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Emergency management of acute asthma

BACKGROUND Life threatening asthma is not an uncommon emergency and all doctors need to have an ordered approach to managing this problem both in the surgery and the home.

OBJECTIVE To develop a plan for the rapid assessment and management of a patient with asthma. The main focus is on severe life threatening asthma and management is based on the equipment and medication a doctor is likely to have available in the surgery.

CONCLUSION The key to successful treatment of life threatening asthma is a rapid assessment of severity, an early emergency call for an ambulance, oxygen, continuous nebulised β_2 agonist, corticosteroids and the use of parenteral adrenaline for the patient in extremis.

The management of a patient with severe, life threatening asthma can be one of the most frightening emergencies to present in general practice. This is because the patient may arrive with advanced respiratory distress and unless the doctor is able to at least partially reverse this immediately, the patient may suffer respiratory and cardiac arrest.

Risk factors for severe asthma

If the condition of the patient permits, then a quick history focussed on identifying risk factors for severe asthma can aid in the initial assessment. If the patient is stable then a more thorough history is appropriate. Key risks include:

- a previous intensive care admission for asthma
- history of rapid onset and poorly responsive asthma
- frequent hospital admissions or oral steroid use
- poor response to treatment of current exacerbation
- psychosocial instability
- poor comprehension or poor compliance.¹

In addition, special concern should be taken with

children under the age of five years. These risk factors should increase the doctors concern for the severity of the asthma attack.

Assessment of severe asthma

The physical assessment of a patient with asthma can be rapidly made and categorised as set out in Table 1, 2. Tables like this have become relatively standardised and widely reported in the literature.^{2,3} Similar tables are also available in the Asthma Management Handbook 2002⁴ and in the form of wall charts from the National Asthma Council (Australia).

It is important that these clinical signs are considered together and not in isolation as each sign alone can be misleading. For example, a patient may be tachycardic as a result of anxiety, or become tachycardic from bronchodilator treatment. Alternatively, a patient may become bradycardic with severe asthma and hypoxia. Similarly, the volume of wheezing heard may diminish in severe asthma as the patient fatigues and the volume of ventilation declines. Pulsus paradoxus refers to the changes in systolic blood

pressure that result from dramatic swings in intrathoracic pressure which are required to overcome the increased ventilatory resistance of asthma. Normally there is less than 10 mmHg difference in systolic pressure between inspiration and expiration, but this can exceed 40 mmHg in severe asthma. Importantly, if the patient fatigues and the respiratory effort declines, the pulsus paradoxus may also decline.

Peak expiratory flow rate (and FEV₁ if it is available) are very useful indicators of asthma severity and serial measurements are used to monitor the response to treatment. However, spirometry is limited by patient technique and can be impossible for patients with severe asthma.

Pulse oximetry is widely used in the hospital setting and a haemoglobin oxygen saturation of less than 95% is a good indication of moderate to severe asthma. Unfortunately, this equipment is rarely available in private practice, but some ambulance crews carry it.

Treatment of severe asthma

A graded approach to the treatment of acute asthma for both adults and children is also set out in Table 3, 4. The main treatment options are considered individually.

When should an ambulance be called?

Most cases of moderate asthma will require referral to hospital, at least for a period of observation in the emergency department. Whether the patient with moderate asthma requires an ambulance or not will largely depend on how they respond to initial treatment in the surgery. However, when a patient presents with severe asthma, an ambulance (dial 000) should be called immediately.

It is not uncommon in metropolitan regions for an ambulance to take 10-15 minutes to respond to an emergency call. With this in mind when confronted with any life threatening emergency the sooner the ambulance call is made, the better.

Is oxygen necessary?

The exact role of oxygen therapy in the treatment of acute asthma is unclear. In the hospital and ambulance, all nebulised medications tend to be administered with oxygen, however, there is abundant evidence that most cases of mild and moderate asthma can be very effectively managed

Table 1. Assessment of acute asthma in adults

| Symptoms | Mild | Moderate | Severe |
|------------------|----------------|------------------|--------------------|
| Talks in | Sentences | Phrases | Words |
| Pulse | <100 minute | 100-120 minute | >120 minute |
| Wheeze | Mild-moderate | Moderate-loud | Becoming quiet |
| Central cyanosis | Absent | May be present | Present |
| Pulsus paradoxus | Not palpable | Possibly present | Present/can fall* |
| Peak exp. flow | >75% predicted | 50-75% predicted | <50% predicted |
| Conscious level | Normal | Normal | Agitated/decreased |

Table 2. Assessment of acute asthma in children

| Symptoms | Mild | Moderate | Severe |
|-------------------|----------------|------------------|--------------------|
| Talks in | Sentences | Phrases | Words |
| Pulse | <100 minute | 100-200 minute | >200 minute |
| Wheeze | Mild-moderate | Moderate-loud | Becoming quiet |
| Accessory muscles | No | Mild | Prominent |
| Central cyanosis | Absent | Absent | Present |
| Pulsus paradoxus | Not palpable | Possibly present | Present/can fall* |
| Peak exp. flow | >60% predicted | 40-60% predicted | <40% predicted |
| Conscious level | Normal | Normal | Agitated/decreased |

with bronchodilators administered via a puffer and spacer.⁵ However, in cases of severe asthma it is likely that the patient is hypoxic and requires oxygen therapy. More importantly, in these cases the use of bronchodilators can cause pulmonary vasodilation and this can result in increased blood flow to areas of poorly ventilated lung. This change in pulmonary blood flow caused by the bronchodilators, increases pulmonary 'shunting' and this can worsen the patient's hypoxia.⁶ For this reason, oxygen should always be used both during and after bronchodilator therapy in severe asthma.

How much bronchodilator?

There is some evidence that in cases of mild and moderate asthma there is no significant difference in the efficacy of bronchodilators whether they are administered via a nebuliser or a metered dose inhaler with a spacer (holding chamber).⁵ However, with life threatening asthma there is evidence that patients respond better to continuous nebulised bronchodilator therapy than to intermittent treatment.⁷ For a patient with severe asthma 5 mg of salbutamol (2.5 mg for a child) should be added to the nebuliser every few minutes to ensure there is a continuous supply of bronchodilator. The

Table 3. Treatment of acute asthma in adults

| Treatment | Mild | Moderate | Severe |
|---------------------------------|--|-------------------------------|--|
| Ambulance | No | Possibly required | Call 000 |
| Oxygen | Recommended both with nebuliser and after if available high flow of at least 8 L/min | | |
| Nebulised β_2 agonist | 5 mg salbutamol X 1 nebuliser | 5 mg salbutamol X 3 nebuliser | 5 mg salbutamol continuous nebuliser |
| β_2 agonist Puffer/spacer | 4-6 puffs into spacer | 4-6 puffs every 3-4 minutes | Only if no nebuliser with O ₂ |
| Ipratropium bromide nebuliser | Not necessary nebuliser X 1 | 500 ug ipratropium optional | 500 ug ipratropium nebuliser X 1 |
| Corticosteroids prednisone | Consider 50 mg orally | prednisone 50 mg 200 mg ivi | hydrocortisone |
| Adrenaline | No | No | Consider (see text) |
| Hospital admission | Unlikely | Probable | Definitely |

Table 4. Treatment of acute asthma in children

| Treatment | Mild | Moderate | Severe |
|---------------------------------|--|---|--|
| Ambulance | No | Possibly required | Call 000 |
| Oxygen | Recommended both with nebuliser and after if available | | |
| Nebulised β_2 agonist | 2.5 mg salbutamol X 1 nebuliser | 2.5 mg salbutamol X 3 nebuliser | 2.5 mg salbutamol continuous nebuliser |
| β_2 agonist Puffer/spacer | 6-12 puffs into spacer and review 20 minutes | 6-12 puffs every 20 minutes. Up to 5 doses then every 1-4 hours | Only if no nebuliser with O ₂ |
| Ipratropium bromide nebuliser | Not necessary | 500 ug ipratropium nebuliser X 1 (optional) | 500 ug ipratropium nebuliser X 1 |
| Corticosteroids | Consider 1 mg/kg prednisone | prednisone 1 mg/kg orally | hydrocortisone 4 mg/kg ivi or methylprednisolone 1 mg/kg ivi |
| Adrenaline | No | No | Consider (see text) |
| Hospital admission | Unlikely | Probable | Definitely |

response of the patient to this therapy should be re-evaluated after 20-30 minutes and if necessary, the treatment continued en route to hospital. In addition a single dose of 500 μ g nebulised ipratropium bromide (250 μ g in children) should be given with the first dose of salbutamol.⁸

What is the best way to administer steroids?

Corticosteroids are fundamental to the management of all grades of asthma. Inhaled steroids are thought to be just as effective as oral steroids in the treatment of mild and moderate asthma.⁹

However, in cases of severe asthma systemic steroids are normally preferred over inhaled steroids. The oral dose is typically 50 mg of prednisone (1 mg/kg in children) or 200 mg of intravenous hydrocortisone (4 mg/kg in children). In severe life threatening asthma, gastric absorption may be decreased and so intravenous steroids are probably more beneficial.

Should parenteral adrenaline be used in the surgery?

Parenteral adrenaline is extremely effective in the treatment of severe life threatening asthma, however, it is also a high risk intervention. Risk factors for increased side effects of adrenaline are:

- over 50 years of age,
- history of coronary artery disease, and
- arrhythmia or uncontrolled hypertension.^{3,10}

Adrenaline is administered as 0.3 mL of 1:1000 solution (300 μ g) either subcutaneously or intramuscularly (10 μ g/kg up to 300 μ g for children). Adrenaline should be reserved for the most severe cases not responding to continuous nebulised salbutamol with oxygen and intravenous corticosteroids. As a rule adrenaline should only be given while the patient is on a cardiac monitor (remember that most ECG machines will give a continuous rhythm strip). However, when confronted with an emergency in the practice (or while on a house call) and there is no monitor available, if the patient is in extremis then subcutaneous adrenaline should be considered.

Of note, parenteral adrenaline has largely been replaced for hospital treatment of severe asthma by salbutamol infusions (this is not available in the doctor's bag) and theophylline is rarely used.

Should the pregnant patient be managed differently?

Oxygen therapy is all the more important in pregnant patients with asthma as the developing fetus will be very susceptible to maternal hypoxia. There is reasonable consensus that short acting β_2 agonists are safe in pregnancy,¹¹ but less is known about the newer, longer acting agents. Inhaled beclamethasone and budesonide have been widely used in pregnancy and appear to be safe (budesonide has been given a category A risk for use in pregnancy), while again there is little information on the newer agents.¹² The use of oral and parenteral steroids is less clear with some suggestion

they pose both maternal and fetal risks.¹² On this basis, a pregnant patient with asthma should be treated the same as a nonpregnant adult. However, if the patient does not respond to short acting inhaled β_2 stimulants and short acting inhaled corticosteroids the patient and family should be aware of the risk benefit analysis of further treatment. In general severe asthma is potentially life threatening for both the mother and fetus.

Conclusion

While severe life threatening asthma is one of the more frightening emergencies that a doctor may be required to manage in the surgery or at home an ordered approach will often relieve the situation. All doctors in the surgery should be able to give nebulised β_2 agonists with oxygen and administer intravenous corticosteroids. On an emergency home visit a metered dose inhaler and spacer should be carried along with the equipment to administer parenteral corticosteroids. The use of subcutaneous adrenaline without cardiac monitoring is not normally advisable, however, it may be required in rare emergencies when the patient does not respond to initial therapies and remains in extremis.

SUMMARY OF IMPORTANT POINTS

- Special concern should be taken with children under the age of five years.
- Clinical signs should be considered together and not in isolation.
- An ambulance may take 10-15 minutes to respond to an emergency call.
- In cases of severe asthma oxygen should always be used both during and after bronchodilator.

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