Reminder of important clinical lesson

All that wheezes is not asthma: a 6-year-old with foreign body aspiration and no suggestive history

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Summary

The authors report the case of a 6-year-old girl, presenting with a 4-month history of wheeze associated with barking cough which frequently became wet requiring antibiotics. Her care was transferred to a paediatrician with specialist interest in paediatric respiratory medicine when she had continued symptoms despite bronchodilators and oral steroids for suspected asthma. Spirometry showed a forced expiratory volume 1 of 79% with no evidence of reversibility. The child was investigated for chronic wet cough. Immunoglobulins, sweat test and chest x-ray were all normal. There was no history suggestive of foreign body aspiration (FBA). Tracheomalacia was considered in view of the nature of the cough. The recurrence of an unusual inspiratory noise prompted referral for bronchoscopy. A small piece of plastic tube was removed from the bronchus intermedius. All symptoms resolved. The importance of clinical assessment to ascertain 'wheeze' when acutely unwell is emphasised. Current literature concerning FBA is reviewed.

BACKGROUND

Approximately 1.1 million children in England and Wales receive treatment for asthma.¹ Asthma, by definition, is a chronic inflammatory disorder of the airways which causes recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning in susceptible individuals.² These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes an associated increase in the existing bronchial hyper-responsiveness to a variety of stimuli.²

Children presenting with wheeze and cough may be referred to a paediatric outpatient department with a pre-existing label of asthma. Asthma is a clinical diagnosis and the history and examination are paramount for making an accurate diagnosis. This case illustrates the importance of going back to basics with a detailed history and examination at the initial consultation. It is not sufficient to accept a label of asthma given by another clinician without reviewing symptoms and signs for yourself to ensure that they satisfy the definition. It is important to challenge a diagnostic label when deviations from the typical picture exist.

The report highlights the usefulness of reviewing a child at a time when he/she is acutely unwell in order to understand what a parent means by wheeze. In this case, the child's main symptom when acutely unwell was a harsh barking cough, and she had evidence of a high-pitched inspiratory noise of musical quality on repeat examination with no evidence of expiratory noise or prolonged expiration.

The importance of a good knowledge of respiratory anatomy and physiology is also emphasised. Clinical application of this knowledge enables an understanding of the variable nature of the symptoms and signs associated

with foreign body aspiration (FBA), as this is dependent on the site of airways obstruction.

CASE PRESENTATION

A 6-year-old girl was referred to the general paediatric outpatients department with a 4-month history of wheeze associated with intermittent dry cough. The wheeze was reported to occur throughout the day with no particular triggers. There was no personal history of atopy, but there was a history of asthma in an older brother. She was born at term and there were no neonatal problems. Her development was age appropriate and she was up to date with all immunisations. The child had been started on Clenil Modulite (200 µm twice daily) by her general practitioner (GP) but this was not felt to have provided any relief of her symptoms. On examination she was growing appropriately with height and weight on the 75th centiles. She had no finger-clubbing or evidence of lymphadenopathy and had a normal chest shape. Bilateral wheeze was described on auscultation. Salbutamol was administered via a volumatic spacer device with a reported reduction in wheeze. A diagnosis of asthma was considered and she was prescribed a salbutamol metered-dose inhaler to use via a volumatic spacer device as required in addition to her inhaled corticosteroid and a 5-day course of oral prednisolone.

At review by a consultant general paediatrician 8 weeks later, the child's parents continued to report daily wheeze despite treatment, with no reported improvement with bronchodilator use. The course of oral steroids had made no difference to symptoms. She had polyphonic wheeze on auscultation. Her inhaler technique was checked by a paediatric respiratory nurse specialist and was found to be appropriate. Spirometry was performed with a forced expiratory volume in 1 sec (FEV1) of 1.15 (79%) and a forced vital capacity (FVC) of 1.37 (93%) giving a normal

FEV1 to FVC ratio of 84%. There was no evidence of reversibility with an FEV1 of 1.16 (80%), an FVC of 1.31 (89%) and an FEV1-to-FVC ratio of 89% after 10 puffs of salbutamol 100 µg via a volumatic spacer device. The consultant paediatrician referred her to a paediatrician with a specialist interest in paediatric respiratory medicine for further review in the light of her continued symptoms despite asthma treatment.

On review, the child was reported to have ongoing wheeze, day and night, with no specific triggers. She had no associated breathlessness and could take part in gymnastics twice a week without any difficulties. She had no history of cough or wheeze in early childhood. There was no history of choking episodes, difficulties swallowing fluids or solids or obstructive features during sleep. Clinical examination revealed a harsh, barking wet cough but normal voice. She had equal air entry on auscultation with an inspiratory 'squeak' throughout both lung fields which the parents described as 'wheeze'. There was no evidence of an expiratory noise and expiration was not prolonged. Systemic examination was otherwise unremarkable. A diagnosis of possible tracheomalacia was made in light of the symptoms of harsh, barking wet cough. A cough swab was sent for culture and sensitivity with no pathogens isolated. The child received a 7-day course of oral amoxicillin, her inhaled medication was discontinued and plans were made for physiotherapy referral. The parents were informed that she did not have asthma.

At review, 2 months later, the child presented with a further episode of wet barking cough and was found to have reduced air entry at the right base but no inspiratory noise on this occasion. She had received an interim course of antibiotics from her GP and was started on a 14-day course of high dose coamoxiclav for secondary lower respiratory tract infection. Investigations were initiated for chronic wet cough at this stage including sweat test, immunological investigations and a chest x-ray (CXR). Repeat cough swab isolated no pathogens.

At follow-up, the clinical findings were not fully explained by the diagnosis of tracheomalacia. The child had a dry, barking-induced cough but the high-pitched inspiratory noise had returned, audible throughout both lung fields and described as being musical in quality and loudest on deep inspiration. Furthermore, the child had been completely well from a respiratory point of view in early childhood with onset of wheeze and cough starting acutely 4 months prior to initial referral. A possibility of acquired large airway obstructive lesion was considered and she was referred to the regional tertiary paediatric respiratory team for consideration for bronchoscopy.

INVESTIGATIONS

Full blood count: normal: haemoglobin 120 g/l, white cell count $5.97 \times 10^9/l$, neutrophil count $3.10 \times 10^9/l$ and platelets $313 \times 10^9/l$.

Immunoglobulins: normal: IgG 9, IgA 1.31 and IgM 1.4 g/l.

Specific antibodies to *Haemophilus Influenza B* (HIB), tetanus and pneumococcus:

Normal pneumococcal antibody titres 52 mg/l; low HIB 0.4 mg/l and tetanus antibodies 0.45 IU/ml with appropriate response to booster vaccinations (HIB >9 mg/l and tetanus antibody greater than 7 IU/ml, as demonstrated by titres taken 6 weeks after vaccination).

Figure 1 Chest x-ray.

IgE and radioallergosorbent tests to house dust mites, cat, dog, tree pollen, grass pollen and mould: borderline: IgE 66 IU/ml (range 0–60) but no evidence of sensitisation to aeroallergens including cat, dog, house dust mite, tree pollen, grass pollen and moulds (specific IgE grade 0).

Sweat test: normal: sweat chloride 9 mmol/l.

CXR: clear lung fields (figure 1).

Repeat cough swabs ×2: No respiratory pathogens isolated.

DIFFERENTIAL DIAGNOSIS

The most important initial diagnostic challenge was confirming that the child did not meet the criteria for asthma and to remove this label when it became apparent this was not the case. This required careful consideration of symptoms and signs in light of the definition of asthma.² The child's noisy breathing was described by parents as wheeze. Careful repeated examination when the child was acutely unwell, confirmed that the noise that the parents were hearing was a high-pitched inspiratory large airways noise that was musical in character, was loudest on deep inspiration and was not associated with prolonged expiration. The child's symptoms had no specific triggers, no diurnal variation and no response to inhaled bronchodilators or oral steroids. There was no personal history of atopy. There was no evidence of reversibility to salbutamol and no improvement in symptoms despite a trial of inhaled steroids and a short course of oral steroids.

Discussion on the differential diagnosis of cough and wheeze in a child is beyond the scope of this report. However, we can formulate a differential diagnosis list tailored to our additional clinical findings. The differential diagnoses to consider for this previously fit and well child with the symptoms of harsh, wet barking cough, recurrent lower respiratory tract infection (LRTI) and a recurrent high-pitched inspiratory noise on auscultation are:

1. Tracheomalacia—tracheomalacia is a weakness of the trachea, frequently due to reduction and/or atrophy of

elastic fibres or impaired cartilage integrity, causing the airway to be softer and more susceptible to collapse.³ Although tracheomalacia is usually troublesome in infancy, some cases do not cause problems until later in childhood.⁴ The child had a barking, harsh cough which was felt to be tracheal sounding and was intermittently wet suggesting secondary LRTI. However, this diagnosis alone did not explain the variable presence of a high pitched inspiratory noise.

2. Upper airways obstruction—this can be congenital or acquired. Intrathoracic lesions can include mediastinal masses, including tumours, thymic lesions, bronchogenic cysts, angiomatous lesions, and enlarged lymph nodes. Extrathoracic obstruction can include subglottic stenosis, laryngeal cysts, web or clefts, haemangiomas, papillomas and foreign body. Congenital airway abnormalities seemed less likely in view of absence of preceding respiratory morbidity.
3. Chronic endobronchial infection—chronic purulent bronchitis is seen in some young children who have no identifiable abnormalities in immunity or other underlying disease and have prolonged periods of cough. Diagnosis requires flexible bronchoscopy and bronchoalveolar lavage (BAL).⁵ The child had evidence of low HIB and tetanus antibody titres which were boosted with vaccination. However, chronic endobronchial infection did not explain the presence of a high pitched inspiratory noise.
4. Vocal cord dysfunction—a functional disorder of the vocal cords may be misdiagnosed as asthma on the basis of an inappropriate description of wheezing. Vocal cord dysfunction syndrome can produce the high-pitched inspiratory stridor caused by paradoxical adduction of the vocal cords during inspiration. The child had no change in quality to voice and her symptoms were not triggered by exercise.
5. FBA—the clinical signs following FBA depend upon the site of airway obstruction. The clinical signs may also change with changing position of the foreign body. Typically, inspiratory noises are associated with extrathoracic abnormalities and expiratory noises with intrathoracic abnormalities. FBA can be a cause of true wheezing if there is partial obstruction of a bronchus. In this child, there was no suggestive history and her CXR was normal. However, she had a recurrent wet cough and changing clinical signs, with an unusual inspiratory noise, therefore this diagnosis needed to be considered in the differential.

TREATMENT

The first and most important treatment was to discontinue all inhaled medication and any further courses of oral steroids once the diagnosis of asthma was refuted.

Tracheomalacia was subsequently suspected. This can be associated with lower respiratory tract infections and requires early recognition of symptoms of wet cough and prompt treatment of the child with antibiotics. Cough swabs should be taken for culture and sensitivity and the child referred for physiotherapy. The child in this case received booster vaccinations for low HIB and tetanus antibody titres and postvaccination antibody responses were satisfactory.

Figure 2 Foreign body removed from airway-end on view.

A referral for bronchoscopy was made due to ongoing clinical signs that were not consistent with a diagnosis of tracheomalacia alone. The purpose of the bronchoscopy was to inspect airways anatomy, to look for evidence of endobronchial infection and to take a BAL specimen for culture and sensitivity as appropriate. The ultimate treatment was removal of the foreign body with antibiotic treatment for associated secondary infection.

OUTCOME AND FOLLOW-UP

The child underwent bronchoscopy under the care of the regional tertiary paediatric respiratory team. A large plug of mucus was seen partially obstructing the bronchus intermedius. After further suctioning of this plug, a tubular plastic foreign body was seen in the airway (figures 2 and 3). This was successfully removed and the remaining secretions suctioned. The child received a further 14-day course of coamoxiclav as an empirical treatment.

Figure 3 Foreign body removed from airway-side view.

At follow-up, 8 weeks postbronchoscopy, the child was completely asymptomatic with a normal examination. Even in retrospect, the child and her family could not recall any incident of coughing or choking suggestive of possible FBA.

DISCUSSION

The peak incidence of FBA in children occurs between 1 and 3 years.^{6,7} The higher incidence in younger children has been attributed to poor chewing ability from a lack of posterior dentition (molars), a tendency of these children to explore their world using their mouths and a tendency to have frequent, vigorous, uninhibited inspiration when startled, laughing or crying.⁸ Organic foreign bodies (FB) are most common in this peak age group, including peanuts and other seeds. The majority of aspirated objects are organic in nature, mainly food. Peanuts are the cause most commonly identified.⁹ Dried foods may cause progressive obstruction as they absorb water.¹⁰ Plastic, wooden and metal object aspirations are more common in older children.¹¹ FBA in children has been shown to have a slight male predominance.¹⁰

FB may become lodged anywhere within the larynx or tracheobronchial tree. The left main bronchus is smaller than the right main bronchus and is slightly angled.¹⁰ Therefore the right main bronchus is a common location for an aspirated foreign body as FB are generally aspirated in the upright position. In a review of 1068 FBAs in children, the authors found the location of 3% in the larynx, 13% in the trachea, 52% in the right main bronchus, 6% in the right lower lobe bronchus, fewer than 1% in the right middle lobe bronchus, 18% in the left main bronchus, 5% in the left lower lobe bronchus¹² and 2% were bilateral.¹²

The clinical presentation of FBA is variable, and symptoms and signs may change if the position of the foreign body changes. The clinical spectrum ranges from asymptomatic, when FB are small and located deep within the airways, to respiratory failure when objects are located at the epiglottis or at the carina.⁹ The history of a choking crisis has been reported to have a sensitivity of 97% and a specificity of 63% in FBA. However, it is reported that a positive history of a choking crisis could not be obtained in 13–49% of children subsequently confirmed to have FBA.¹³

The location of the FB is important in terms of symptom development. If a foreign body is lodged in the supraglottic region, a child will present with cough, dyspnoea, salivation and voice changes. A laryngeal location presents with stridor, cough, voice changes and severe difficulty in breathing. A tracheal foreign body can be intrathoracic, typically presenting with signs of expiratory wheeze±inspiratory stridor. An extrathoracic tracheal foreign body typically presents with signs of inspiratory stridor±expiratory wheeze. When a foreign body is lodged in a main stem bronchus the symptoms can vary from the child being asymptomatic to presenting with cough and wheeze with localised signs on examination.⁹ Localised wheeze or diminished breathing sounds from the affected lung are the most common findings secondary to the commonest location of a foreign body being

within the bronchi.¹⁴ However, physical examination has also been reported to be normal or non-specific in 20–40% of children.⁹ In the case reported, it is postulated that the foreign body was initially positioned in the trachea with possible migration into the bronchus intermedius around the time when focal right-sided chest signs were identified.

A CXR is the initial investigation of choice. It is important to look indirectly for signs of the foreign body, as most are food substances and therefore radiolucent.¹⁰ Evidence of unilateral hyperinflation on CXR would be in keeping with a foreign body sited in a main stem bronchus. Analysis of chest radiographs in children with suspected FBA demonstrated that 119 (74%) of the 160 children had pathological findings, namely focal hyperinflation and/or mediastinal shift (sensitivity, 86.1%; specificity, 63.2%).¹³ Only 4% of FB (5/122) were radiopaque.¹³ If the possibility of foreign body is significant but has not been diagnosed by physical examination or radiographic studies, flexible bronchoscopy should be considered.¹⁰ Diagnosis is made when the foreign body is identified in the airway. Bronchoscopy is the only procedure that can be both diagnostic and therapeutic.¹¹ The complication rate of bronchoscopy for FBA is reported to be between 0.9% and 25.9%. Mortality, on the other hand, varies between 0% and 1.4%.¹⁵

Recognition of possible FBA is important, as there is a significant associated respiratory morbidity. The more difficult cases are those in which aspiration is not witnessed or is unrecognised and, therefore, is unsuspected. In these situations, the child may present late with persistent or recurrent cough, wheezing, persistent or recurrent pneumonia, lung abscess, focal bronchiectasis or haemoptysis.¹⁴ In a study of 174 children with FBA, clinical, radiological and bronchoscopic findings were evaluated according to the nature of foreign body and elapsed time from aspiration to diagnosis.¹⁶ Cough, recurrent pneumonia and fever were the most common presenting symptoms in patients with delayed diagnosis.¹⁶ Long-term follow-up was available for 110 patients for a mean duration of 37.8±23.7 months (range, 1–88 months).¹⁶ Bronchiectasis was found to be a major complication, identified in 25% of patients whose diagnosis was delayed by more than 30 days.¹⁶ Factors associated with a worse prognosis are prolonged presence of the FB in the airway, the presence of an FB which impacts on the left bronchial segments and atelectasis on the CXR.¹²

A careful history and examination are required in a child where FBA is suspected. However, it is equally important to include questions concerning recollection of an episode of coughing or choking during a routine respiratory history for any child presenting with recurrent noisy breathing or cough. This case reported highlights that, even in retrospect, a suggestive history may not be available. It emphasises the importance of considering the diagnosis, even in the absence of a history, when there are unusual clinical signs that suggest an airway abnormality which do not fit a typical diagnostic picture. This is critical in order to prevent the recognised complications that are known to arise through delayed diagnosis.

Learning points

- ▶ The key to formulating a differential diagnoses is a thorough clinical history and detailed examination. It is particularly important not to simply accept a diagnostic label given previously without revisiting the history.
- ▶ It is important to challenge a diagnostic label such as asthma and consider alternative diagnoses when deviations from the typical picture exist.
- ▶ The opportunity to see a child when acutely unwell is invaluable, as a parent's description of a respiratory noise as wheeze may well be inaccurate.
- ▶ Airway foreign bodies should be considered in the differential diagnosis of a child with chronic cough and wheeze, even in the absence of a suggestive history and in the presence of a normal chest x-ray.
- ▶ Knowledge of airways anatomy and physiology improves understanding of the varied clinical presentation of foreign body aspiration in children.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. Where do we stand? Asthma in the UK today. Asthma. UK, 2006. <http://www.stayinghealthyatwork.co.uk/documents/HealthAwareness/wheredowestand2.pdf> (accessed 21 Aug 2012).
2. International consensus report on diagnosis and treatment of asthma. *Eur Respir J* 1992;**5**:601–41.
3. **Carden KA**, Boisselle PM, Waltz DA, *et al*. Tracheomalacia and tracheobronchomalacia in children and adults: an in-depth review. *Chest* 2005;**127**:984.
4. **Wood RE**. Localized tracheomalacia or bronchomalacia in children with intractable cough. *J Pediatr* 1990;**116**:404–6.
5. **Weinberger M**, Abu-Hasan M. Pseudo-asthma: when cough, wheezing, and dyspnea are not asthma. *Pediatrics* 2007;**120**:855.
6. **Mu L**, He P, Sun D. Inhalation of foreign bodies in Chinese children: a review of 400 cases. *Laryngoscope* 1991;**101**:657–60.
7. **Wai PM**, Chung LW, Kwok FH, *et al*. A prospective study of foreign-body ingestion in 311 children. *Int J Pediatr Otorhinolaryngol* 2001;**58**:37–45.
8. **Tan HKK**, Brown K, McGill T, *et al*. Airway foreign bodies (FB): a 10-year review. *Int J Pediatr Otorhinolaryngol* 2000;**56**:91–9.
9. **Lima AB**, Fischer GB. Foreign body aspiration in children. *Paed Resp Rev* 2002;**3**:303–7.
10. **Michael RB**. Pediatric Airway Foreign Body. <http://emedicine.medscape.com/article/1001253-overview> (accessed 21 Aug 2012).
11. **Darrow DH**, Holinger LD. Aerodigestive tract foreign bodies in the older child and adolescent. *Ann Otol Rhinol Laryngol* 1996;**105**:267–71.
12. **Eren S**, Balci AE, Dikici B, *et al*. Foreign body aspiration in children: experience of 1160 cases. *Ann Trop Paediatr* 2003;**23**:31–7.
13. **Heyer CM**, Bollmeier ME, Rossler L, *et al*. Evaluation of clinical, radiologic, and laboratory prebronchoscopy findings in children with suspected foreign body aspiration. *J Pediatr Surg* 2006;**41**:1882–8.
14. **Bloom DC**, Christenson TE, Manning SC, *et al*. Plastic laryngeal foreign bodies in children: a diagnostic challenge. *Int J Pediatr Otorhinolaryngol* 2005;**69**:657–62.
15. **Kiyan G**, Gocmen B, Tugtepe H, *et al*. Foreign body aspiration in children: the value of diagnostic criteria. *Int J Pediatr Otorhinolaryngol* 2009;**73**:963–7.
16. **Karakoc F**, Karadag B, Akbenlioglu C. Foreign body aspiration: what is the outcome? *Pediatr Pulmonol* 2002;**34**:30–6.

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