ABC of 1 to 7 (Revised)

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BRONCHIAL ASTHMA

The symptoms of bronchial asthma are caused by narrowing of the bronchi and bronchioles by mucosal swelling and contraction of the muscle in their walls, with viscid secretion obstructing the lumen. The muscle contraction is reversible by bronchodilators which belong to two main groups: β adrenoceptor stimulants such as salbutamol or xanthine derivatives such as aminophylline. In most children with bronchial asthma there are no symptoms or abnormal signs between acute attacks, and lung function tests, unless performed after exercise, are normal. Asthma is the most common chronic disease of childhood and it affects about 10% of schoolchildren. About 80% of children with asthma have the first symptoms before the age of 5 years and at least half will stop having attacks when they become adults.

During the past 20 years new prophylactic drugs and better methods of administering them have resulted in many children with asthma being completely free of symptoms. Treatment needs to be reviewed regularly as the severity fluctuates and the most suitable preparation changes as the child grows.

Diagnosis

Bronchial asthma should be suspected if there is *recurrent* cough, wheezing, or shortness of breath, especially after exercise or during the night. Improvement with a bronchodilator is helpful evidence. The first attack may occur at any age, but to avoid many children with an acute lower respiratory tract infection being labelled as asthmatic it is preferable to wait until three episodes have occurred within a year before confirming the diagnosis. There is no clinical or laboratory method of distinguishing between acute bronchial infection and asthma. Rhonchi may be heard in the chest during and between attacks of asthma, but there may be no abnormal signs despite repeated examinations. Recurrent night cough may be the only feature, and the absence of night cough is the best evidence that treatment is adequate. The length of absences from school, poor growth, and chest deformity as well as the number of hospital admissions give an indication of the severity of the problem. Details of previous drug treatments may help to avoid the repetition of failures.

Assessment

A detailed history should be taken of exposure to household pets or other animals which may belong to friends or relatives. Severe symptoms or hay fever at a particular time of the year may incriminate pollen. Skin tests tend to be negative under the age of 5 years and also when the child is taking steroids. The results may be helpful in avoiding exposure to allergens, but the long-term effects of attempts at desensitisation are unknown.

The single most useful test is the peak flow reading, which can be measured using the low-range (30–370 l/m) mini-Wright peak flow meter. Normal ranges are related to the height of the child. In asthma peak flow varies greatly throughout the day, being lowest in the early morning and shortly after five minutes of exercise. This exercise can be of any type. In children over the age of 5 years, especially in those

Date this card was started:		1	2	3	4	5	6	7	8	9	10
1. WHEEZE LAST NIGHT	Good night	0									
	Slept well but slightly wheezy	1									
	Woke x 2-3 because of wheeze	2									
	Bad night, awake most of time	3									
2. COUGH LAST NIGHT	None	0									
	Little	1									
	Moderately bad	2									
	Severe	3									
3. WHEEZE TODAY	None	0									
	Little	1									
	Moderately bad	2									
	Severe	3									
4. ACTIVITY TODAY	Quite normal	0									
	Can only run short distance	1									
	Limited to walking because of chest	2									
	Too breathless to walk	3									
5. NASAL SYMPTOMS	None	0									
	Mild	1									
	Moderate	2									
	Severe	3									
6. METER Best of 3 blows	Before breakfast Medicines										
	Before bedtime Medicines										
7. DRUGS	Name of Drug										
	Dose Prescribed										
	Number of doses actually taken during the past 24 hours.										
8. COMMENTS	Note if you see a Doctor (D) or stay away from school (S) or work (W) because of your chest and anything else important such as an infection (I).										

in whom the diagnosis is not clear, a fall in peak expiratory flow rate of 15% or more after exercise or a similar rise with a bronchodilator confirms the diagnosis. About 10% of children with asthma have a normal response to these tests. Regular peak flow reading and completion of a standard diary card of symptoms may be helpful in assessing the severity of the problem and the response to treatment.

A chest radiograph is taken at the initial assessment to exclude a foreign body in the lung or oesophagus, but further films are usually not helpful. A sweat test excludes cystic fibrosis.

The importance of psychological factors in inducing attacks of asthma is difficult to determine, though stresses caused by absence from school, disruption of the family, and conflicting advice are inevitable in the severely affected child. The help given by a child psychiatrist may depend on his enthusiasm. The problem of the child who has had a recent increase in attacks or who is poorly controlled despite apparently adequate treatment should be discussed by the paediatrician with a child psychiatrist. Virus infections are the most important precipitating cause of attacks of asthma and antibiotics are therefore not indicated except for selected patients with severe attacks requiring hospital admission.

Allergen avoidance

House dust, house dust mite, and grass pollens produce the highest incidence of positive skin tests in children with bronchial asthma. Complete avoidance of house dust is impossible but feather pillows can be replaced by foam rubber pillows and the mattress can be completely enclosed in a plastic bag. It may be helpful for a damp duster to be used for wiping surfaces and for cleaning in the child's room to take place while he is in another part of the house. Vinyl floor covering can be used instead of carpets. Fitted carpets are an important source of the house dust mite.

The importance of food in precipitating attacks and the value of exclusion diets in preventing symptoms are controversial. Recent studies suggest that the following items have precipitated symptoms in specific children: orange and lemon squash, fried foods, nuts, and drinks containing ice or carbon dioxide. If parents have noted that symptoms are precipitated by a particular food it would seem reasonable to avoid that food for a limited trial period of six weeks, but it is essential that this diet is supervised by a paediatric dietitian.

Drug treatment

Selection of a route of administration which is appropriate to the age of the child is essential for effective treatment. A common cause of failure to respond to an inhaled drug is lack of proper tuition, and it is helpful if a practice nurse or health visitor takes on this task for all the children in the practice. Bronchodilator drugs can be given at any age, but they tend to be less effective in infants under the age of 18 months. Powder preparations can be inhaled by children over about 4 years of age. Pressurised canisters can be used by a child over about 10 years. It is essential that his coordination of inspiration and release of the dose is checked. The metered dose can be released into a plastic disposable cup or plastic container and younger children can inhale the drug through a valve, but this technique may not be effective.

Infrequent mild attacks (one in three months) can be treated by a bronchodilator given at the beginning of an upper respiratory tract infection and continued for a week. A β stimulant bronchodilator should also be given half an hour before vigorous exercise.

Children who have frequent attacks (more than once in six weeks) need a prophylactic drug continuously for at least a year. The choice is between sodium cromoglycate and long-acting theophylline preparations. Sodium cromoglycate has been used for over 15 years and the rare side effects are candida of the mouth or a cough during inhalation of the powder which can be eliminated by a preceding dose of bronchodilator. Children usually have to be over the age of 4 years before they can grasp the idea of sucking in air and powdered cromoglycate through the Spinhaler into their lungs. A whistle device can be attached to the Spinhaler to check correct technique. For younger children and those who cannot manage the powder, cromoglycate is available as a liquid preparation given as an aerosol. This needs a mains pump, which costs about £85, and the procedure takes about five minutes on each occasion. Hand operated nebulisers are not effective.

Acute attack of asthma

During the past eight years long-acting oral preparations of theophylline have been introduced into paediatric practice. Aminophylline contains theophylline and ethylenediamine. These preparations have a therapeutic effect for 10 hours or more, whereas the older preparations were effective for only about three hours owing to rapid elimination in children. Prescribing the exact dose is difficult as there is no liquid preparation; the tablets should not be broken and dividing a capsule does not provide an accurate dose. Neither the tablets nor the granules in the capsules should be chewed. The capsules can be opened and sprinkled on jam or given with milk. The doses in children are relatively high compared with those for adults, and blood concentrations must be measured to avoid the side effects of vomiting and headache.

Failure to respond to cromoglycate or theophylline is an indication for prophylactic inhaled steroids. As there have been no very long term studies of the effects of this treatment, there must be good indications before it is started. Beclomethasone dipropionate powder can be inhaled by children above the age of about 4 years using a Rotahaler. An alternative is budesonide, but this is available only as a pressurised aerosol canister. The dose is released into a container and is inhaled by the child through a valve.

A few patients who are well controlled with prophylactic drugs need two or three courses of daily oral steroids each year. Each course should last less than a week and be confined to the known vulnerable seasons for that child. Oral steroids given on alternate mornings are still needed for a few children who have failed to respond to all other forms of treatment.

Children taking prophylactic drugs should always have available a fast-acting bronchodilator to treat acute attacks.

If an acute asthma attack does not respond quickly to the child's usual treatment at home he will need urgent treatment with salbutamol or terbutaline aerosol using a face mask and nebuliser attached to an air compressor or compressed oxygen supply. If the family doctor is not immediately available to provide this treatment the child should be seen in the day care unit or accident and emergency department. Delay in appreciating the severity of the attack or providing treatment can be fatal. Drowsiness, cyanosis of the lips, and shortness of breath during speaking are signs of a severe attack. The duration of the episode of asthma and details of the drugs taken previously should be noted, especially those taken during the preceding 24 hours. Tachycardia is often a side effect of drugs.

Nebulised bronchodilator drugs can be given to children of any age and are accepted if the mask is held by the mother and she talks to the child during treatment. The mother's presence calms the child. He has usually improved considerably before the dose is finished. He is then observed for 2-4 hours. If he is completely well after that time he can be sent home and be reviewed by the family doctor or paediatrician. In children old enough to use a peak flow meter the response to treatment can be monitored and failure to improve after the bronchodilator or a peak flow rate of less than 25% of that expected is an indication for admission.

Treatment on admission

On the way he should be encouraged to sit upright in the position that makes him most comfortable; this is usually with his elbows forward. If two hours have elapsed since the previous dose of nebulised salbutamol a further dose may be given with oxygen. Alternatively, nebulised ipratropium bromide can be given. These drugs can have an additive therapeutic effect and may be given alternately or together. If he is deteriorating the following are given.

(1) Intravenous fluids are started with sodium chloride 0.18% with glucose 4%. In addition to the maintenance volume extra fluid may be needed as the child may be dehydrated.

(2) If an aminophylline preparation has not been given during the previous 24 hours a single intravenous dose of 3 to 5 mg/kg body weight can be given. It must be given slowly by adding it to the burette of the giving set and allowing it to run in over at least half an hour. This is followed by an infusion of aminophylline at a lower dose of 1 mg/kg/hour for a further eight hours. If aminophylline has been given during the previous 24 hours the initial large dose is omitted and the slow infusion given.

(3) Hydrocortisone is given in a dose of 100 mg intravenously every three hours for three doses and then every six hours for a total of 24 hours. The dose is not related to body weight.

(4) Prednisolone 2 mg/kg/24 hours by mouth should replace the intravenous hydrocortisone as soon as the child can swallow. This is gradually reduced and stopped within a week.

(5) Humidified oxygen at a concentration of 100% is given by face mask or other method acceptable to the child.

(6) If the child is drowsy or becoming exhausted he should be admitted to the intensive care unit, where arterial blood needs to be taken for urgent estimation of PaO_2 , PaCO_2 , pH, and plasma sodium and potassium concentrations. The most suitable site for obtaining arterial blood is the radial artery, and the femoral artery should be avoided. Deterioration may occur rapidly and the same observer should see the patient at least every half hour. These investigations need to be repeated every two hours or whenever the child's condition becomes worse. Artificial ventilation is indicated if the PaCO_2 is rising rapidly or is above 9 kPa (67 mm Hg). Steroids do not have a maximal effect before six to eight hours.

If the attack is severe and does not respond quickly to treatment a chest radiograph should be performed to exclude pneumothorax or pneumonia.

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Suggested drug doses

Adrenoceptor stimulants

- (1) Salbutamol (Ventolin)
Oral	1-2 years	1 mg per dose × 3 daily
	2-8 years	1-2 mg per dose × 3 daily
	over 8 years	4 mg per dose × 3 daily
Powder (rotacaps)		200 µg × 3 daily
Nebulised (with pump)		2.5-5.0 mg to be repeated once only after 4 hours (if the child is being treated at home)
- (2) Terbutaline (Bricanyl)
Oral	1-2 years	0.75 mg per dose × 3 daily
	2-8 years	1.5-2.5 mg per dose × 3 daily
	over 8 years	2.5-5.0 mg per dose × 3 daily
Nebulised (with pump)		2 mg to be repeated once only after 4 hours (if the child is being treated at home)

Xanthine derivatives

- (3) Aminophylline tablets (Phyllocontin) 8-10 mg/kg dose
 (4) Theophylline capsules (Slo-phyllin) 12 hourly

Cromoglycate

- (5) Sodium cromoglycate (Intal)
Powder	1 capsule (20 mg) × 3 daily
Nebulised (with pump)	1 ampoule (20 mg) × 3 daily

Steroid

- (6) Beclomethasone dipropionate (Becotide)
Powder	5-10 years	100 µg × 3 daily
	over 10 years	200 µg × 3 daily