Childhood asthma: Prevalence and presentation

In the first of a two-part article, **Dr Peter Greally** outlines the clinical presentation and differential diagnoses of asthma in childhood

Asthma is a chronic inflammatory condition of the lower airways. It leads to breathing difficulties due to narrowing of the bronchial tubes. It is common in childhood but may occur throughout life, even presenting for the first time with symptoms in elderly people.

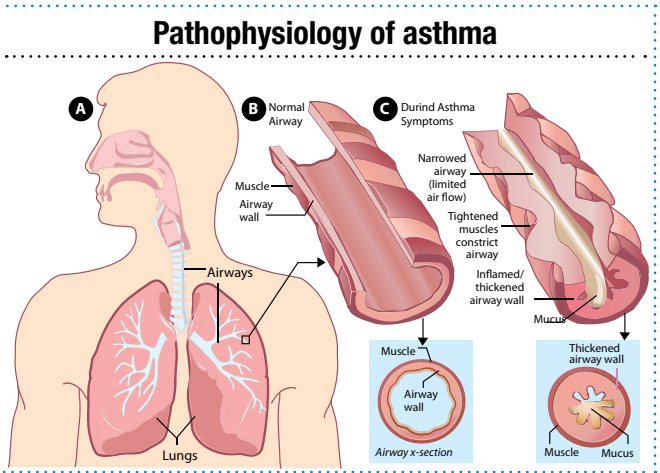
Many hypotheses have been proposed to explain asthma,[1] however to date the aetiology remains uncertain. We know that asthma tends to run in families and can co-exist with other 'atopic' conditions such as food allergy, eczema and allergic rhinitis (or hay fever). Some 80% of children with asthma are atopic and approximately 80% of those will react to house dust mite. Of children with asthma, 50% may have concurrent allergic rhinitis.

The respiratory tract actually begins at the nose, which warms and humidifies inhaled air in preparation for its passage down through the larynx and trachea. In cross section, the bronchial tubes consist of the mucosa, which is in direct contact with the inhaled air, and a smooth muscle layer, which surrounds the lining layer. In asthma, the mucosa becomes inflamed, the lining becomes swollen, the local small blood vessels become engorged and an excess of mucus is produced. The surrounding smooth muscle becomes twitchy and irritable, and can constrict the lumen of the airway *(see Figure 1)*. The net result is a generalised loss of airway calibre throughout the bronchial tree – a process known as bronchoconstriction – which leads to an obstruction to the flow of air into and especially out of the lungs. The obstruction is reversible, sometimes spontaneously, and sometimes with the aid of medications such as salbutamol or terbutaline.

Attacks or episodes of bronchoconstriction, or airway narrowing, can be induced by a variety of trigger factors, for example, exercise, viral upper respiratory tract infections, tobacco smoke, animal dander, dust mites, fumes and chemical sprays. On rare occasions, ingested substances such as aspirin, NSAIDs, carbonated drinks, tatrazine, sulphites, aspartame, metabisulphite, monosodium glutumate and food colorants can precipitate asthma episodes. Cold drinks or ice cream may also do so. Trigger factors will vary from person to person. Inflammation of the airway lining is usually a prerequisite and predisposes asthma sufferers to symptoms when they encounter these environmental triggers.

Bronchial hyper-responsiveness is another important component of the asthma syndrome. If untreated the airways are more susceptible to bronchoconstriction when exposed to specific triggers. The more severe the condition, the more likely it is that the individual will respond to a given stimulus. The degree of this susceptibility to bronchoconstriction can be quantified by inhaling histamine or methacholine and taking measurements of lung function as part of a bronchial provocation test in a safely regulated clinical environment. This approach can be used for diagnosis of the condition.

Figure 1



Prevalence and burden of disease

In Ireland, in common with other developed countries, the prevalence of asthma more than quadrupled between the 1980s and 2000. In 1983, a questionnaire was completed by almost 3,000 Irish schoolchildren (aged four to 19 years); this was repeated again nine years later in the same age group. The questionnaire screened children for asthma-like symptoms, eczema and hay fever. The researchers found that in 1983, asthma prevalence was 4.4% and that over the subsequent decade, the rate had increased to 11.9%.

More recent figures emerged from the International Study of Asthma and Allergic Conditions (ISAAC) studies. This is a series of large-population-based investigations using validated questionnaires designed to compare asthma prevalence between countries and to assess changes in epidemiology over time. Initially, children aged 13-14 years were studied, but younger groups, aged six to seven years, were subsequently included. The initial Irish study showed that asthma prevalence in 13-14 year olds was 15.2% in 1995 and by 2007 had risen to 21.6%, a relative increase of 33%.[2] Ireland comes fourth in an international league table of asthma prevalence, behind Australia, New Zealand and the UK. Follow-up ISAAC studies have generally shown no significant increases in many areas, with existing high prevalence giving rise to some authorities suggesting that the prevalence is plateauing in these regions. However, increases have been observed in regions that had low prevalence rates in the initial assessment.

In Ireland, the burden of asthma is high, with one in five Irish schoolchildren having asthma symptoms. The condition affects one-eighth of the general population and it is estimated that there are 470,000 people with asthma in Ireland. There are 5,500

hospital admissions every year; 55% of which concern children under 14 years of age. There are approximately 50 adult deaths a year due to asthma,[3] 30% of which were under 40 years of age. Fortunately, deaths in children from asthma are relatively rare, usually less than one a year.

In a study published in 2005,[4] 400 patients with current asthma in Ireland were interviewed in the Asthma Insights and Reality in Ireland (AIRI) survey to determine their healthcare utilisation, symptom severity, activity limitations and level of asthma control. Acute services were utilised by a significant number of respondents – in the previous year, 27% had either an emergency visit to the hospital or their general practitioner and 7% were hospitalised for asthma. In terms of asthma control, 19% experienced sleep disturbance at least once a week, 29% missed work or school, and 37% experienced symptoms during physical activity over the previous four-week period. Based on these findings, the level of asthma control and management in Ireland falls well short of recommended national and international asthma guidelines.[4,5]

Clinical presentation

Not all children with asthma will have the same symptoms. There can often be a preceding viral illness, with snuffles or cold-like symptoms. Symptoms will depend on the child's age; for example, infants and toddlers won't complain of exercise-related breathlessness, but will merely do less.

The symptoms of asthma can reflect the underlying pathophysiology. Wheeze is the dominant symptom of asthma, but not all wheeze is due to asthma and not every asthmatic wheezes. Wheeze is a whistling sound that occurs during exhalation; it is caused by airflow through narrowed bronchial tubes. Narrowing of the airway can be caused by conditions other than asthma. A GP will take a careful history and perform a physical examination in order to rule out the other less common possibilities.

Care must be taken before making a diagnosis of asthma in children under two years of age. Recurrent respiratory illness with wheeze is common in this age group, with identical symptoms to asthma. However, we know from longitudinal population studies like the Tucson Children's Birth Cohort, that the majority of these children are non-atopic wheezers, whose symptoms are only triggered by viral upper respiratory infection, and that the condition will subside by school age. Sometimes wheeze will be associated with chest discomfort or even pain. Pre-school children don't localise pain very well and in this age group, abdominal pain may be a manifestation of asthma.

Where cough is a symptom of asthma, it is usually dry and worse at night or on exertion. Cough may be the only symptom of asthma; however, clinicians are more reticent about making a diagnosis using only cough as the basis.

In older children who participate in more formal exercise, it may be noticed that they can't keep up or that they lack stamina. Sometimes these children opt for more sedentary pursuits or, instead of playing midfield for example, prefer to play in goal. It has been shown using accelerometers (devices which measure the physical activity through footsteps) that asthmatic children are less active than their peers.

Exertional symptoms can reflect poor asthma control, yet exercise symptoms may dominate and can occur against a background of generally good control. There is a specific form of asthma where exercise is the only trigger – this is termed exercise-induced asthma.

Differential diagnosis

'All that wheezes is not asthma'. Many, much rarer conditions can be associated with narrowing of the airway and can produce wheeze and cough, thus mimicking asthma:

Inhaled foreign body: Inhalation of a foreign body such as a peanut can often occur in a pre-school child. A history of choking will be present in only 50% of cases. Treatment involves removal of the foreign body by bronchoscopy, under general anaesthetic.

Cystic fibrosis (CF): This is a life-shortening genetic condition of mucus-producing cells throughout the body. It principally affects the lungs, sweat glands and pancreas. It may present with cough, wheeze and breathlessness, which may be confused with asthma. Children with CF may also have loose stools and be underweight. The condition is diagnosed by sweat test. Newborn screening for CF in Ireland was introduced in July 2011.

Congenital airway abnormalities: These include tracheomalacia or bronchomalacia where localised weakness of the airway wall leads to floppiness and collapse of the airway, leading to wheeze.

Inherited immune deficiency: There are many disorders of the immune system which predispose affected children to respiratory infections and wheeze. The most common type is IgA deficiency, which affects one in 600 people and is often associated with atopy and asthma.

Primary ciliary dyskinesia: Cilia are projections that extrude from respiratory cells. Their function is to facilitate clearance of microbes and pollutants from both the upper and lower respiratory tracts. Rarely, in some children, these cilia fail to function correctly, which may result in recurrent upper and lower respiratory tract infection. Primary ciliary dyskinesia is treated with chest physiotherapy; respiratory infection is treated with antibiotics.

Bronchiectasis: This is a disease state defined by localised, irreversible dilation of part of the bronchial tree. It may be caused by a severe pneumonia, immune deficiency, CF or ciliary dyskinesia.

Gastro-oesophageal reflux with aspiration: This is where the contents of the stomach are passed back into the gullet (because of malfunction of the valve or sphincter, between stomach and oesophagus) and then inhaled into the respiratory tract.

Direct aspiration (via fistula between trachea and oesophagus): Very rarely, infants can be born with communications between the respiratory tract and the gullet, where formula can pass into the respiratory tract, leading to coughing and wheeze. Symptoms often occur after feeds. Surgical closure of the defect is required.

Vocal cord dysfunction (VCD): This is a condition that affects the vocal cords, which is characterised by full or partial vocal fold closure, which usually occurs during inhalation for short periods of time; however, the condition can occur during both inhalation and exhalation. VCD can produce an expiratory sound which may mimic asthma. The condition is diagnosed at laryngoscopy and treatment usually consists of speech and language therapy.

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Next month: Childhood asthma – Diagnosis, treatment and assessment

References

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