

Assessing wheeze in pre-school children

Wheeze in children aged less than five years has many potential causes. Often it is regarded as the first sign of asthma, however, a substantial proportion of young children who wheeze will not go on to develop asthma.¹ In infancy, bronchiolitis is the most likely cause of wheeze. As children get older, episodic viral wheeze becomes more common. Atopic wheeze is most likely in children with risk-factors, such as a family history of asthma. By school-age, some of these children with wheeze will be diagnosed with asthma and others will have “grown out” of their symptoms. Therefore, rather than focusing on making a diagnosis when a young child presents with wheeze, it is more important to ensure the child receives appropriate management of their symptoms and that the parents receive education about their child’s treatment and advice about vaccinations, infection prevention and maintaining a smoke-free home.

Not all that wheezes is asthma

Half of all children will have an episode of wheeze before school age.² Many will “grow out” of their symptoms by the time they attend school, but some will go on to have recurrent respiratory symptoms and a clear pattern of reversible airway obstruction that will be recognised as asthma.² It can be challenging for the clinician to differentiate those young children who will go on to have asthma from those who will not.¹

Wheeze is clinically defined as a continuous, musical sound due to intrathoracic airway obstruction.¹ The small physical size of a young child’s respiratory system, an immune system that is still developing and high levels of exposure to viral respiratory pathogens make wheeze both more common and more difficult to diagnose in young children than in older children.³ Environmental factors also play a significant role in the development and severity of wheeze. Exposure to tobacco smoking, both before and after birth, significantly increases the likelihood of a child developing wheeze.³ In addition, exposure to smoking in the household exacerbates respiratory symptoms.³ There are many other environmental factors that can cause or aggravate wheeze in children, including damp homes, dust mites, pets, food allergies, air pollution and infections.

The usefulness of a diagnosis of asthma in pre-school children is debated. The signs, symptoms and treatment described by the terms “episodic viral wheeze” and “atopic wheeze” in pre-school children (Page 11) are very similar to “episodic asthma” and “atopic asthma”, respectively.² Asthma is also commonly diagnosed in school-aged children who had previous recurrent wheeze. Because of this, some clinicians believe that wheeze and asthma are part of the same spectrum, and that giving the “label” of asthma leads to more appropriate treatment strategies.⁴ Others are reluctant to make a diagnosis of asthma when the pathology in pre-school children is largely unknown, and there may be unintended social and psychological consequences of a diagnosis of asthma which later turns out to be transient.²

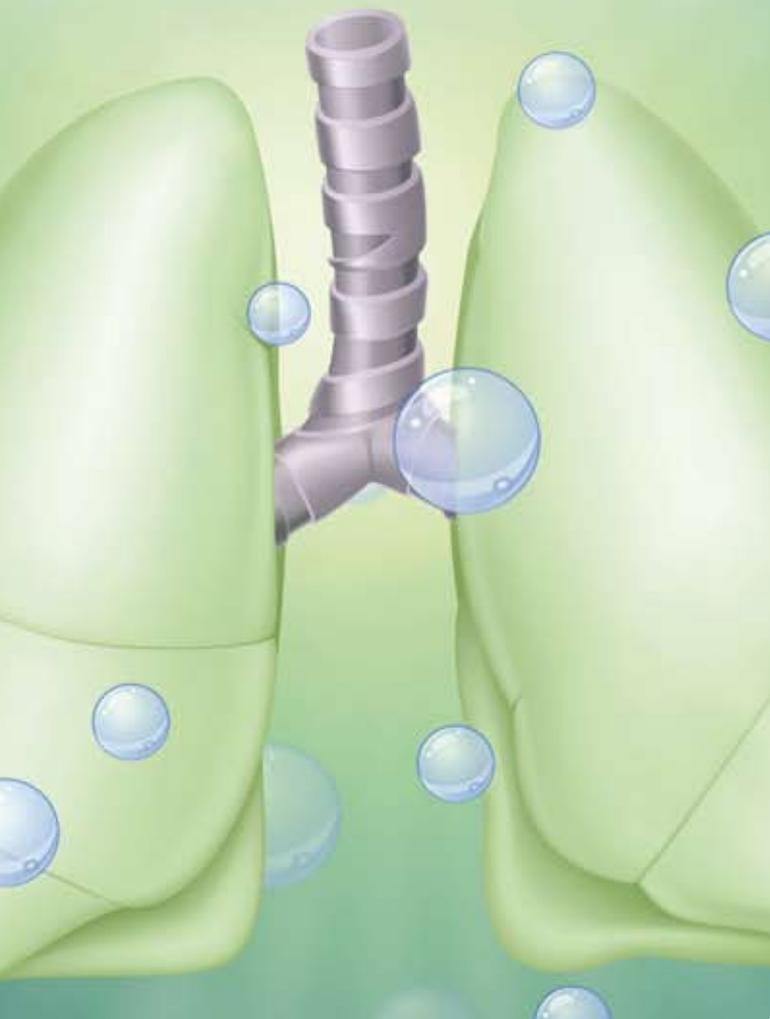
In practice, determining a definitive cause of wheeze in pre-school children requires a long-term approach, with consideration of the likelihood of the common causes, ruling out serious congenital or acquired conditions and assessment of the child’s response to treatment. The goal for primary care should be to provide symptomatic control, to manage exacerbating factors and to monitor the child rather than provide a firm diagnosis, as the presentation may change over time.

Transient infant wheeze

Transient infant wheeze is an epidemiological term for self-limiting wheeze that occurs in children aged up to three years.⁴ The term has limited clinical utility but is commonly used in the literature to describe the group of children with recurrent wheeze who grow out of their symptoms by age three years.

Children in this group are generally born with smaller airways, have reduced lung function from birth, do not have an increased family history of atopy or asthma compared to children without wheeze and have often been exposed to tobacco smoke antenatally.⁴ Prematurity and low birth weight may also be risk factors for transient infant wheeze.

In general, it is not possible to clinically differentiate transient infant wheeze from other forms of wheeze.



The causes of wheeze in pre-school children

The first step in assessing wheeze in a young child should be to establish how long the symptoms have been present. If there is a recent, sudden onset of wheeze (i.e. that day or within a few days) and there is no obvious cause, e.g. viral illness, consider the possibility of an inhaled foreign body. If the wheeze is of recent onset, but a concurrent upper respiratory tract infection is present, consider episodic viral wheeze or bronchiolitis. If wheeze has been present for several weeks/months or the child has presented multiple times with wheeze, consider atopic wheeze. However, the symptoms may also be due solely to recurrent upper respiratory tract infections.

Inhaled foreign body

An item which is sucked into the tracheobronchial system and becomes lodged can cause acute onset wheeze, dry cough and reduced lung sounds.⁵ The key finding in a child with an inhaled foreign body is that symptoms began after an episode of choking or severe coughing.⁵ However, this episode is not always observed and children may not volunteer the information.⁵ If diagnosis is delayed other symptoms may be present, including dyspnoea and a wet cough with sputum production.⁵

Serious complications of an inhaled foreign body (including pneumonia, pneumothorax and subglottic oedema) are more likely when the diagnosis is made more than 24 hours after inhalation.⁵ Long-term complications, such as recurrent pneumonia, lung abscesses and bronchiectasis, become more likely the longer diagnosis is delayed.⁵

Children with a suspected inhaled foreign body require immediate referral to a Paediatrician or emergency department.⁵

Bronchiolitis

Bronchiolitis is an acute infection of the lower respiratory tract that primarily occurs in young infants, and is most common in winter.¹ It is usually caused by respiratory syncytial virus (RSV).¹

In a child with bronchiolitis, tachypnoea, cough, hyperinflation of the chest and fine inspiratory crackles are likely.⁶ A short, tight cough is likely to be present, and airway secretions play a significant role in obstruction.⁶ The child may also have a low-grade fever (< 39°C).⁶ A high-grade fever may indicate another diagnosis, such as pneumonia, although wheeze is rare in children with bacterial pneumonia.

Bronchiolitis is the most common cause of wheezing in children aged one to six months.¹ By age ten months, the incidence of bronchiolitis is much lower, and it is rare after age one year.¹

 For further information on bronchiolitis, see: "Bronchiolitis in infants", *BPJ* 46 (Sep, 2012).

Episodic viral wheeze

Episodic viral wheeze, also referred to as non-atopic wheeze, is wheezing associated with viral upper respiratory tract infections (URTI).² Children with episodic viral wheeze do not usually display respiratory symptoms between episodes of viral infection. The most common causative viruses include rhinovirus, coronavirus, human metapneumovirus, parainfluenza virus and adenovirus.²

Symptoms include acute wheeze and dyspnoea, usually with cough, shortly after the onset of an upper respiratory illness. Children with acute viral wheeze are unlikely to have chest crackles, as seen in children with bronchiolitis. In addition, bronchiolitis is usually a single episode of acute disease, compared to recurrent infections with viral wheeze.

Episodic viral wheeze is most common in children from age ten months up until age three years.¹ Children who develop wheeze as a symptom of viral infection will usually have fewer episodes over time,² and most children with wheeze without concurrent atopy will grow out of their symptoms by, or soon after, school age. However, some children with episodic viral wheeze will go on to have a confirmed diagnosis of asthma.

Atopic wheeze

Atopic wheeze, or multiple-trigger wheeze, is recurrent/persistent wheeze, associated with atopic features and multiple exacerbating factors, e.g. cold air, night time, exercise or allergen exposure.² Symptoms occur when the child does not have a viral illness, and more severe exacerbations will be present when the child has a viral illness.²

Children with atopic wheeze are typically found to have bilateral, widespread wheeze and/or rhonchi, that are most prominent on exhalation, alongside cough, dyspnoea, prolonged expiration, increased respiratory rate and chest tightness.^{1,7} A child with recurrent wheeze with signs of atopy or eczema, positive skin-prick tests or a family history of asthma or atopy can be considered to have atopic wheeze.¹

Atopic wheeze is unusual in a child aged under two years (although it does occur), but becomes the dominant form

of wheeze after age three years.¹ In practice, it appears that almost all children with atopic wheeze go on to be diagnosed with asthma after reaching school-age. Occasionally, a child who initially has wheeze that only occurs with viral respiratory infections will develop interval symptoms over time and wheeze in response to other triggers, before eventually being diagnosed as having asthma later in childhood.

Assessing a child with wheeze

The history is the most important aspect of the assessment of wheeze in a young child.² It is important to describe wheeze to the parent/caregiver and check that this fits their description of the child's symptoms. Most people use the word "wheeze" to describe a wide range of audible breath sounds, however, the clinical definition is specific – a high-pitched, musical or whistling sound coming from the chest.¹

Enquire about:

- The nature and duration of the wheeze, including whether it is present constantly or intermittently
- The presence of other respiratory symptoms
- Exacerbating factors and triggers
- Previous episodes
- The smoking status of the household
- Whether the child has ever had eczema or other symptoms or signs of atopy
- Whether there is a family history of atopy

The physical examination is primarily used to help identify potentially serious causes of wheeze. Ideally, the child's wheeze should be assessed during the examination to confirm that it fits the clinical definition of wheeze, but this will not always be possible.²

The examination should include a general assessment of the child, including respiratory rate, heart rate, temperature and oxygen saturation (if pulse oximetry is available). In a child with acute wheeze, the examination should assess whether concurrent upper respiratory infection is present, e.g. otitis media or pharyngitis.⁸ Observe the child's chest to assess for signs of hyperinflation and respiratory distress, e.g. intercostal in-drawing and accessory muscle use. Perform auscultation of the child's chest and note any wheeze or crackles and whether there are focal sounds.

Laboratory and respiratory investigations are generally not used for assessing wheeze in pre-school aged children.² Further investigation, such as chest x-ray, is generally reserved for children in whom symptoms have been present since birth

or for children with wheeze that is unusually severe, does not respond to a trial of treatment or is accompanied by unusual clinical features.²

Peak-flow, spirometry and other assessments of lung function are generally not used in children aged under five years as they cannot provide a reliable, consistent result between tests.⁷

The management of wheeze in children

The management of pre-school children with wheeze should begin with a clear discussion with the parents/caregivers about the likely prognosis of the child's illness and limitations of treatment. Explain that the diagnosis will usually become clearer with time and that pharmacological treatment can be used to relieve symptoms, but does not alter the natural history of the child's wheeze, nor prevent the development of asthma.¹⁻³ Regular re-evaluation of the child's symptoms will be necessary as the type of wheeze can change over time, before age five years.

Lifestyle interventions for preventing exacerbations

A young child presenting with wheeze provides a good opportunity to encourage all adults in the household to stop smoking. Give smoking cessation advice and support where necessary and record the smoking status of family members. Maternal smoking during pregnancy should also be strongly discouraged.

Exacerbating factors, such as damp housing and inadequate heating in winter, should be discussed and parents assisted with solutions where possible, as these have been found to reduce childhood respiratory symptoms.

Infection prevention strategies should be discussed, particularly for children with episodic viral wheeze. Children should be up to date with their immunisation schedule and receive the influenza vaccine each year. Regular hand washing and good hygiene practices should be encouraged to avoid transmission of infections in the household or daycare environments.

Allergen avoidance has long been discussed as an early intervention for wheeze and asthma. However, there appears to be limited benefit to attempting allergy avoidance and the intervention can be difficult and costly.⁹

 For further information on smoking cessation, see: "Encouraging smoke-free pregnancies: the role of primary care", BPJ 50 (Feb, 2013) and "Update on smoking cessation", BPJ 33 (Dec, 2010).

Treating acute episodes of wheeze

Bronchodilators

Infants with **bronchiolitis** should not generally be treated with bronchodilators, as they provide minimal benefit.³

Children aged under five years with **episodic viral** or **atopic wheeze** can be trialled on a short-acting bronchodilator for symptomatic control.³

Where required, bronchodilator treatment should be with a short-acting beta-agonist (SABA).^{2, 3} Salbutamol, 100 micrograms, as required, to a maximum of 800 micrograms per day, is recommended for children.¹⁰

This should be given by inhalation using a spacer and mask. Instruction on proper use and cleaning of the device should be given.

Long-acting beta-agonists (LABAs), while potentially effective for young children with wheeze, are generally not recommended as there are few strong studies in young children illustrating their benefit or safety.²

Theophylline is not recommended for use in children with wheeze or asthma.¹¹

Oral corticosteroids

In a child with acute severe wheeze requiring hospitalisation, oral corticosteroids are recommended, and may be given while awaiting transfer. In a child with acute severe wheeze, who does not require hospitalisation, the use of oral corticosteroids is less clear, and should be based on clinical judgement. Evidence of the efficacy of oral corticosteroids in children aged under five years is limited and often conflicting, and most studies focus on older children.^{2, 3, 12}

If required, oral prednisolone can be given at 1 – 2 mg/kg per day, up to maximum of 40 mg, for three days.¹⁰

The practice of giving parents a "back-pocket" prescription for corticosteroids is not recommended in pre-school children, as it has not been shown to prevent exacerbations or hospital admission in this age group.^{2, 3}

Oral corticosteroids are associated with a range of adverse effects when used for short periods, including appetite, mood and behaviour changes. When used for longer periods (more than three months) adverse effects can be severe, including reduced growth, changes to skin, muscle weakness, Cushing's syndrome, bone weakening and increased risk of diabetes.¹⁰

Preventing symptoms between episodes

Inhaled corticosteroids

In children with **atopic wheeze** who have symptoms between viral episodes, consider the use of inhaled corticosteroids (ICS).²

In children with **episodic viral wheeze** treatment with ICS is less effective and is not commonly recommended.²

Treatment with ICS in children aged under five years with wheeze is for symptom control only, and has no effect on the long-term natural history of the condition, and does not reduce the likelihood that a child will develop persistent wheeze or progress to asthma over time.¹⁻³ The response to treatment with ICS in younger children is usually less than that seen in older children.²

The recommended ICS in children aged under five years is fluticasone 50 – 100 micrograms, twice daily, via a spacer and mask device, for up to three months.¹⁰

The ICS should be stopped (after tapering) rather than just reduced, once interval symptoms resolve. Short-term treatment with ICS is as effective as continuous use in pre-school aged children, and may limit adverse effects.¹³

The use of corticosteroids in young children may cause several adverse effects. The most significant is reduced height growth, with studies finding approximately 1 cm less height (which may persist) in children treated with ICS for two years compared to placebo.² Adrenal suppression has also been observed in children taking ICS,² but impairment on adrenocorticotrophic hormone (ACTH) stimulation tests may be more common than currently recognised.

Montelukast has a role in managing episodic and atopic wheeze

Montelukast, a leukotriene receptor antagonist, is an appropriate treatment for symptom and exacerbation control in children with **wheeze of any type**. The medicine is currently subject to Special Authority criteria for subsidy (see: "Montelukast Special Authority has changed"). The Special Authority criteria allows for use in children with intermittent wheezing, which is currently an "off-label" use.

In pre-school aged children with wheeze, continuous use of montelukast appears to moderately reduce episodes of wheeze, and intermittent use, when the first signs of an upper respiratory tract infection appear, may help control symptoms and reduce the number of visits to primary care.²

Montelukast Special Authority has changed

In November, 2013, the Special Authority requirements for subsidy of montelukast were updated. The changes occurred due to feedback that the previous requirements, particularly the requirement that exacerbations be severe enough to require hospitalisation, were too restrictive.

The Special Authority may be applied for by any relevant practitioner. For the initial application for managing wheeze in children aged under five years, both of the following criteria must be met:

1. Montelukast is to be used for the treatment of intermittent severe wheezing (possibly viral)
2. The patient has had at least three episodes of acute wheeze in the previous 12 months severe enough to seek medical attention

Renewal can be from any relevant practitioner. Approvals are valid for two years where the treatment remains appropriate and the patient is benefitting from treatment.



Montelukast may be used alone for preventing and managing exacerbations of wheeze, or can be used alongside ICS, to avoid having to increase the dose of ICS for effectiveness. It is available in a chewable tablet. The recommended dose of montelukast in children aged two to five years is 4 mg, once daily.¹⁰ The ideal duration of treatment is unclear. Twelve months of continuous treatment appears to be effective in preventing exacerbations and controlling interval symptoms. However, short-term dosing, such as seven day cycles initiated by the parent or caregiver when symptoms occur, are also effective at controlling exacerbations and episodes and may reduce the overall combined dose of the medicine.³

No clinically relevant adverse effects have been reported in children taking montelukast.²

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