

# Asthma in childhood

Marie Claire Formosa

## Case scenario

A 4 year old girl, has been brought to the clinic by her parents due to three episodes of coughing and wheezing, with the first episode occurring approximately 6 months previously. The child has a history of eczema and her mother suffered from asthma. The father is a smoker. This is a case of asthma in childhood. What is the cause of asthma and how is such a case managed in general practice?

## Introduction

Asthma is the commonest chronic lung disease in children characterized by chronic inflammation of the airways leading to obstruction of airflow.<sup>1,2</sup> This may be completely or partially reversed with or without specific therapy. Asthma exacerbations are episodic but airway inflammation is chronically present.<sup>3</sup> Estimates of prevalence of asthma range from 7% in France and Germany to 11% in the USA and 15 to 18% in the United Kingdom. Approximately 20% of these patients have severe asthma, of which 20% is inadequately controlled.<sup>4</sup> Peak age of onset is 5 years, where it is more common in boys than girls, at a ratio of 3:2.<sup>5</sup> During adolescence, the prevalence is equal among males and females. Globally, morbidity and mortality associated with asthma have increased over the last 2 decades.<sup>2</sup>

## Predisposing and triggering factors

The development of asthma in childhood is due to an interaction between environmental and genetic factors. There is no single gene for asthma.<sup>6,7</sup> Asthma is associated with a genetic predisposition to atopy, with an atopic component present in 40% of patients, in the form of a personal or familial history of eczema, hay fever and urticaria.<sup>5</sup> Approximately 79% to 90% of children with asthma have allergy.<sup>8</sup>

Common environmental triggers for asthma include exposure to allergens such as those from house dust mites, animals with fur, cockroaches, pollen, molds and tobacco smoke.<sup>3</sup> However the “hygiene hypothesis” claims that living in a clean environment predisposes the immune system towards allergic reactivity. In fact a large number of studies have consistently shown that growing up on a farm in various rural areas in Europe confers protection from the development of hay fever, atopic sensitization and asthma from childhood into young adulthood.<sup>9</sup> The early exposure to other children, domestic animals and less frequent use of antibiotics also has a protective effect.<sup>8</sup> Exposure to environmental tobacco smoke worsens asthma control. Reduced smoking in the home and for young adults smoking restriction on the work place may lower the prevalence of asthma, improve asthma control, and reduce the use of medical services.<sup>10</sup> A bidirectional relationship might also be present between asthma and smoking in adolescents. Non-smoking adolescents with current diagnosed asthma and with more severe asthma have an increased risk to become regular smokers. Among girls and adolescents with a smoking mother, having asthma symptoms can be protective for experimental smoking. With regards to the effect of smoking on asthma, adolescent

## Key words

Asthma, paediatrics

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**Table 1:** Consider asthma if any of the following signs or symptoms are present<sup>3</sup>:

- Frequent episodes of wheezing – more than once a month
- Activity-induced cough or wheeze
- Cough particularly at night during periods without viral infections
- Absence of seasonal variation in wheeze
- Symptoms persist after three years of age
- Symptoms occur or worsen in the presence of triggering factors
- The child's colds repeatedly "go to the chest" or take more than 10 days to clear up.
- Symptoms improve when asthma medication is given

smoking predicts a higher incidence of asthma symptoms. In addition, smoking leads to an increased symptom severity score, and this effect seems to be stronger in girls.<sup>11</sup> There is also evidence for an association between asthma and air pollutants, including ozone, NO<sub>2</sub> and particulate matter. Air pollution research is evolving rapidly and in the near future, clinicians and public health agencies may provide recommendations for asthmatics that go beyond paying attention to the air-pollution forecast.<sup>12</sup> Viral infections are important triggers of asthma. Infants hospitalized with bronchiolitis are at significantly increased risk for both recurrent wheezing and childhood asthma. It is not known whether viral bronchiolitis directly contributes to asthma causation or simply identifies infants at risk for subsequent wheezing. Alternatively the properties of the infecting virus may be important. A genetic susceptibility to asthma after viral bronchiolitis might be present.<sup>13</sup> Bacterial infections may also be responsible. In fact neonates colonized in the hypopharyngeal region with *S. pneumoniae*, *H. influenzae* or *M. catarrhalis*, or with a combination of these organisms, are at increased risk for recurrent wheeze and asthma early in life.<sup>14</sup> Asthma and excessive body weight frequently coexist. Excessive body weight is associated with an additional decrease in quality of life in children with asthma.<sup>15</sup> Other triggers include exercise, cold air, strong emotional expressions, (e.g. laughing and crying) chemical irritants, drugs such as aspirin and beta blockers and aggravating conditions not appropriately treated (e.g. rhinitis, sinusitis, gastroesophageal reflux).<sup>3,8</sup>

### Clinical features

Asthma is characterized by recurring episodes of wheezing, breathlessness, chest tightness and coughing. Between attacks the child may be asymptomatic with no abnormal physical signs.<sup>5</sup> A history of persistent cough (cough-variant asthma), night coughs, exercise induced cough, post-tussive emesis from copious amounts of mucus and cough following cold air exposure are all suggestive of asthma. Abdominal pain is common owing to the use of accessory muscles.<sup>1</sup> The child may also complain of

**Table 2:** Differential diagnosis of wheezing<sup>1</sup>

#### Respiratory causes

(Common)

- Infection
- Foreign body
- Cystic fibrosis
- Laryngotracheomalacia

(Uncommon)

- Bronchopulmonary dysplasia
- $\alpha$ 1-antitrypsin deficiency
- Allergic bronchopulmonary aspergillosis
- Ciliary dyskinesia syndrome
- Hypersensitivity pneumonitis
- Bronchiectasis
- Pulmonary hemosiderosis
- Visceral larva migrans – hypereosinophilic disorders

#### Cardiovascular causes

- Congenital heart disease
- Vascular rings/slings

#### Gastrointestinal

- Gastroesophageal reflux
- H-type tracheo-esophageal fistula
- Foreign body

#### Miscellaneous

- Immunodeficiency disorder
- Vasculitis, collagen vascular disease
- Psychogenic cough

#### Consider alternate diagnosis if<sup>8</sup>

- Failure to thrive
- Cyanosis at feeding
- Vomiting at feeding
- Failure to respond to appropriate treatment
- Clubbing

fatigue and becomes easily irritated. Infants may have difficulty feeding or may grunt during sucking. Older children may avoid certain activities such as sports and sleep-overs.<sup>8</sup> Most children who develop wheezing after 5 years of age have asthma.<sup>3</sup> The nature of wheezing changes with the severity of the asthma. In the mildest form, wheezing is only end-expiratory. As severity increases, the wheeze lasts throughout expiration, and may even be present during inspiration. In most severe cases, air flow may be so limited that wheezing may be absent.<sup>2</sup>

Any child with asthma can experience a life-threatening episode.<sup>8</sup> During acute episodes, the physical examination may reveal a hyper-inflated chest that is hyper-resonant

to percussion. Tachypnea, tachycardia, cough, inspiratory and expiratory wheezing, and a prolonged expiratory phase are common clinical signs. As the attack progresses there is cyanosis, use of accessory muscles of respiration, decreased breath sounds (tight silent chest) and diminished wheezing, agitation and inability to speak, tripod sitting position, and *pulsus paradoxus*.<sup>1</sup>

If the child is in imminent respiratory arrest, in addition to the aforementioned symptoms, there is drowsiness and confusion. However, adolescents may not have these symptoms until they are in frank respiratory failure.<sup>2</sup>

## Diagnosis

Asthma can be diagnosed on the basis of the patient's symptoms and medical history (Table 1). This disease is frequently under-diagnosed and many patients do not receive adequate therapy. On the other hand, not all wheeze and cough are caused by asthma and caution is needed to avoid prescribing asthma therapy unnecessarily (Table 2).<sup>3</sup>

Lung function measurement helps diagnosis and also assessment of asthma severity. Spirometry is the preferred method, but this may not be feasible in young children, particularly under the age of 4 years. Moreover some children cannot conduct the manoeuvre adequately until after age 7. For these children, the diagnosis of asthma has to be based largely on clinical judgement and an assessment of symptoms and physical findings and usually on the response to a trial of inhaled bronchodilator and/or corticosteroid therapy.<sup>3</sup> Newer techniques, such as a measurement of airway resistance using impulse oscillometry system are being evaluated for this population of patients.<sup>2</sup> In children who can perform spirometry an increase in FEV<sub>1</sub> of more than or equal to 12% or 200ml after administration of a bronchodilator indicates reversible airflow limitation consistent with asthma. However most asthma patients will not exhibit reversibility at each assessment, and repeated testing is advised.

Peak expiratory flow (PEF) measurements can also be utilised in monitoring of asthma. PEF measurements are ideally

compared to the patient's own previous best measurements using his/her own peak flow meter. A diary of symptoms and PEF readings should be kept. An improvement of 60L/min (or  $\geq 30\%$  of the prebronchodilator PEF) after the inhalation of a bronchodilator, or diurnal variation of PEF of more than 20% (with twice daily readings, more than 10%) suggests uncontrolled asthma.<sup>3</sup> Patients and parents can be advised on how to alter their treatment according to the PEF values (Table 3).

Chest radiographs in both posteroanterior and lateral views should be obtained in all new wheezing patients to identify anatomic abnormalities, atelectasis, foreign bodies or neoplasms.<sup>1</sup> If the child is a known asthmatic and there is not suspicion of infection, radiology is not required for every admission.<sup>5</sup> If a full blood count is taken it may show an eosinophilia. Allergy testing is recommended for children with persistent asthma who are exposed to perennial indoor allergens and is helpful for diagnosing relevant allergic factors that may contribute to asthma severity.<sup>8</sup>

## Treatment

Asthma can be primarily treated in the community with most patients achieving good control of their disease.<sup>5</sup> A holistic approach is required.

## Patient, family and doctor partnership and education

The children and their families need to be actively involved in managing asthma. Education should begin at the time of the diagnosis and continue at every step of clinical care. Knowledge about avoiding risk factors, how to take the medication correctly and understanding the difference between controller and reliever medications is crucial for optimal control, together with information on how to monitor the asthma control status, recognize signs of worsening asthma and take the appropriate action.<sup>3</sup> A written personal asthma action plan that is appropriate and practical should be prepared with the collaboration of the doctor, child, and family members<sup>3</sup> since a relationship between parental beliefs about asthma medications and medication adherence exists.<sup>17</sup> As children grow older they need education about what is happening especially adolescents who would benefit from receiving all information themselves.<sup>8</sup> Using known personalities who themselves have asthma and using teen support groups can be very affective. Parents should support the teenager's efforts toward self-management, but still be involved in their children's care.

Children with asthma require regular monitoring. Information about symptom patterns over the past 2 weeks (particularly night and early morning symptoms) and school absenteeism and limitation of daily activities due to asthma should be sought. For infants it is important to ask about difficulty with feeding, changes in respiratory rate, retractions, irritability and weight loss.

The older child spends a substantial amount of hours at school. The school should be given an action plan including

**Table 3: The Peak Flow Zone System<sup>8</sup>**

**>80% \*GREEN ZONE: Good control**

- No asthma symptoms
- Take medications as usual

**50-80% \* YELLOW ZONE: Caution**

- Use a short-acting inhaled  $\beta_2$ -agonist
- Check about changing medications or increasing dose

**<50% \* RED ZONE – Medical alert**

- Use a short-acting inhaled  $\beta_2$ -agonist
- Call doctor or emergency department

early warning signs of an asthma episode, what medications the student uses and how they should be taken. The parents should be encouraged to meet with the teacher, school nurse and perhaps the principal at the beginning of the school year to make them aware of the child's needs regarding asthma.<sup>8</sup>

### Identifying and reducing exposure to risk factors

Allergen avoidance can produce changes in disease activity and symptoms, before any medical intervention is implemented.<sup>18,19</sup> Smoking must be avoided around the child, therefore smoking cessation plans for parents and care givers need to be implemented as part of asthma management. Dust mites can be limited by encasing the child's mattress in an allergen-impermeable cover and cover the pillow in and allergen impermeable case, which need to be washed weekly at a temperature of 130°F (55°C). Desirable actions include removing carpets from the bedroom and from rooms that are laid on cement. Stuffed toys should be minimized from the child's bedroom and washed weekly in hot water. Pets should ideally be removed from home but if this is not acceptable they should be kept out of the child's bedroom and washed weekly.<sup>8</sup> Physical activity can cause asthma symptoms but patients should not avoid exercise. Symptoms can be prevented by taking a rapid-acting inhaled  $\beta_2$ -agonist before strenuous exercise (leukotriene receptor antagonists or cromolyn are alternatives).<sup>27</sup>

### Pharmacological management – stepwise approach

Pharmacologic management includes the use of control agents such as inhaled corticosteroids, inhaled, long-acting bronchodilators, theophylline, leukotriene receptor antagonists, and recently introduced strategies such as the use of anti-IgE antibodies. Relief medications include short-acting bronchodilators, systemic corticosteroids and ipratropium.<sup>2</sup> A stepwise approach to pharmacologic treatment to achieve and maintain control of asthma should be used (Tables 4 and 5). A child should start treatment at the step appropriate to the initial severity.

### Monitoring and maintaining control

Treatment should be reviewed every 1 to 3 months after the initial visit and every three months thereafter. After an exacerbation follow up should be offered within two weeks to one month.<sup>3</sup> Before stepping up treatment, the appropriateness of the inhaler and the technique being used should be assessed. If control is achieved step wise reduction to the lowest possible corticosteroid dose may be possible. The dose must be reduced slowly, with a reduction being considered every 3 months and be decreased by up to 50% each time.<sup>20</sup> Any exacerbation should prompt review of maintenance treatment. By definition any exacerbation in any week indicates uncontrolled asthma.<sup>3</sup>

### Pharmacological management – drug information

$\beta_2$ -adrenergic agonist inhalation therapy is best reserved for acute symptomatic episodes of wheezing rather than being used for routine chronic therapy during asymptomatic periods. Commonly reported potential side effects include a fine tremor, headache and palpitations.<sup>20</sup>

**Table 4:** Stepwise approach to the management of asthma in children aged 5 to 18 years<sup>20</sup>

#### Step 1

Occasional use of inhaled short-acting  $\beta_2$ -agonists (ISABA)

#### Step 2

(if above are used more than once a week, or exacerbations requiring systemic steroids or nebulised bronchodilators)  
ISABA as required

+

Regular standard dose inhaled corticosteroids

#### Step 3

ISABA as required

+

Regular standard dose inhaled corticosteroids

+

Inhaled long-acting  $\beta_2$ -agonist

#### If no response:

Discontinue long-acting  $\beta_2$ -agonist

Increase dose of inhaled corticosteroids to upper end of standard dose

#### If still no response:

Add one of leukotriene receptor antagonist, modified release theophylline, or modified release oral  $\beta_2$ -agonists

#### Step 4

Inhaled short-acting  $\beta_2$ -agonist as required

+

Regular high dose inhaled corticosteroids

+

Inhaled long acting  $\beta_2$ -agonist

+

6 week therapeutic trial of one or more of leukotriene receptor antagonist, modified release theophylline or modified release oral  $\beta_2$ -agonist

#### Step 5

If persistent poor control refer to respiratory specialist

Inhaled corticosteroids (ICS) can cause side effects. This depends on the formulation, dosing and device used, and the subject's age, severity of asthma and inhaler technique.<sup>22</sup> Administration of inhaled steroids at or above 400µg per day of beclomethasone dipropionate or equivalent and administration of long term oral steroids e.g. longer than 3 months or three to four courses per year may be associated with systemic side effects such as growth suppression. However there is little evidence for reduction in long-term growth at normal doses.<sup>21</sup> Nevertheless it is important to monitor child's height on regular basis and screen for development of cataracts if high doses are being used.<sup>5</sup> Growth deceleration of asthmatic children on maintenance ICS is compensated for after the first 12 months of treatment. This effect does not differ between budesonide or fluticasone propionate, despite some variation in the pattern of linear growth.<sup>23</sup> At above-licensed doses, biochemical adrenocortical suppression can occur with some unusual but documented cases of clinical Addisonian crisis. Limited evidence in paediatric age groups would suggest that ciclesonide may have some advantage although it is not as yet licensed in all countries.<sup>21</sup> Hypertrichosis may be a useful clinical pointer to exogenous steroid excess.<sup>24</sup> Hoarseness and candidiasis of the mouth or throat have been reported. This can be reduced by using a spacer device and by rinsing the mouth with water after inhalation.<sup>20</sup>

There a strong scientific rationale for single inhaler therapy in asthma. The use of the single inhaler combining salmeterol/fluticasone propionate provided a statistically significant improvement in lung function and in symptoms but provided no significantly increased protection against exacerbations when compared to increased doses of inhaled corticosteroids in patients with asthma.<sup>25</sup> In patients with mild asthma, the symptom-driven use of inhaled beclomethasone (250µg) and salbutamol (100µg) in a single inhaler is as effective as regular use of inhaled beclomethasone (250µg twice daily) and is associated with a lower 6 month cumulative dose of the inhaled corticosteroids.<sup>26</sup> Using a budesonide/formoterol combination inhaler as regular maintenance treatment twice daily but also as a rescue therapy for breakthrough symptoms can provide more effective control of asthma, particularly in reducing exacerbations, than using a short-acting β2-agonist or formoterol as rescue therapy.<sup>27</sup> There is insufficient evidence at present to recommend the use of combination products rather than increased moderate doses of ICSs as a first-line treatment for patients uncontrolled on their current doses of ICSs. Combination therapy should be prescribed to patients with moderate to severe asthma after daily long-term treatment with inhaled corticosteroids has been tried without obtaining adequate control and it is not indicated to be used as first line treatment in asthma.<sup>28</sup>

Steroids are not always prescribed as indicated by guidelines. Pediatricians and family physicians reported different barriers to prescribing daily inhaled corticosteroids for children with persistent asthma. Although both groups indicated that parent hesitancy and non adherence were common barriers, the most common barrier for family physicians was a perceived cost of the asthma medications for families. Pediatricians were more likely to indicate that lack of time (21% vs 10%) was a barrier to prescribing inhaled corticosteroids.<sup>29</sup>

A leukotriene receptor antagonist can be used as a preventer if inhaled steroids are contra indicated.<sup>5</sup> Recently the use of montelukast has been approved for children aged 2 years and older. In moderately persistent asthma, low or medium-dose inhaled corticosteroids combined with a long acting bronchodilator or leukotriene antagonist can be used, especially for the control of nocturnal or exercise-induced symptoms.<sup>2</sup> When montelukast was prescribed as an add on to the usual therapy, there was a 53% reduction in days with worse asthma symptoms compared with placebo and a 78% reduction in unscheduled physician visits for asthma. The benefit of montelukast was seen both in those using and not using regular inhaled corticosteroids. Boys aged 2 to 5 years showed greater benefit from montelukast than did older boys, whereas among girls the treatment effect was most evident in 10 to 14 year olds, with non significant effects in younger girls.<sup>30</sup> Montelukast has a rapid onset of action and may be effective if used intermittently. If treatment is initiated at the onset of each upper respiratory tract infection or asthma symptoms and continued for a minimum of 7 days or until symptoms had resolved for 48 hours, there is a modest reduction

**Table 5:** Stepwise approach in the management of asthma in children younger than 5 years of age:

**Step 1**

Short acting β2-agonist as required – Preferably inhaled, since more effective and less side effects than oral

**Step 2**

(if above are used for more than twice a week or night time symptoms or exacerbations)

Inhaled short acting β2-agonist

+

Regular standard dose of inhaled corticosteroids (ICS), of leukotriene receptor antagonist or theophylline if ICS cannot be used.

**Step 3**

Under 2 years: refer to respiratory specialist

2 to 5 years:

Inhaled short acting β2-agonists

+

Regular standard dose inhaled corticosteroids

+

Leukotriene receptor antagonist

**Step 4**

If persistent poor control refer to respiratory specialist.

in acute health care resource utilization, symptoms, time off from school and parental time off from work in children with intermittent asthma.<sup>31</sup>

Theophylline and long acting  $\beta$ 2-agonists are bronchodilators used for the management of persistent asthma symptoms, especially nocturnal asthma. They represent different classes of drug with differing side-effect profile. Theophylline preparations are becoming less attractive because of a narrow therapeutic index and complex pharmacokinetics. Long acting  $\beta$ 2-agonists particularly salmeterol are more effective than theophylline in improving morning and evening PEF but are not significantly different in their effect on FEV<sub>1</sub>. There is evidence of decreased daytime and nighttime short-acting  $\beta$ 2-agonist requirement with salmeterol. Fewer adverse events occurred in participants using long-acting  $\beta$ 2-agonists (salmeterol and formoterol) as compared to theophylline.<sup>32</sup>

Patients with moderate-to-severe asthma who react to perennial allergens despite inhaled corticosteroids may benefit from the anti-Ig E monoclonal antibody omalizumab treatment. When used as an add-on therapy to inhaled corticosteroids, omalizumab reduced mean asthma exacerbation as confirmed by improvements in other measurements of asthma control, including symptom scores.<sup>2</sup>

### Selection of best inhaler device

Inhaled medications are preferred since they are more effective than syrups and have fewer systemic side effects.<sup>5</sup> Devices available to deliver inhaled medication include pressurized-metered-dose inhalers (pMDIs) breath-actuated metered-dose inhalers, dry powder inhalers (DPIs) and nebulisers. For children younger than 5 years a pressurized metered dose inhaler should be used with a spacer with a face

**Table 6:** Recognition of acute severe asthma in children<sup>5</sup>

#### **The child is:**

- too breathless to talk
- too breathless to feed
- respiration is more than 50 breaths/min
- pulse is more than 140 beats/min
- PEF is less 50% best or predicted
- Using accessory muscles to breath

#### **In life threatening acute severe asthma:**

- PEF less than 33% of best or predicted
- cyanosis, poor respiratory effort or silent chest
- fatigue or exhaustion
- agitation or reduction in level of consciousness

Note : children may not appear distressed despite suffering a severe attack - this makes assessment of the very young very difficult.

mask if necessary. If this is not effective and depending on the child's condition, nebulised therapy may be considered. In children older than 3 years of age a dry powder inhaler may also be considered. In a child aged between 5 to 15 years corticosteroids should be given via a pMDI and a spacer.<sup>20</sup>

Spacer or valved holding-chamber, devices make inhalers easier to use especially in infants and children with poor inhalation technique and reduce systemic absorption and side-effects of inhaled glucocorticosteroids.<sup>3</sup> The spacer device must be compatible with the prescribed MDI. As soon as a child is able to use a mouth piece this is the preferred delivery system. Advice regarding the care of spacers should be given to parents and children. The device should be cleansed once a month by washing in a mild detergent and then allowed to dry in air. The mouthpiece should be wiped clean of detergent before use. More frequent cleaning should be avoided since any electrostatic charge may effect drug delivery. Spacers should be replaced every 6 to 11 months.<sup>20</sup>

### Acute asthma exacerbations

Exacerbations of asthma are episodes of a progressive increase in shortness of breath, cough, wheezing or chest tightness, or a combination of these symptoms.<sup>3</sup>

The respiratory rate, heart rate, oxygen saturation (SpO<sub>2</sub> over 92%) and peak expiratory flow (every 1 to 4 hours) should be monitored. Recognizing acute severe symptoms is of crucial importance (Table 6).

### Acute mild to moderate exacerbation in a child under 2 years of age

A short acting  $\beta$ 2-agonist using a pressurized meter dosed inhaler with a spacer device and a close fitting mask is recommended. One puff must be given every 15 to 30 seconds up to a maximum of 10 puffs. This dose can be repeated after 20 to 30 minutes. If response is poor or if relapse occurs within 3 to 4 hours the child should be transferred immediately to hospital.<sup>20</sup>

### Acute mild to moderated exacerbations of asthma in a child between 2 and 18 years of age

A short acting  $\beta$ 2-agonist via a pMDI with a spacer device (if younger than 5 years with a close fitting mask) should be given. One puff every 15 to 30 seconds can be given up to a maximum of 10 puffs. Treatment can be repeated after 20 to 30 minutes. In all cases oral prednisolone at a dose of 1 to 2 mg per kg (max 40mg) should be given once daily for 3 to 5 days. If response is poor or relapse occurs within 3 to 4 hours the child should be transferred immediately to hospital.

### Indications for hospital admission

- Indications for hospital admission include:
- failure to respond to or early deterioration after inhaled bronchodilators

**Table 7: What is asthma control in children?<sup>28</sup>**

- No coughing
- No difficulty breathing, wheezing, or chest-tightness
- No waking up at night because of asthma
- Normal activities, including play, sports, exercise, or other school activities
- No acute episodes of asthma that require a doctor visit, emergency room visit, or urgent care
- No absences from school or activities
- No missed time from work or other activities for the parent or caregiver
- Normal or near normal lung function

- inability of the child to take or the parents to give appropriate treatment
- request for admission from the general practitioner
- severe breathlessness and increasing tiredness
- peak expiratory flow less than 50% of the expected value 10 minutes after treatment<sup>5</sup>

## Prognosis

Asthma is known to have a direct impact on the quality of life of children and their families.<sup>33</sup> Poor asthma control is associated with a substantial degree of impairment.<sup>34</sup> Each year, children with asthma miss more than 14 million school days, which may negatively affect grades, academic achievement, self-esteem, and future life successes. Parents also miss from their time off work. Disturbed sleep from night-time asthma symptoms can also decrease productivity at work for parents and at school for children.<sup>8</sup> In adolescents, the presence of at least four wheezing attacks during the previous year was associated with relevant deficits in quality of life.<sup>35</sup> Asthma has also been related to a higher risk of psychological problems.<sup>36</sup> However children with well-controlled asthma can have a normal life style. It is therefore crucial for the well being of patients and their families that asthma is well controlled (Table 7).

The majority of children with asthma will have fewer symptoms as they grow older. Over half of those patients with infrequent episodes of asthma will stop being symptomatic in adult life.<sup>5</sup> Risk factors for persisting asthma symptoms into adulthood include, early age of onset and requiring frequent periods of hospital treatment, ongoing eczema, chronic lung abnormalities and the combination of smoking.<sup>5</sup>

Patients should be reminded that asthma is not a cause for shame. Olympic athletes, famous leaders, other celebrities and ordinary people live successful lives with asthma.<sup>3</sup>

## Conclusion

The girl in the above clinical scenario had widespread wheezing at the time of the examination. The diagnosis of asthma was based on the history and the clinical finding since the child could not perform peak expiratory flow measurements in view of her young age. The parents were given verbal and printed information about asthma. The patient was prescribed salbutamol 2 puffs four times a day for four days followed by 2 puffs three times a day for 3 more days, via a pMDI and a spacer with a face mask. Since this was the third episode of wheezing she was also prescribed inhaled beclomethasone as 2 puffs in the morning and evening for 7 days followed by 2 puffs in the evening till the next visit. The parents were advised to limit triggering factors in the child's environment. Review had to occur within one month and there were also plans to address the need for the father smoking cessation in the following appointments.

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