# Management of childhood asthma

See also the separate Diagnosing Childhood Asthma in Primary Care article.

## What is asthma?

Asthma is the most common respiratory disorder of children. Chronic inflammation of the bronchial mucosa and hyper-reactive airways results in bronchoconstriction and reversible airway narrowing. It typically presents with wheeze, dry cough, difficulty breathing and/or chest tightness. See also Wheezing in Children.

Managing childhood asthma involves both an appreciation of current treatment practice and also a willingness to educate and support the child and their family in the longer term.

## Acute asthma

| Important information |
| --- |
| Acute asthma is a relatively common paediatric emergency. Treat acute asthma as severe until proven otherwise and refer children who respond inadequately to community treatment urgently to hospital. |

### Acute asthma symptoms

It is vital to recognise the severity of an acute asthma attack. Clinical signs are a poor indicator of the degree of airways obstruction and some with acute severe asthma may not appear distressed.

Always assess and record:

- Pulse rate.
- Respiratory rate.

- Oxygen saturations ($SpO_2$).
- Degree of breathlessness (eg, ability to complete sentences, and to feed).
- Use of accessory muscles of respiration (feel the neck muscles for involvement in breathing).
- Amount of wheezing (with increasing severity, wheeze may become biphasic or less apparent).
- Degree of agitation and conscious level.

## Clinical assessment of the severity of an acute asthma attack in those aged over 2 years [1]

| Acute severe | Life-threatening |
|---|---|
| Oxygen saturations ($SpO_2$) <92%.<br>Too breathless to talk.<br>Pulse >125 in those aged over 5 years or >140 in 2-5 year-olds.<br>Respiratory rate >30 in those aged over 5 and >40 in 2- to 5-year-olds.<br>Use of accessory neck muscles.<br>Peak expiratory flow rate (PEFR) 33-50% best/predicted (age over 5 years). | $SpO_2$ <92% plus any of:<br>Silent chest.<br>Cyanosis.<br>Poor respiratory effort.<br>Agitation.<br>Confusion.<br>Coma.<br>PEFR 33-50% best/predicted (age over 5 years). |

## Clinical assessment of the severity of an acute asthma attack in those aged under 2 years [1]

| Moderate | Severe |
|---|---|
| $SpO_2$ ≥92%.<br>Audible wheezing.<br>Using accessory muscles.<br>Still feeding. | $SpO_2$ <92%.<br>Cyanosis.<br>Marked respiratory distress.<br>Too breathless to feed. |
| Most infants are audibly wheezy with intercostal recession but not distressed. Life-threatening features include apnoea, bradycardia and poor respiratory effort. | |

Children should be monitored carefully and assessed repeatedly to determine the need for admission to secondary care or for transfer to a high-dependency unit (HDU) or paediatric intensive care unit (PICU), where there are features of poorly responsive severe asthma or life-threatening asthma.

## Investigations

These include:[1]

- Peak expiratory flow rate (PEFR) in children aged over 5 years (use best of three readings, expressed as a % of personal best PEFR).
- Oxygen saturation - should be available in primary care, as low oxygen saturations (<92%) after initial bronchodilator therapy indicate a more severe subgroup of patients, in whom inpatient treatment may be required.
- CXRs and arterial blood gases are *not* routinely indicated, as their information yield is rarely high.

## Acute asthma treatment and management[1] [2]

- Admit (emergency 999) all children with features of a life-threatening asthma exacerbation.
- Admit if any feature of a severe asthma attack persisting after initial bronchodilator treatment.

- Admit if moderate asthma exacerbation with worsening symptoms despite initial bronchodilator treatment and/or who have had a previous near-fatal asthma attack. Children with a moderate exacerbation may also require admission if they have factors that warrant a lower threshold for admission, such as:
    - Poor treatment adherence.
    - Physical or learning disability.
    - Previous severe asthma attack.
    - Exacerbation despite an adequate dose of oral corticosteroids before presentation.
    - Presentation in the afternoon or at night.
    - Recent nocturnal symptoms.
    - Recent hospital admission.
    - Concern over family/social circumstances.

**NICE recommendations for management in children aged 2 years and over**

- Children with features of severe or life-threatening acute asthma should start treatment as soon as possible and be referred to hospital immediately following initial assessment.
- Any child who fails to respond to treatment adequately at any time should also be referred to hospital immediately.
- Supplementary high flow oxygen (via a tight-fitting face mask or nasal cannula) should be given to all children with life-threatening acute asthma or $SpO_2$ <94% to achieve normal saturations of 94-98%.
- First-line treatment for acute asthma is an inhaled short-acting $beta_2$ agonist (such as salbutamol) given as soon as possible.
- For children with acute severe or life-threatening symptoms, administration via an oxygen-driven nebuliser is recommended, if available.

- Parents/carers of children with acute asthma at home, should seek urgent medical attention if initial symptoms are not controlled with up to 10 puffs of salbutamol via a spacer; if symptoms are severe, additional bronchodilator doses should be given as needed whilst awaiting medical attention.
- Urgent medical attention should also be sought if a child's symptoms return within 3-4 hours; if symptoms return within this time, a further or larger dose (maximum of 10 puffs of salbutamol via a spacer) should be given whilst awaiting medical attention.
- In all cases of acute asthma, children should be prescribed an adequate dose of oral prednisolone. Treatment for up to three days is usually sufficient, but the length of the course should be tailored to the number of days necessary to bring about recovery.
- Repeat the dose in children who vomit, and consider the intravenous route in those who are unable to retain oral medication.
- It is considered good practice that inhaled corticosteroids are continued at their usual maintenance dose whilst receiving additional treatment for the attack, but they should not be used as a replacement for the oral corticosteroid.
- Nebulised ipratropium bromide can be combined with a nebulised $beta_2$ agonist for children with a poor initial response to $beta_2$ agonist therapy to provide greater bronchodilation.
- Consider adding magnesium sulfate (unlicensed use) to each nebulised salbutamol and ipratropium bromide in the first hour in children with a short duration of severe acute asthma symptoms presenting with an oxygen saturation less than 92%.
- Children with continuing severe acute asthma despite frequent nebulised $beta_2$ agonists and ipratropium bromide plus oral corticosteroids, and those with life-threatening features, need urgent review by a specialist with a view to transfer to a high dependency unit or paediatric intensive care unit (PICU) to receive second-line intravenous therapies.

- In children who respond poorly to first-line treatments, intravenous magnesium sulfate (unlicensed use) may be considered as first-line intravenous treatment. In a severe asthma attack where the child has not responded to initial inhaled therapy, early addition of a single bolus dose of intravenous salbutamol may be an option.
- Continuous intravenous infusion of salbutamol, administered under specialist supervision with continuous ECG and electrolyte monitoring, should be considered in children with unreliable inhalation or severe refractory asthma.
- Intravenous aminophylline may be considered in children with severe or life-threatening acute asthma unresponsive to maximal doses of bronchodilators and corticosteroids.

**NICE recommendations for management in children aged under 2 years**

- Acute asthma treatment for all children aged under 2 years should be given in the hospital setting. Treatment of children aged under 1 year should be under the direct guidance of a respiratory paediatrician.
- For moderate and severe acute asthma attacks, immediate treatment with oxygen via a tight-fitting face mask or nasal prongs should be given to achieve normal $SpO_2$ saturations of 94-98%. Trial an inhaled short-acting $beta_2$ agonist and if response is poor, combine nebulised ipratropium bromide to each nebulised $beta_2$ agonist dose.
- Consider oral prednisolone daily for up to three days, early in the management of severe asthma attacks.
- In children not responsive to first-line treatments or have life-threatening features, discuss management with a senior paediatrician or the PICU team.

Current evidence does not support increasing the dose of inhaled corticosteroids (ICS) as part of a self-initiated action plan to treat exacerbations in adults and children with mild-to-moderate asthma. Increased ICS dose is not associated with a statistically significant reduction in the odds of requiring rescue oral corticosteroids for the exacerbation, or of having adverse events, compared with a stable ICS dose.[3]

### Follow-up[4]

- Episodes of acute asthma may be a failure of preventative therapy. Therefore review is required to prevent further episodes.
- A careful history should be taken to establish the reason for the asthma attack.
- Inhaler technique should be checked and regular treatment should be reviewed.
- Parents should be given a written asthma action plan aimed at preventing relapse, optimising treatment, and preventing delay in seeking assistance in future attacks.
- It is essential that the GP practice is informed within 24 hours of discharge from the emergency department or hospital following an asthma attack, and the patient be reviewed by their GP within two working days.
- Any child who has had a near-fatal asthma attack should be kept under specialist supervision indefinitely.
- A respiratory specialist should follow up all children admitted with a severe asthma attack for at least one year after the admission.

## Chronic asthma

It is very important to consider the upper respiratory tract when treating asthma. It is much more difficult to treat asthma successfully if co-existing allergic rhinitis (perennial or seasonal) is not adequately controlled.[5]

### Non-drug[1]

- The National Institute for Health and Care Excellence (NICE) guidance on air quality at home recommends:[4] [6]
    - Inclusion of approaches to minimising indoor air pollution and reducing exposure to outdoor air pollution personalised action plans.
    - Advice to patients on the role of indoor air pollutants - including nitrogen dioxide, damp, mould, particulate matter and volatile organic compounds (VOCs) - in triggering or exacerbating asthma.
    - Consideration of housing as a possible cause of cough or wheeze and, if relevant, assistance to patients/parents in requesting a housing assessment from the local authority.
    - Patients whose asthma is triggered by household sprays, air fresheners or aerosols should be advised to avoid them and use non-spray alternatives.

- Allergen avoidance - commonly recommended in patients with asthma but there is a lack of good evidence showing its efficacy:[7]
    - House dust mite - a Cochrane review concluded that chemical and physical methods of house dust mite avoidance could not currently be recommended.[8] However, some families are very committed to trigger avoidance and suggestions can include:
        - Complete bed-covering barrier systems.
        - Removing all carpets.
        - Removing soft toys from the bed.
        - High-temperature washing of bed linen.
        - Acaricides to soft furnishings.
        - Improving ventilation with or without dehumidification.
    - Pet allergy - there are no controlled trials looking at removing domestic pets. There is varied anecdotal evidence with some experiencing no benefit on removing the pet and others, with continuing exposure to the pet, developing some tolerance. However, it seems sensible not to have a cat or dog if someone in the family already has asthma.
- Dietary manipulation - studies looking at supplementation with vitamin C, vitamin E, magnesium and fish oil have not shown significantly beneficial effects.[9]
- Complementary and alternative therapies:
    - There is insufficient evidence to recommend acupuncture, herbal or Chinese medicines, homeopathy, hypnosis or relaxation therapies.
    - Air ionisers offer no benefit to the treatment of asthma.
- Smoking cessation advice to caregivers and teenagers with asthma. Direct or passive smoking reduces lung function and increases the need for rescue medication and long-term 'preventer' treatment.

- Physical exercise therapy - may increase overall fitness but is of no specific benefit to asthma.
- Family therapy - where asthma is difficult to control, this may be a useful adjunct.
- Patient/carer education with the aim of creating partnership with family and child and confident self-care.
- Written asthma action plans for self-management lead to consistently improved outcomes.[10]
- Consider care links - eg, to school and transition to adult services. Schools should have their own asthma policy; staff are not required to administer asthma drugs except in an emergency but most are supportive of children with asthma and receptive to training in managing asthma and the correct way to administer inhaled drugs.
- Links to local and national patient groups for support and information.

### Drug[1] [4]

Current national guidelines advocate a stepwise approach. Start at the step most appropriate to the initial severity of symptoms. Aim to achieve early control and then decrease treatment by stepping down to the lowest controlling step once stable. Always check concordance and reconsider the diagnosis if response to treatment is poorer than anticipated.

### NICE pharmacological treatment pathway for children and young people aged 5 to 16

- Offer a short-acting beta$_2$ agonist (SABA) as reliever therapy for newly diagnosed asthma. In asthma with infrequent, short-lived wheeze and normal lung function, consider treatment with SABA reliever therapy alone.
- Offer a paediatric low dose of an inhaled corticosteroid (ICS) as the first-line maintenance therapy at presentation that clearly indicates the need for maintenance therapy (eg, asthma-related symptoms three times a week or more, or causing waking at night), or asthma that is uncontrolled with a SABA alone.

- If asthma is uncontrolled on a paediatric low dose of ICS as maintenance therapy, consider a leukotriene receptor antagonist (LTRA) in addition to the ICS and review the response to treatment in 4-8 weeks.
- If asthma is uncontrolled on a paediatric low dose of ICS and an LTRA as maintenance therapy, consider stopping the LTRA and starting a long-acting beta$_2$ agonist (LABA) in combination with the ICS.
- If asthma is uncontrolled on a paediatric low dose of ICS and a LABA as maintenance therapy, consider changing their ICS and LABA maintenance therapy to a maintenance and reliever therapy (MART) regimen with a paediatric low maintenance ICS dose. Ensure that the child or young person is able to understand and comply with the MART regimen. MART is a form of combined ICS and LABA treatment in which a single inhaler, containing both ICS and a fast-acting LABA, is used for both daily maintenance therapy and the relief of symptoms as required. MART is only available for ICS and LABA combinations in which the LABA has a fast-acting component (eg, formoterol).
- If asthma is uncontrolled on a MART regimen with a paediatric low maintenance ICS dose, consider increasing the ICS to a paediatric moderate maintenance dose (either continuing on a MART regimen or changing to a fixed dose of an ICS and a LABA, with a SABA as a reliever therapy).
- If asthma is uncontrolled on a paediatric moderate maintenance ICS dose with LABA (either as MART or a fixed-dose regimen), consider seeking advice from a healthcare professional with expertise in asthma and consider either:
    - Increasing the ICS dose to paediatric high maintenance dose (only as part of a fixed-dose regimen, with a SABA used as a reliever therapy) or
    - A trial of an additional drug (for example, theophylline).

## NICE pharmacological treatment pathway for children under 5

- It can be difficult to confirm asthma diagnosis in young children, therefore the following recommendations apply only to children with suspected or confirmed asthma. Asthma diagnosis should be confirmed when the child is able to undergo objective tests.

- Offer a SABA as reliever therapy for suspected asthma. This should be used for symptom relief alongside all maintenance therapy.
- Consider an eight-week trial of a paediatric moderate dose of an ICS for:
    - Symptoms at presentation that clearly indicate the need for maintenance therapy (for example, asthma-related symptoms three times a week or more, or causing waking at night); or
    - Suspected asthma that is uncontrolled with a SABA alone.
- After eight weeks, stop ICS treatment and continue to monitor symptoms:
    - If symptoms did not resolve during the trial period, review whether an alternative diagnosis is likely.
    - If symptoms resolved then reoccurred within four weeks of stopping ICS treatment, restart the ICS at a paediatric low dose as first-line maintenance therapy.
    - If symptoms resolved but reoccurred beyond four weeks after stopping ICS treatment, repeat the eight-week trial of a paediatric moderate dose of ICS.
    - If suspected asthma is uncontrolled on a paediatric low dose of ICS as maintenance therapy, consider an LTRA in addition to the ICS.
- If suspected asthma is uncontrolled on a paediatric low dose of ICS and an LTRA as maintenance therapy, stop the LTRA and refer the child to a healthcare professional with expertise in asthma for further investigation and management.

Management of those aged over 12 years is as for adults. See the separate Management of Adult Asthma article.

**Omalizumab** [11]

NICE recommends omalizumab as an option for treating severe persistent confirmed allergic IgE-mediated asthma as an add-on to optimised standard therapy in children aged 6 years and older who need continuous or frequent treatment with oral corticosteroids (defined as four or more courses in the previous year). Omalizumab should only be initiated by a specialist.

Optimised standard therapy is defined as a full trial of and, if tolerated, documented compliance with high-dose ICS, LABAs, leukotriene receptor antagonists, theophyllines and oral corticosteroids.

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**Editor's note**

Dr Krishna Vakharia, 21st April 2023
**Tezepelumab for treating severe asthma** [12]
NICE has recommended tezepelumab as an add-on to maintenance treatment in people 12 years and over with severe asthma, when treatment with high-dose inhaled corticosteroids plus another maintenance treatment has not worked well enough to treat severe asthma.
Studies have shown that when this medication is given alongside usual asthma medication, it reduces exacerbations and the dose of oral corticosteroids needed.

Criteria for prescribing by specialists are:
The person has had three or more exacerbations in the previous year.
The person is taking maintenance oral corticosteroids.
In addition, tezepelumab should be stopped if the rate of severe asthma exacerbations, or the maintenance oral corticosteroid dose, has not been reduced by at least 50% at 12 months.

## Referral [1] [4]

Indications for specialist referral in children include:

- Referral for tests not available in primary care.
- Diagnosis unclear.
- Poor response to monitored initiation of asthma treatment.
- Severe/life-threatening asthma attack.

- ‘Red flags’ and indicators of other diagnoses:
    - Failure to thrive.
    - Unexplained clinical findings (eg, focal signs, abnormal voice or cry, dysphagia, inspiratory stridor).
    - Symptoms present from birth or perinatal lung problem.
    - Excessive vomiting or possetting.
    - Severe upper respiratory tract infection.
    - Persistent wet or productive cough.
    - Family history of unusual chest disease.
    - Nasal polyps.
- Parental anxiety or need for reassurance.

If suspected asthma is uncontrolled in children under 5 years on a paediatric low dose of ICS and an LTRA as maintenance therapy, stop the LTRA and refer the child to a healthcare professional with expertise in asthma for further investigation and management.

Consider referral for specialist assessment if a child repeatedly cannot perform objective tests and is not responding to treatment.

## Immunisation[13]

**Influenza vaccine** - children with asthma who require continuous or repeated use of inhaled/systemic steroids or with previous exacerbations requiring hospital admission should be given the influenza vaccine.

However, influenza vaccine should be offered to all children who are not otherwise in a clinical risk group but who are eligible for vaccination as part of the ongoing phased roll out of the extension of the programme to all children aged 2 to less than 17 years old.

If children receive repeated systemic steroids sufficient to cause immunosuppression they also require pneumococcal vaccination.

## Drug delivery devices [1] [14] [15]

See the separate Which Device in Asthma? and Nebulisers in General Practice articles.

- A metered dose inhaler (MDI) plus spacer device is the first-line choice for the delivery of ICS therapy in those aged over 5 years.
- Where poor compliance with MDI and spacer is likely to jeopardise good asthma control, alternative devices should be considered whilst still looking to minimise systemic absorption.
- For those aged less than 5 years, corticosteroid and bronchodilator therapy should be delivered via MDI/spacer and face mask combination. Nebulisers may be considered where MDIs and spacers are not effective or if the child's clinical condition is poor.
- Children and their carers need to be trained in the use of their chosen device prior to prescribing and should be suitability reviewed looking at compliance and technique.

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# Complications

- Reduced quality of life.
- Reduced growth, usually as a result of poor control rather than treatment.
- Psychological morbidity - although differences appear to be the result of poor health rather than asthma itself. [16]
- Absence from school and educational disadvantage.

# Prognosis [2]

- The earlier the onset of asthma, the better the prognosis. Most children who present under 2 years of age become asymptomatic by 6-11 years of age.
- Early-onset asthma in atopic children may be associated with a worse prognosis.

- The Melbourne Epidemiological Study of Childhood Asthma (a 1964-1999 longitudinal study) found that in most children with asthma, significant wheezing continued into adult life. The more severe or frequent symptoms were in childhood, the more likely it was that symptoms would continue into adulthood.
- One longitudinal analysis found that half of the children with severe asthma no longer had severe asthma after three years. There was a stepwise decrease in the proportion meeting severe asthma criteria. [17]

## Further reading

- Primary Care Respiratory Society UK
- Resources for schools and early years; Asthma UK
- Global Initiative for Asthma (GINA)
- Rehder KJ; Adjunct Therapies for Refractory Status Asthmaticus in Children. Respir Care. 2017 Jun;62(6):849-865. doi: 10.4187/respcare.05174.
- Pike KC, Levy ML, Moreiras J, et al; Managing problematic severe asthma: beyond the guidelines. Arch Dis Child. 2018 Apr;103(4):392-397. doi: 10.1136/archdischild-2016-311368. Epub 2017 Sep 13.




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