



LRI Emergency Department and Children's Hospital

Management of Acute Wheeze and Asthma in Children

Staff relevant to:	Paediatrics and Children's ED medical, nursing, support staff and allied professionals
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1. Introduction and Who Guideline applies to

Any child presenting to the Leicester Children’s Hospital or Emergency Department with a clinical presentation suggestive of an acute asthma attack or acute wheeze.

Key points:

- Identify the severity of presentation and follow the recommended guidance for treatment (Table 1 and Table 2).
- Remember to consider the amount and method of treatment PRIOR to arrival (i.e. have they had adequate therapy or is this their first inhaler dose).
- Always consider the child’s OWN written asthma plan when treating
- Always consider other causes of wheeze and refer to the appropriate guideline (Table 4).
 - There is limited evidence for the use of oral steroids in pre-school children, so do not give without discussion with senior colleagues
- Have a low threshold for admission if:
 - previous CICU admission / severe episode / rapid deterioration
 - repeat ED/CH attendances with a wheeze over past year OR ≥ 1 in past month
 - on high dose inhaled steroids (Table 5)
 - on maintenance oral steroids, theophylline, or biologics.
- The full discharge checklist MUST be completed prior to discharge home
- Children should ONLY be discharged when the discharging clinician feels confident that the child can last at least 4 hours between salbutamol doses
- **If you have any concerns – request SENIOR help immediately**

Presentation:

Asthma is a common condition characterised by wheeze, breathlessness, chest tightness, and cough; and by objective evidence (by spirometry) of variable airflow obstruction. Recent descriptions of asthma have included airway hyper-responsiveness (challenge tests) and airway inflammation (FeNO) as components of the disease.

Additional features suggestive of asthma include:

- Personal or family history of asthma or other atopic conditions

- Triggers e.g. pollen, dust, animal dander, exercise, viral infections, chemicals, and tobacco smoke

Risk factors for morbidity and mortality include:

- Excessive use of bronchodilators
 - Patients requiring three or more classes of asthma medications
 - Frequent attacks (requiring oral steroids)
 - Previous admissions to CICU/HDU
 - Previous life threatening asthma
- Please consider relevant socio-economic factors to allow a safe discharge.

Assessment (Table 1)

- Wheeze is not a good marker of severity. 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)
- Tachycardia can be a sign of severity but is also a side effect of beta agonists such as salbutamol.
- A silent chest with no wheeze may herald imminent respiratory collapse.
- Asymmetry on auscultation is often found due to mucous plugging, but warrants consideration of foreign body.

2. Management:

SEE TABLE 1(page 4)

Table 1. Quick Reference Table to guide management of children presenting with an acute asthma attack or wheeze

First identify the severity according to presenting clinical features and then follow the colour coded guidance for treatment

Severity	Presenting Clinical Features	Management
Mild / Moderate	<p>All features below:</p> <ul style="list-style-type: none"> - Able to talk in sentences and feeding well - SpO2 ≥ 92% in air - Heart rate: <ul style="list-style-type: none"> • ≤ 140/min in children aged < 5 years • ≤ 125/min in children ≥ 5 years - Respiratory rate: <ul style="list-style-type: none"> • ≤ 40/min in children aged < 5 years • ≤ 30/min in children ≥ 5 years - No or minimal accessory muscle use. 	<ul style="list-style-type: none"> - Salbutamol by MDI/spacer – up to 10 puffs and assess response after 20 minutes. <ul style="list-style-type: none"> • If no better after one dose, salbutamol can be repeated every 20 minutes up to three times in first hour. • Consider oral steroids if no improvement after first dose of salbutamol. - Review after first hour. - If good response: <ul style="list-style-type: none"> • Reassess every 30-60 minutes and stretch inhalers as tolerated. If improvement maintained and managing to stretch inhalers to 3-4 hourly: <ul style="list-style-type: none"> - Consider suitability for discharge (Table 3) - Discharge check list must be completed (Table 3) - Poor response or improvement not maintained - <u>Treat as severe</u> <p>Note: salbutamol will cause tachycardia, assess improvement based on work of breathing and air entry</p>
Severe	<p>Any one of these features:</p> <ul style="list-style-type: none"> - Too breathless to talk or feed - SpO2 < 92% in air - Heart rate: <ul style="list-style-type: none"> • > 140/min in children aged < 5 years • > 125/min in children ≥ 5 years - Respiratory rate: <ul style="list-style-type: none"> • > 40/min in children aged < 5 years • > 30/min in children ≥ 5 years - Use of accessory muscles 	<ul style="list-style-type: none"> - Alert paediatric or ED SpR - Oxygen if O2 saturation is < 92% - Bronchodilators by MDI/spacer every 20 minutes <ul style="list-style-type: none"> • Salbutamol - every 20 minutes for 1 hour, and review ongoing need after 3rd dose • Ipratropium - every 20 minutes for 1 hour only - Oral steroids if not already given (IV dexamethasone if vomiting) - If improving, stretch bronchodilators as tolerated <ul style="list-style-type: none"> • Admit to children's hospital once stable on 1-2 hourly bronchodilators • In children ≥ 5 years, perform peak flow to guide response to treatment - If no clinical improvement or deteriorating <ul style="list-style-type: none"> • Treat as life threatening <p>Note: salbutamol will cause tachycardia, assess improvement based on work of breathing and air entry</p>
Life-Threatening	<p>Features of severe, plus:</p> <ul style="list-style-type: none"> • Altered Consciousness / Agitation • Silent Chest • Poor Respiratory Effort / Exhaustion • Confusion • Cyanosis 	<ul style="list-style-type: none"> - Alert CICU registrar and move patient to resus if in ED - Apply continuous saturations monitoring and ECG - ABC inc. high flow O2 via reservoir mask - Continue nebulised salbutamol every 20-30 minutes and Ipratropium - every 20 minutes for 1 hour only - IV access (x 2) and FBC, UE, Mg and Gas - IV dexamethasone (if not already had steroids or vomited first dose) - IV 2/3 maintenance fluids (0.9% saline, 5% dextrose plus potassium) - CXR - If still no improvement <ul style="list-style-type: none"> • Give IV magnesium sulphate (first choice) • Give IV salbutamol bolus and commence infusion (second choice IV drug) • Consider IV aminophylline if poor response or deterioration despite above measures (CICU decision) - Admit to HDU/CICU once stabilised

Table 2. Drug Dosages		
Bronchodilators (inhaled and nebulised)		
	Ages	Dose
Salbutamol MDI + spacer	ALL	Up to 10 puffs
Salbutamol nebuliser	< 5yrs	2.5 mg
	≥ 5yrs	5 mg
Ipratropium nebuliser	< 12yrs	250 micrograms
	≥ 12yrs	500 micrograms
Oral Steroids		
	Ages	Dose
Prednisolone	< 2yrs	10 mg once daily for 3-5 days
	2-5yrs	20 mg once daily for 3-5 days
	> 5yrs	30-40 mg once daily for 3-5 days
Dexamethasone	ALL	0.6 mg/kg (Max 16 mg) Usually a single dose (see appendix)
Intravenous Drugs (please also refer to UHL guideline sheets)		
	Ages	Dose (NOTE MAX)
Dexamethasone (at discretion of intensivist)	ALL	0.15mg/kg (max 4 mg) – 6 hourly
Hydrocortisone (if dexamethasone not available)	ALL	4mg/kg (max 100 mg) – 6 hourly
Magnesium sulphate	>2yrs	40mg/kg (max 2g) bolus over 20 min
Salbutamol bolus	<2yrs	5 micrograms/kg bolus over 10 min- maximum 250micrograms
	>2yrs	15 micrograms/kg bolus (MAX 250micrograms) over 10 minutes
Salbutamol infusion	>2yrs	1-2 microgram/kg/min (if needing more than this, please discuss with CICU) For children aged <2 years- a salbutamol infusion should only be used under direction from the CICU team
Aminophylline bolus	ALL	5mg/kg (max 500mg) bolus over 20 min (OMIT if on oral theophylline)
Aminophylline infusion	ALL	<12 years: 1mg/kg/hr (adjusted according to plasma level) BNFc and UHL medusa GL is for 0.5-0.7mg/kg/hr for 12-17 years.

Additional considerations:

- Always consider the child's **OWN written asthma** plan when making treatment decisions
- Children (≥ 5 years) admitted with severe/life-threatening asthma should have **regular peak flow monitoring** to guide response to treatment (see appendix, A2 for normal values)
- Nebulised bronchodilators should be continued while the patient is receiving intravenous bronchodilators
- Chest X-rays are not routinely indicated unless there is:
 - Life threatening asthma not responding to treatment.
 - Persistent unilateral signs on auscultation (i.e. pneumothorax or collapse)
- Oral steroids – prednisolone is suggested as the preferred option in the BTS/SIGN asthma guideline (1). Dexamethasone is an alternative as this may be tolerated better (see appendix, A1, if given dexamethasone and further doses are felt to be needed)

Discharge:

Do NOT discharge children home on a weaning plan for salbutamol.

Advise the following:

- Use the blue reliever inhaler (Salbutamol) **as needed** if your child has any of the following symptoms: wheeze, chest tightness, shortness of breath, cough and difficulty breathing.
 - Give 2 puffs, one at a time and wait 2 minutes, repeat if necessary until you have given up to 6 puffs. The symptoms should have disappeared. The effects should last for at least 4 hours.
- If your child needs the blue reliever inhaler more than every four hours, your child's asthma attack is not controlled and you need to take emergency action now.**
 - Take up to 10 puffs and seek urgent medical attention STRAIGHTAWAY either at an urgent care centre (walk in clinic) or by attending the Emergency Department..

SEE TABLE 3 for discharge criteria (page 7)

Table 3. Discharge Criteria and Checklist

Always consider the child's **OWN written asthma plan** when making discharge decisions

Clinicians should feel confident that children can last at **least 4 hours** between doses of bronchodilator inhaler prior to discharge.

Mild asthma attacks- discharge criteria

Children with mild asthma can be discharged from ED once stable and are observed to be able to stretch safely to at least 3 hours from their last salbutamol dose, providing the clinician and family feel confident that the child is not likely to need to use salbutamol more than 4-hourly at home.

Moderate to severe asthma attacks- discharge criteria

These children should be admitted for a period of observation, and demonstrated to be stable on a maximum of 6 puffs of salbutamol every 4 hours, and (in children 5 years or older) have a peak expiratory flow and/or FEV1 of more than 70% of best or predicted prior to discharge. *

Parental education with the full discharge checklist below MUST be completed prior to discharge home

- | | |
|--|--------------------------|
| Check inhaler technique | <input type="checkbox"/> |
| Issue / review personalised written asthma plan and check adherence to current treatment | <input type="checkbox"/> |
| Review need to initiate/increase regular asthma treatment (as per <i>BTS guidance</i> *) | <input type="checkbox"/> |
| Clear safety net advice on when to seek medical review | <input type="checkbox"/> |
| If discharging from ED, issue ED asthma/wheeze action plan | <input type="checkbox"/> |
| Primary Care follow up within 2 working days and review need for paediatric outpatient follow up (table 5) | <input type="checkbox"/> |

*National (BTS/SIGN) guidelines also recommends SpO₂ > 94% in air prior to discharge. See reference below.

Differentials

Table 4. Differential Diagnoses for Wheeze		
	Suggestive Features	Management
Bronchiolitis	< 2yrs of age, preceding history of coryzal illness, fever. Diffuse crackles and wheeze on auscultation.	Refer to appropriate guideline or discuss with senior (ST4 or above) doctor
Episodic Viral wheeze	< 5yrs of age, symptoms with viral infections only, can have mild exercise induced symptoms Note: limited evidence for oral steroids	
Viral / atypical pneumonia	History of coryza, cough, fever. Crackles on chest auscultation	
Anaphylaxis	Urticarial rash, swelling, exposure to potential allergen, cardiovascular instability	
Cardiac failure	Heart Murmur, hepatomegaly, history of cardiac abnormality.	
Foreign body	Previously well, short history, witnessed choking episode, asymmetrical air trapping on CXR (but can be normal)	

Follow up arrangements:

Table 5. Follow Up

It is a National Recommendation that children presenting with an asthma attack should be reviewed by Primary Care within 2 working days.

Review asthma preventer medications. The Global Initiative for Asthma (GINA) (2) no longer recommends treatment of asthma with short acting beta-2 agonists alone (without inhaled corticosteroids (ICS)) in children >5 years because of the risk of severe asthma attacks requiring emergency department presentation or hospitalization, and asthma-related deaths. These risks are markedly reduced by ICS-containing therapy

Consider an outpatient **general paediatric asthma** clinic referral for any child with frequent symptoms of wheeze, shortness of breath, cough; and/or more than one hospital admission; and/or more than 1 course of oral steroids in the last year.

Please discuss the following patients with the Respiratory Team prior to discharge:

Children already known to the difficult asthma clinic (CYPDA)

OR

- Children on regular high dose ICS defined as:

Children aged ≤5 years on ≥ 400microg BDPE

Children aged >5 years on > 400microg BDPE

OR

- Children with persistent airflow obstruction (PEF or FEV1 <70% predicted) despite clinically being well enough for discharge and having completed at least 3 days of oral steroids

OR

- Children admitted with a severe life threatening attack defined as
- requiring invasive or non-invasive ventilation or IV infusion of aminophylline/salbutamol

Definitions

BDPE = Beclomethasone Dipropionate Equivalence

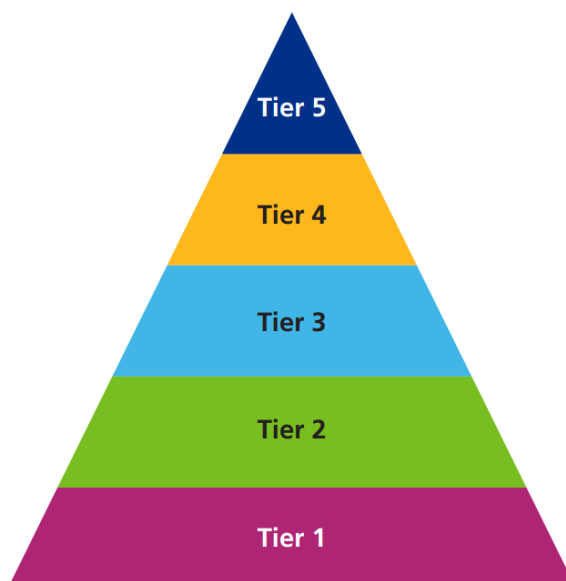
ICS- inhaled corticosteroids

400 BDPE	>400 BDPE
Clenil 100 2 puffs BD	Clenil 200 2 puffs BD
Seretide 50 2 puffs BD	Seretide 125 2 puffs BD
Symbicort 100/6 2 puffs BD	Symbicort 200/6 2 puffs BD
QVAR 50 2 puffs BD	QVAR 100 2 puffs BD

Table 5: List of commonly used inhalers in BDPE doses

3. Education and Training

Staff managing childhood asthma should receive training appropriate as per the National Asthma Framework (3).



Individuals should look at their own role and choose the tier most appropriate to the care they deliver.

Indicative levels of training are as follows:

- Tier 1- minimum level required for all staff involved in the care of children with asthma
- Tier 2- staff nurses involved in the management of children and discharge of children with an asthma attack.
- Tier 3- all paediatric doctors
- Tier 4- paediatricians with a special interest in asthma, Advanced Nurse Practitioners, Advanced Pharmacist Practitioner
- Tier 5- tertiary respiratory paediatricians

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Audit We will be monitoring our practice through the National Asthma Audit.	Through our local data collection	Dr Erol Gaillard	6 monthly	

5. Supporting References

1. BTS/SIGN guidelines on Asthma, <https://www.brit->

thoracic.org.uk/quality_improvement/guidelines/asthma/

2. GINA Asthma Guideline <https://ginasthma.org/wp-content/uploads/2019/04/GINA-2019-main-Pocket-Guide-wms.pdf>

3. The National Capabilities Framework for Professionals who care for Children and Young People with Asthma <https://www.e-lfh.org.uk/wp-content/uploads/2022/09/National-Capabilities-Framework-3.pdf>

4. NICE Asthma guideline <https://www.nice.org.uk/guidance/ng80>

6. Key Words

Bronchodilators, Nebuliser, Peak Flow

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

CONTACT AND REVIEW DETAILS	
Guideline Lead (Name and Title) Manisha Ramphul- Consultant in Paediatric Respiratory Medicine	Executive Lead Chief Medical Officer
Details of Changes made during review: September 2023 Discharge criteria updated- on doses of salbutamol for discharge Referral criteria to general asthma and difficult asthma services added in Education training tiers included Weaning plan removed To have separate leaflets for inhaler technique and personalised asthma action plan Drug doses updated	

A1. Oral Steroid Flow Chart for Dexamethasone



In children re-presenting to hospital with worsening asthma symptoms soon after discharge, further courses or steroids can be considered if felt to be of clinical benefit after discussion with SpR/Consultant:

- If a child presents more than 7 days following their last course of oral dexamethasone with asthma, then they can be given a further 1-2 day course of oral dexamethasone IF steroids are thought to be needed
- If a child presents within 7 days following their last course of oral dexamethasone with asthma, then they can be given a course of prednisolone IF steroids are thought to be needed

A2. Paediatric peak flow values

PAEDIATRIC NORMAL VALUES

PEAK EXPIRATORY FLOW RATE

For use with EU / EN13826 scale PEF meters only

Height (m)	Height (ft)	Predicted EU PEFR (L/min)	Height (m)	Height (ft)	Predicted EU PEFR (L/min)
0.85	2'9"	87	1.30	4'3"	212
0.90	2'11"	95	1.35	4'5"	233
0.95	3'1"	104	1.40	4'7"	254
1.00	3'3"	115	1.45	4'9"	276
1.05	3'5"	127	1.50	4'11"	299
1.10	3'7"	141	1.55	5'1"	323
1.15	3'9"	157	1.60	5'3"	346
1.20	3'11"	174	1.65	5'5"	370
1.25	4'1"	192	1.70	5'7"	393

Normal PEF values in children correlate best with height; with increasing age, larger differences occur between the sexes. These predicted values are based on the formulae given in Lung Function by J.E. Cotes (Fourth Edition), adapted for EU scale Mini-Wright peak flow meters by Clement Clarke.
Date of preparation – 7th October 2004