Severe asthma and acute attacks: diagnosis and management in adults and children

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Abstract

Patients who continue to have symptoms with frequent attacks of asthma despite being adherent to treatment with multiple asthma medications, have severe asthma. Severe asthma has significant implications for the affected individual and utilise a disproportionate share of the health care costs associated with asthma.

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INTRODUCTION

Asthma is a common disease, with a rising prevalence throughout the world. In South Africa, the prevalence of asthma has been estimated to be between 10 - 15%, although some studies suggest an even higher prevalence.[1] Most asthmatics have mild to moderate disease, with severe asthma thought to affect less than 10% of asthmatics.[2] Severe asthma has significant implications for the affected individual and patients with severe asthma also utilise a disproportionate share of the health care costs associated with asthma.

SEVERE ASTHMA

WHAT CONSTITUTES SEVERE ASTHMA?

Current guidelines classify asthma as severe on the basis of night-time symptoms, frequent use of short-acting bronchodilators, day-time symptoms and reduced lung functions. There are many problems with this approach, one of which is the poor correlation between symptoms and lung functions. In addition, it is well known that patients and doctors both underestimate asthma severity. The patient with truly severe asthma is someone who continues to have symptoms with frequent attacks of asthma despite being adherent to treatment with multiple asthma medications.[2]

Severe asthma in children tends to be different from that in adults. Boys tend to have more severe asthma than girls, but in adulthood a switch occurs to a female predominance. Asthmatic children with low lung functions and early onset of asthma are more likely to develop severe asthma, either during childhood or as adults. However, some adults with severe asthma do not have these risk factors, suggesting that other mechanisms play a role in the development of severe asthma.[2]

An approach to the patient who has severe asthma that is proving difficult to control is as follows:

1. Check adherence to therapy.
2. Check drug delivery system and technique.
3. Assess the environment and triggers.
4. Consider alternative diagnoses, such as post-viral wheezing or gastro-oesophageal reflux. Check medical records, re-evaluate the history and physical examination, assess response to medication, review the chest X-ray, lung functions (pre- and post-bronchodilator), and allergy tests. Remember that it is especially important to consider alternative diagnoses in young children. In adult-onset asthma, consider perimenstrual asthma, aspirin-sensitive asthma and occupational asthma.[3]
5. Consider and treat co-morbid conditions such as allergic rhinitis, sinusitis, gastro-oesophageal reflux.
6. Consider psychosocial factors.

OPTIONS FOR THERAPY IN SEVERE ASTHMA

Patients with severe asthma should be referred to a specialist for assessment and control. Optimal therapy depends on the resources available. All patients with persistent asthma should receive preventer medication in the form of inhaled corticosteroids (ICS). Patients with severe asthma require high dose ICS to which additional therapy should be added if available and affordable. There is wide variation in the recommended doses of ICS in severe asthma. The South African guidelines recommend ICS > 400 µg/day of beclomethasone (BDP) or equivalent for severe asthma in children and > 1000 µg/day BDP equivalent for severe asthma in adults.[4, 5]

If control is not achieved with high dose ICS, then add-on therapy is preferable to further increasing the dose of ICS. Options for add-on therapy are an inhaled long-acting $ß_2$ agonist (e.g. salmeterol or formoterol) or a leukotriene receptor antagonist (e.g. montelukast) or low dose sustained-release theophylline. If control is not achieved with high dose ICS and one add-on treatment, then a second add-on medication may be necessary. Oral corticosteroids (CS) may be required on a long-term basis – this is effective and inexpensive treatment but carries the risk of significant side effects, especially in children. The potential risks of systemic CS must be weighed up against the risk of death from severe asthma.

ACUTE ASTHMA ATTACKS

Acute attacks of asthma come on suddenly. They may occur in patients with well-controlled asthma, but usually are an indication of failure of the long-term

management plan. The patient with acute asthma presents with cough and wheezing, shortness of breath, increased work of breathing and anxiety. Precipitants of acute asthma episodes include viral upper respiratory tract infections (especially rhinovirus infections), allergen exposure and other environmental factors. The fundamental problem in acute asthma is abnormal narrowing of the airways. The three major factors affecting the size of the airway lumen are smooth muscle constriction, mucosal oedema and mucus plugs.

ASSESSING THE PATIENT

The initial assessment of the patient with an acute asthma attack is important, as acute asthma may result in death. Findings suggesting a severe attack placing the patient at risk of dying include disturbance in level of consciousness, inability to speak and/or feed, severely diminished or absent breath sounds, and central cyanosis. Other indications of the severity of an attack include the use of accessory muscles while breathing.

Non-invasive objective measures, which aid in the assessment of the patient with acute asthma, include the peak expiratory flow rate (PEF) and pulse oximetry (oxygen saturation of the blood).

CLASSIFICATION OF THE SEVERITY OF THE ASTHMA ATTACK

The severity of the asthma attack guides the management of the patient. GINA identifies four groups of severity of asthma attacks: mild, moderate, severe and imminent respiratory arrest.[6] Patients at high risk for fatal asthma also include:

- Previous ICU admission for asthma, especially if mechanical ventilation required
- Current or very recent treatment with prednisone
- Hospitalisation or emergency department visit for asthma in the past year
- Not currently using inhaled corticosteroids
- History of psychiatric disorder or psychosocial problems
- Excessive use of short-acting inhaled $ß_2$ agonist (e.g. salbutamol)

The British Guideline[7] uses a similar approach to GINA regarding the severity of an acute asthma attack, and here the two guidelines are combined in the following classification:

Life threatening asthma

This type of asthma attack must be recognised and treated immediately. Characteristics of these patients include one or more of the following:

- Inability to speak
- Exhaustion
- Confusion or drowsiness
- Wheezing not audible ("silent chest")
- Marked accessory muscle use
- Slow pulse rate (bradycardia)
- Cyanosis
- Unable to blow PEF meter or PEF < 33% best or predicted

Severe asthma attack

This is also a serious type of attack and requires immediate recognition and treatment. Characteristics of these patients include one or more of the following:

- Breathless at rest
- Only able to speak single words because of shortness of breath
- Young child too short of breath to feed
- Marked agitation
- Increased respiratory rate (age-dependent)
- Accessory muscle use
- Loud wheezing
- Tachycardia > 120/min (> 130/min for children)
- PEF 33 - 50% of best or predicted

Moderate asthma attack

Characteristics of these patients include one or more of the following:

- Increasing symptoms
- Able to speak phrases but still short of breath
- Increased respiratory rate (age-dependent)
- Some accessory muscle use
- Clearly audible wheezing
- PEF 50 - 70% of best or predicted
- No features of severe asthma

Mild asthma attack

Characteristics of these patients include one or more of the following:

- Able to speak in sentences
- Moderate wheezing or wheezing only on expiration
- Pulse rate < 100/min (< 120/min for children)
- PEF > 70% of best or predicted

WHEN SHOULD PATIENTS WITH ACUTE ASTHMA BE REFERRED?

Any patient with features of severe or life-threatening asthma should be referred to hospital. Patients with features of a life threatening or near fatal attack should be admitted, as well as patients with severe asthma that persists after initial treatment.

THERAPY OF ACUTE ASTHMA

The standard treatment of acute asthma attacks consists of repeated doses of rapidly acting inhaled bronchodilators, systemic corticosteroids, and oxygen.[6]

STANDARD MANAGEMENT OF ACUTE ASTHMA

Oxygen – the first step

Patients with life-threatening asthma, severe asthma or with oxygen saturations less than 92% should receive high concentrations of inspired oxygen (usually 40 - 60%) via a high flow face mask.[7] Unlike patients with chronic obstructive pulmonary disease there is very little danger in precipitating hypercapnoea (high CO_2 levels). Oxygen driven nebulisers are the preferred method of bronchodilator delivery in hospitals, but in situations where these are unavailable, it should not prevent nebulised therapy from being given if indicated.

Beta-2 agonist bronchodilators – the second step

Inhaled $ß_2$ agonists form the mainstay of the therapy of acute asthma. They stimulate $ß_2$ receptors on airway smooth muscle, resulting in smooth muscle relaxation. The most commonly used agents in South Africa are salbutamol and fenoterol. They may be delivered by nebulisation or pressurised metered dose inhaler (pMDI) with a spacer (4 - 6 puffs, each inhaled separately).[7, 8, 9] If using a nebuliser, the mask must fit closely. A pMDI plus spacer is the optimal drug delivery device for the treatment of mild to moderate acute asthma.

Repeated doses of $ß_2$ agonists should be administered at 15 - 30 minute intervals.

Steroid therapy – the next step

Corticosteroids (CS) constitute first-line treatment for acute asthma, as the underlying cause of asthma is inflammation. They have been shown to decrease mortality, relapses, hospital admission and bronchodilator use. The earlier they are administered in the acute attack, the better the outcome. Steroid tablets or liquid are as effective as injected steroids, provided the patient is able to swallow and is not vomiting.[7, 10] The usual dose of oral prednisone or prednisolone is 2 mg/kg/day or 40 - 50

mg daily in adults. Intravenous steroids include hydrocortisone, methylprednisolone and dexamethasone. Steroids should be given for at least five days or until the patient has recovered from the acute attack. It is unnecessary to taper the steroid dose.

Ipratropium bromide

Anticholinergics such as ipratropium bromide (IB) cause bronchodilatation. The combination of nebulised IB with a nebulised $ß_2$ agonist has been shown to result in greater bronchodilatation than a $ß_2$ agonist alone.[11] The most severely affected patients benefit the most, and IB should be considered in combination with inhaled $ß_2$ agonists in the more severe forms of asthma, especially early in the acute attack, or if there is an incomplete response to inhaled $ß_2$ agonists on their own.

OTHER ISSUES IN THE MANAGEMENT OF ACUTE ASTHMA

The above constitutes standard therapy for acute asthma in adults and children, and the majority of patients will respond. The following therapies may be considered in the management of acute severe asthma not responding to the standard treatment.

Magnesium sulphate

A single dose of IV magnesium sulphate has been shown to be safe and effective in those patients with acute severe asthma who have had a poor response to initial therapy. The response to magnesium appears to be best in patients who present with very severe illness.[12] The dose is 25 - 50 mg/kg/dose (maximum 2 g) by slow IV infusion.

Intravenous salbutamol

The use of IV salbutamol (15 mcg/kg as a once-off dose) in the early management of acute severe asthma in children presenting to the emergency department (ED) has been shown to reduce the duration of the exacerbation and hasten the discharge from hospital of the children.[13] In the intensive care unit IV salbutamol by continuous infusion is effective and probably safer than aminophylline.

Intravenous aminophylline

Theophylline and its water-soluble salt aminophylline are methylxanthine derivatives that have largely fallen out of favour due to their narrow therapeutic index and potentially severe side-effects (cardiac arrhythmias, convulsions). Aminophylline is not indicated in patients with mild to moderate acute asthma, but it may be used in cases of near fatal or life threatening asthma in the intensive care unit.

Adrenaline

Adrenaline 0.01 ml/kg of a 1:1000 solution administered subcutaneously may be used in patients who are moribund on presentation to the ED, or where inhaled therapy is not available.

Inhaled steroids (ICS)

The usual role of inhaled steroids is in the maintenance therapy of chronic asthma. ICS may improve airflow in acute asthma, with a more rapid onset than systemic steroids if administered in very high doses. The biggest disadvantage is the cost of the ICS compared to prednisone. Maintenance doses of ICS should be continued or started as soon as possible to form the basis of the chronic asthma management plan.

Antibiotics

These are not routinely indicated in acute asthma, which is usually precipitated by viral infections.

Intravenous fluids

Patients with prolonged severe asthma may become dehydrated as a result of poor intake or vomiting. It is, however, inadvisable to overhydrate patients with acute asthma, and the recommended IV fluid volume in children should not exceed 50 ml/kg/24 hours.

HOSPITAL DISCHARGE AND FOLLOW UP[7]

It is difficult to define when patients can safely be discharged after being admitted with acute asthma. They should certainly be on treatment that they could manage at home, and be receiving minimal inhaled $ß_2$ agonists. They should receive asthma education with the emphasis placed on treatment and inhaler technique. They should be discharged on appropriate maintenance therapy, with an action plan to manage exacerbations. They should have a follow up appointment with their primary care provider within a week of discharge.

See CPD Questionnaire, page 41

(P) This article has been peer reviewed

REFERENCES

1. Levin M. Asthma prevalence in Cape Town: urban-rural gradients, class, culture and language. S A Respir J 2006;12(1):14-18.
2. Moore WC, Peters S. Severe asthma: An overview. J Allergy Clin Immunol 2006;117: 487-94.
3. Wenzel S, Szefler SJ. Managing severe asthma. J Allergy Clin Immunol 2006;117:508-11.
4. Motala C, Kling S, Gie RP *et al.* Guideline for the Management of Chronic Asthma in Children – 2000 Update. S Afr Med J 2000; 90(5): 524-539.
5. Lalloo UG, Bateman ED, Feldman C *et al.* Guideline for the Management of Chronic Asthma in Adults – 2000 Update. S Afr Med J 2000; 90(5):540-52.
6. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2006. www.ginasthma.org. Accessed 16 November 2006.
7. British Thoracic Society and Scottish Intercollegiate Guidelines Network. British Guideline on the Management of Asthma Updated November 2005. www.brit-thoracic.org.uk/Guidelines. Accessed 28 November 2006.
8. Zar HJ, Brown G, Donson H *et al.* Home-made spacers for bronchodilator therapy in children with acute asthma: A randomised trial. Lancet 1999; 354:979-982.
9. Leversha AM, Campanella SG, Aickin RP, *et al.* Costs and effectiveness of spacer versus nebulizer in young children with moderate and severe acute asthma. J Pediatr 2000; 136:497-502.
10. Becker JM, Arora A, Scarfone RJ, *et al.* Oral versus intravenous corticosteroids in children hospitalised with asthma. J Allergy Clin Immunol 1999; 103:586-590.
11. Plotnick LH, Ducharme FM. Combined inhaled anticholinergic agents and inhaled beta-2 agonists for initial treatment of acute asthma in children (Cochrane Review). In The Cochrane Library Issue 3 2001.
12. Ciarallo L, Sauer AH, Shannon MW. Intravenous magnesium therapy for moderate to severe pediatric asthma: results of a randomised, placebo-controlled trial. J Pediatr 1996; 129:809-814.
13. Browne GJ, Penna AS, Phung X, Soo M. Randomised trial of intravenous salbutamol in early management of acute severe asthma in children. Lancet 1997; 349:301-305.