

Asthma: diagnosis and management

A guide suitable for developing countries

Richard A Lewis^a BSc DM FRCP

Introduction

The prevalence of asthma is highest in 'developed' countries and lowest in developing and emerging countries. The prevalence increases as development progresses (1) and is higher in urban compared to rural areas in developing countries. This increase may be a result of several factors including:

- The population facing new allergens in an urban environment (2).
- A reduced exposure to infectious agents, symbiotic micro-organisms and parasites which leads to a reduction of T helper 1 mediated immune responses and thus an increase in T helper 2 mediated responses which stimulate antibody mediated immunity leading to allergic disease. This has been called the 'hygiene hypothesis' (3).
- Increased awareness of asthma in areas with more health provision.

Even a small rise in asthma prevalence in developing countries has important public health implications (4).

This guide should be read together with local guidelines including the 'Prevention and Treatment Guidelines for Primary Health Care Centres and Hospitals' (5). It is not meant to replace any of the recommendations of local guidelines. It is designed to help those managing asthma to think about why asthma may be a problem and how to overcome that problem.

Management of asthma - The 5 'D's

I use a simple checklist of 5 'D's (Diagnosis, Drugs, Dose, Delivery, Dirty air) when faced with a case of difficult asthma. This checklist explains why the asthma is difficult to control.

Diagnosis

The diagnosis of asthma is more difficult in developing countries with a high prevalence of tuberculosis and other poverty related lung conditions, and HIV associated lung diseases. It is likely that many patients with asthma are not recognised. Diagnosis in the under 5-year-olds is even more difficult due to a high incidence of viral respiratory infections associated with wheeze. I have noted an increase in bronchial hyper-reactivity in patients with

tropical pulmonary eosinophilia in a deprived community in India. In the UK I find the following conditions could mimic or exacerbate asthma so, rather than add another layer of anti-asthma medication, I always check for:

1. **A for Aspergillus** related disease. Both allergic bronchopulmonary aspergillosis (ABPA) and Severe Asthma with Fungal Sensitisation (SAFS) (6) results in asthma which is difficult to control. The chest X-ray may show segmental or subsegmental collapse, sputum may contain *Aspergillus fumigatus* and blood tests may show a raised IgE and raised aspergillus RAST or aspergillus precipitins. Anti-fungal treatment with itraconazole for one month or more helps both conditions. This may be combined with oral steroids.
2. **B for Bronchitis**, especially in children where viral illness may mimic asthma. There may also be a prolonged period of bronchial hyper-reactivity after a respiratory viral illness.
3. **C for COPD**. Chronic obstructive pulmonary disease may be difficult to distinguish from asthma. The diagnosis is helped by a history of exposure to tobacco smoke or biomass smoke ('biomass' is biological material from living or recently living organisms such as dead branches, wood chippings, crop remains) (7). A symptom-based questionnaire is available to distinguish COPD from asthma (8)
4. **D for Diffuse lung disease**. This can be difficult to diagnose without X-ray. Fine crackles, especially at the lateral lung bases should alert you to the possibility of an interstitial lung disease such as idiopathic pulmonary fibrosis. Spirometry is restrictive rather than obstructive. Peak flow may be normal.
5. **E for Embolus**. Pulmonary embolus can cause rapid onset of breathlessness and should always be considered in patients in whom the degree of breathlessness is disproportionate to the severity of their other underlying lung disease or lung function.
6. **F for Failure**. Heart failure may mimic asthma with wheeze and indeed used to be called 'cardiac asthma'. There may be significant reversibility to

^a Consultant Physician, Worcestershire Royal Hospital, Worcester WR5 1DD UK. Professor of Respiratory Medicine, University of Worcester, Senior Research Fellow. National Pollen and Aerobiology Research Unit.

MAIN ARTICLES

inhaled beta agonists. A history of heart disease and the presence of basal crepitations help to make the diagnosis.

7. **G for Gastro-oesophageal reflux (GORD)** which is frequent in asthma patients and may be exacerbated by the asthma or be a reason for poor asthma control. Always ask whether patients have “heart burn” or acid reflux, and treat aggressively. Note that use of anti-acid therapy such as a proton pump inhibitor may remove the symptoms of acid reflux without stopping the refluxate which may still inflame the larynx or airways due to the presence of pepsin (9).
8. **H for Hyperventilation.** Hyperventilation is frequently associated with asthma and may be the cause of failure of asthma control. Use of a simple tool such as the Nijmegen Questionnaire may help pick up these cases (10).
9. **I for Inhaled foreign body** which may cause wheeze both in the acute and chronic phase. If asthma has been of rapid onset always ask about this possibility. Unilateral wheeze is an important sign and indicates the need to try and obtain an X-ray. Many foreign bodies however may not show on X-ray or CT scan and bronchoscopy is required
10. **J for Just never forget local common diseases** such as tuberculosis which can mimic asthma with breathlessness, noisy breathing and cough.

A major problem in diagnosing and treating asthma in countries like South Sudan is the lack of medical equipment. Clear history taking is therefore very important. Table 1 lists important questions to ask to diagnose asthma.

International guidelines for the management of

Table 1. Important questions to ask to diagnose asthma

From Global Strategy for Asthma Management and Prevention, 2010 Global Initiative for Asthma (11)

1. Has the patients had an attack or recurrent attacks of wheezing?
2. Does the patient have a troublesome cough at night?
3. Does the patient wheeze or cough after exercise?
4. Does the patient experience wheezing, chest tightness or cough after exposure to airborne allergens or pollutants?
5. Do the patient's colds 'go onto the chest' or take more than 10 days to clear up?
6. Are symptoms improved by appropriate asthma treatment?

asthma usually mention the fundamental need for spirometry and blood gases to assess patients and oxygen and nebulisers for management. In a questionnaire study we undertook of 41 centres in 24 developing countries in Africa and Asia (12) we found that continuous electricity was available in 25 centres, oxygen in 23 areas, peak flow measurement in 26, and spirometry in 3 centres. Nebulisers were available in 19 centres and oxygen in 23. Peak flow measurement can be a useful and inexpensive tool in the diagnosis of asthma when a 15% improvement following administration of 400mcg salbutamol supports the diagnosis. Spirometry, particularly using a machine which can provide a flow volume loop, is more helpful to diagnose COPD and to exclude restrictive lung diseases as a cause of breathlessness. Peak flow meters, if available, can also be used to confirm variation over time or show the characteristic morning dip of asthma. We have successfully used colours and symbols on peak flow meters to enable home use in an illiterate population (see Figures 1a and b.) (13)

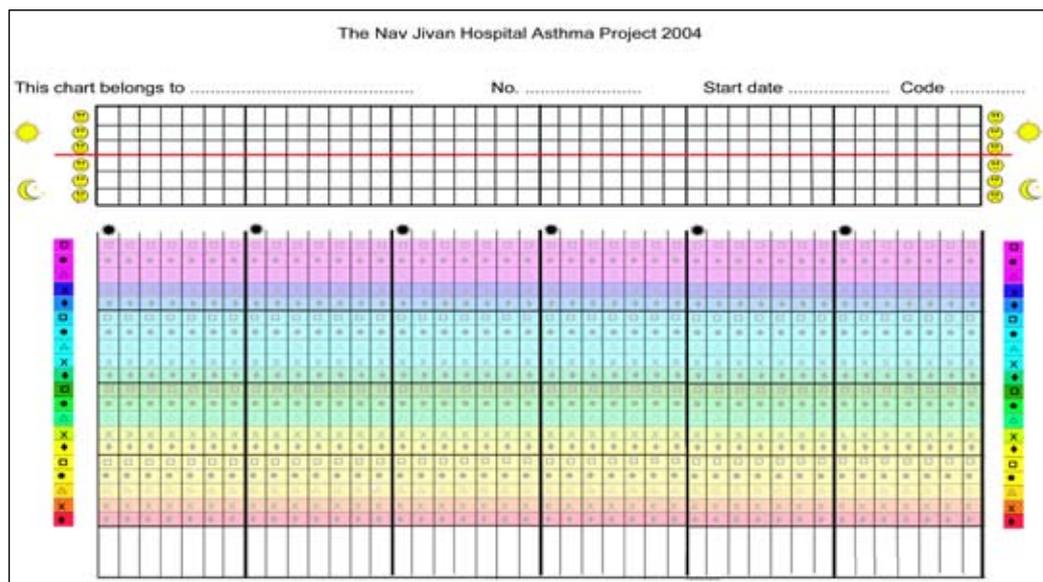
Drugs

Always check whether the patient is taking drugs which may exacerbate asthma such as beta blockers which may be taken orally or as eye drops.

The problem in developing countries is that the most basic drugs required for the management of asthma (such as inhaled bronchodilators and inhaled steroids) are unaffordable. In the questionnaire study we undertook (12) inhaled steroids were prescribed in only 2 out of 41 centres. Where they were available, the median (range) cost of a beclomethasone 50 micrograms inhaler was 20% (6.8-100%) of average local monthly income and a salbutamol inhaler 13% (3.3-250%). Following the publication of this paper the Asthma Drug Facility (ADF) (14) was established by the International Union Against Tuberculosis and Lung Disease. Through the ADF, low and middle income countries can purchase the quality-assured asthma medicines they need at affordable cost. The ADF has a quality assurance system based on World Health Organization norms and standards. It keeps prices down by having a competitive process among selected manufacturers. However it is probable that oral medication such as oral beta agonists, theophyllines and steroids may be the only affordable drugs. For recommendations for the management of acute asthma and maintenance therapy in South Sudan see MOH/GOSS 2006 (5).

Dose

The most important aspect of ‘dose’ is not the dose prescribed but the dose that the patient is actually



Figures 1a and b. Example of a colour coded peak flow meter and chart for home use by illiterate patients.

taking. Lack of funds, fear of side effects or lack of understanding of the need to take regular medication may result in the patient taking a much lower dose of drug than that prescribed, or stopping the medication when the symptoms resolve. It is important to:

- Establish the actual dose being taken.
- Explain the difference in action of the various inhalers, and the fact that the 'preventer' steroid inhaler should be taken on a regular basis while the 'reliever' bronchodilator is taken as required. 'Stepping up' the dose of inhaled steroids when asthma control is not established is frequently considered, but 'stepping down' once control is established is not so frequently considered. This is important as it reduces costs and long term side effects.

Delivery

The metered dose inhaler (MDI) is the cheapest form of delivery of asthma medication in most countries and therefore the most commonly used and misused (15). In my experience the lack of ability to use the MDI is the most common cause of failure of asthma control. A simple rule is to assume that patients fail to use an MDI correctly until proved otherwise. Unfortunately demand delivery devices such as dry powder inhalers, or auto delivery inhalers are more expensive. The use of a spacing device with an MDI overcomes the problems of co-ordination, markedly improves response (16) and reduces oropharyngeal side effects of inhaled steroids. A spacer is an additional expense, but a cheap spacer may be made from a plastic bottle. It is important to stress the need for compliance with the spacer since many patients do not feel they are benefitting from their MDI unless they feel

the spray hitting the back of the mouth!

The use of inhalers should not be a problem for Muslims fasting during Ramadan because using a spacer device means that most of the inhaled medication goes directly to the lungs and the small amount delivered to the oro-pharynx can be rinsed out.

Dirty Air

The three types of 'dirty air' to consider are inhaled smoke, occupational lung disease and allergens.

- **Inhaled tobacco smoke** may be passive in children and those living with smokers or due to active smoking. In the UK many smokers deny smoking, but brown discolouration of the nails, smell of smoke on the breath or, if necessary, measurement of end-tidal carbon monoxide helps confirm the truth. In developing countries smoke inhalation due to the use of biomass fuels in unventilated huts is an important cause of respiratory disease (17). Education and cultural changes may be necessary, but these have to adapt to users' needs (18). The education level has shown a strong correlation with the risk of respiratory diseases from biomass exposure in women; illiterate women are at three to six times higher risk for all respiratory diseases compared with literate women (19).

- **Occupational lung disease.** Ask patients with asthma about their occupation and whether asthma symptoms are better on days they are not working. There are many occupational exposures which cause or exacerbate asthma and appropriate health and safety precautions may not be in place or followed.

MAIN ARTICLES



Figure 2. Inhalation of smoke from biomass fuel may cause respiratory disease in adults and children.

- **Allergens** may be an important cause of asthma. In 2003 locusts were associated with 11 deaths and 1600 hospital visits in central Sudan. Asthma and rhinitis in Sudan has also been associated with exposure to airborne allergen from the “green nimitti” midge *Cladotanytarsus lewisi*. Urbanisation is associated with an increase in exposure to indoor allergens such as the house dust mite or pet dander (2), and increased air pollution increases sensitisation to allergens.

References

1. Beasley R, Crane L, Lai CK et al. Prevalence and aetiology of asthma *J Allergy Clin Immunol.* 2000; 105 (2 Pt 2): S466-S472
2. Weinberg EG. Urbanization and childhood asthma: An African perspective *J Allergy Clin Immunol.* 2000; 105: 224-31
3. Strachan DP. Family size, infection and atopy: the first decade of the hygiene hypothesis *Thorax.* 2000; 55 (Suppl 1): S2-S10
4. Zar H. 2008 URL http://www.cipp-meeting.org/proceedings2008/CONTENT/2-SATURDAY_AFTERNOON/7-KEYNOTE/Heather_Zar.pdf (accessed 26 Aug 2011)
5. MOH/GOSS. Prevention and Treatment Guidelines for Primary Health Care Centres and Hospitals, Ministry of Health, Government of Southern Sudan. 2006. p 232-235 http://www.southsudanmedicaljournal.com/assets/files/misc/SS_Treatment_Guidelines07.pdf (last accessed 13 Sept 2011)

6. O'Driscoll BR, Hopkinson LC, Denning DW. Mould sensitization is common amongst patients with severe asthma requiring multiple hospital admissions. *BMC Pulm Med.* 2005; 5: 4.
7. Guoping H, Yumin Z, Jia T et al. Risk of COPD from exposure to biomass smoke: a metaanalysis *Chest.* 2010; 138(1): 20 - 31.
8. Tinkelman DG, Price DB, Nordyke RJ et al. Symptom-based questionnaire for differentiating COPD and asthma *Respiration* 2006; 73 (3): 296-305
9. Johnston N, Knight J, Dettmar PW, Lively MO, Koufman J. Pepsin and carbonic anhydrase isoenzyme III as diagnostic markers for laryngopharyngeal reflux disease *Laryngoscope.* 2004; 114(12): 2129-2134.
10. van Dixhoorn J, Duivenvoorden HJ. Efficacy of Nijmegen Questionnaire in recognition of the hyperventilation syndrome *J Psychosom Res.* 1985; 29(2): 199-206
11. GINA. URL http://www.ginasthma.org/pdf/GINA_Report_2010.pdf (accessed 26 Aug 2011)
12. Watson JP, Lewis RA. Is asthma treatment affordable in developing countries *Thorax.* 1997; 52: 605-607
13. Tenzing C, Lewis RA. Personal communication
14. ADF. URL <http://www.globaladf.org/> (accessed 26 Aug 2011)
15. Crompton GK. Problems patients have using pressurized aerosol inhalers. *Eur J Respir Dis.* 1982; 63: (Suppl 119): 101 – 104
16. Cushley MJ, Lewis RA, Tattersfield AE. Comparison of three techniques of inhalation of the airway response to terbutaline *Thorax.* 1983; 38: 908-913
17. Torres-Duque C, Maldonado D, Pérez-Padilla R et al. Biomass fuels and respiratory diseases. *Proc Am Thor Soc.* 2008; 5:577 – 590
18. Budds J, Biran A, Rouse J. 2001. What's cooking? A review of the healthy impacts of indoor air pollution and technical interventions for its reduction. Leicestershire, UK: Loughborough University Water, Engineering and Development Centre. WELL Task No. 512.
19. Parikh J, Parikh K, Laxmi Pandey V. Lack of energy, water and sanitation and its impact on rural India. In: Parikh K, editor. *India Development Report, 2004–2005*: Oxford University Press, p. 84–95.

Conflicts of interest: none.

I thank Dr Chris Lewis for his comments on the manuscript and for supplying Figure 2. Other images are the property of the author.