>, **AND/OR**
- Short acting  $\beta_2$  agonist use (not including before sport) more than 2 days/week, **AND/OR**
- Ongoing daytime symptoms more than 1x/week<sup>2,22</sup>, **AND/OR**
- Acute exacerbations at least monthly, **AND/OR**
- Nocturnal symptoms more than once a week<sup>2,22</sup>, **AND/OR**



- Difficulty participating in physical activities due to asthma symptoms<sup>2,22</sup>. Be aware that exercise induced dyspnoea is not always due to asthma. Misinterpretation of dyspnoea as asthma can potentially lead to overtreatment<sup>2</sup>.

### Preventive Treatment

The aim of preventive therapy should be for patients to achieve and maintain good asthma control, with the **least** amount of preventive treatment and at minimal risk of side effects<sup>2</sup>. Start treatment at the step most appropriate to the level of asthma severity and step up or down as necessary<sup>2,3</sup>. Improvement from initiating or stepping up preventer therapy should be evident within 1 month<sup>2,11</sup>.



**Before stepping up treatment check:**

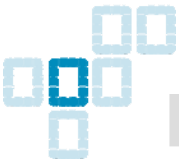
- Adherence
- Device & technique
- Environmental factors
- Diagnosis
- Intrinsic factors (e.g. allergic rhinitis)

**Remember:**

Back titration

**Children not controlled on fluticasone 250mcg (or equivalent) should have paediatrician involvement<sup>2</sup>**

**Children not controlled on maximum dose ICS + LABA should be referred to a respiratory physician or paediatrician with expertise in asthma management**



### Leukotriene receptor antagonists (LTRAs):

LTRAs may be useful in children with mild persistent or frequent intermittent asthma as an alternative to low dose ICS<sup>2,23,24,25</sup>. They have also been shown to reduce exercise induced bronchoconstriction in children<sup>3,21</sup>.

### Long acting $\beta_2$ agonists (LABAs):

LABAs should not be used as initial therapy for children with asthma and must always be used in association with an ICS<sup>2,3,26,27</sup>. Adding LABAs to ICS therapy should only be considered for children with persistent asthma that is not adequately controlled on optimal doses of ICS<sup>2,27</sup>. Recent evidence links long-term use of LABAs with an increased risk of asthma related hospital admissions, life threatening asthma exacerbations and asthma related deaths<sup>26</sup>. Subsequently, it is strongly advised that the long term use of LABAs should be more restrictive and their use closely monitored by using the following guidelines:

- Always combine LABAs with ICS<sup>2,26,27</sup>
- If no improvement in asthma symptoms after 1 month LABAs should be withdrawn<sup>2,26</sup>. Consider referral to a respiratory physician in this circumstance (especially if already on high dose ICS).
- If there is a good response, try and wean off LABAs and see if good control maintained. If not, consider increasing inhaled steroid dose (if on a low – moderate dose).

## MEDICATION DELIVERY FOR CHILDREN

### Spacers

- **Medication delivery via Spacer & Metered Dose Inhaler compared to Nebulisers:**  
Bronchodilators are largely given via spacer and MDI. Research shows that bronchodilators delivered by metered dose inhaler (pMDI) and spacer is at least equivalent to nebuliser for relief of acute asthma symptoms, and may also result in fewer side effects<sup>28</sup>. The combination of pMDI and spacer is also more cost effective, easier to use, and provides patients and their parents with the skills to manage an acute attack of asthma at home.
- **Cleaning of spacers at home**  
Parents need to be informed of appropriate anti-static measures for spacers at home. Spacers should be washed in warm water with household detergent and left to drip-dry without rinsing off the suds (do not rub dry) when first purchased and then once a week. This will remove static, resulting in a two to threefold increase in lung delivery<sup>29,30</sup>.

**Appropriate spacer device and technique for age:**

AGE	SPACER	TECHNIQUE
<3 years	Small spacer with mask	4-5 tidal breaths with each puff of medication. Always give 1 puff at a time. If using mask ensure firm seal over mouth & nose
3-5 years	Small spacer (no mask)  Use mask <b>only</b> if uncooperative or poor technique*	
≥ 5 years	Large spacer (no mask)	1 deep inspiration and hold breath for 5 seconds with each pMDI actuation.  If breathless or poor technique revert to 4-5 tidal breaths with each actuation.

**\*Lung deposition increases 2-3 times with oral inhalation compared to nasal inhalation i.e by mask<sup>29,31</sup>**




**Nebulisers**

- In the acute setting nebulisers can be considered for patients with severe asthma who are unable to co-operate with the pMDI/spacer or are deteriorating despite appropriate use of pMDI/spacer. A T-piece, rather than a mask, is preferred in children over 3 years in order to encourage oral inhalation. Nebulisers are indicated for children with critical asthma, requiring continuous inhaled salbutamol.
- Due to the effectiveness of pMDI/spacer there is no indication for the use of nebulisers in the home setting. Nebulisers are cumbersome and costly, and only deliver a small proportion of medication particles in the respirable range compared to the pMDI and spacer.

**Dry Powder and Breath Activated Devices**

- Patients need to generate enough inspiratory flow in order to use these devices effectively, and hence they are only suitable for older age groups<sup>2,3</sup>.
- If using any of these devices in a corticosteroid form, extra care should be taken by patients to rinse their mouth after each use to avoid side effects such as oropharyngeal thrush or dysphonia, as oropharyngeal deposition is higher with these devices<sup>2</sup>.



DEVICE		AGE
Breath Activated Metered Dose Inhalers	Dry Powder Inhalers	
Autohaler 	Accuhaler 	Turbuhaler 
For children $\geq 8$ years <sup>2</sup>		
Possible in some children 5 – 8 years <sup>2</sup> , but rare		

LINKS:

- [Asthma UK](#)
- [Asthma WA](#)
- [Reference List](#)

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**This document should be read in conjunction with disclaimer in the introduction to these guidelines**