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Acute asthma exacerbations: tips from the shop floor

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Abstract

Asthma places a significant burden on acute and non-acute services and is frequently encountered in the emergency department and the medical take. The UK has one of the highest asthma mortality rates in Europe. The National Review of Asthma Deaths has identified multiple factors that have contributed to preventable asthma deaths and solutions to these factors, including a better understanding and implementation of asthma guidelines. The British Thoracic Society and Scottish Intercollegiate Guidelines Network have recently updated their guidance on the management of asthma.

This article outlines the guidelines for junior doctors managing patients with acute exacerbations of asthma. It highlights key areas of the initial assessment, establishing severity and initiating and escalating treatment. Furthermore, the discharge process from discharge criteria to promoting patient safety, education and ongoing self-management is discussed. This process, in particular education and personalised asthma action plans, can make a significant difference to the patient's outcomes and day-to-day burden of symptoms.

Key words: Asthma; Emergency Service; Hospital; Patient discharge; Patient safety; Self-management

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Introduction

The British Thoracic Society (2019) estimates that 5.4 million people are being treated for asthma in the UK. Asthma accounted for 77 124 hospital admissions in 2016–17 (Calvert et al, 2019), placing a significant burden on acute and non-acute services.

According to the National Review of Asthma Deaths (Royal College of Physicians, 2014), the UK has one of the highest asthma mortality rates in Europe. The British Thoracic Society (2019) reports that three people die from an asthma exacerbation every day. The National Review of Asthma Deaths (Royal College of Physicians, 2014) identified that better knowledge and implementation of the UK asthma guidelines could reduce the number of avoidable asthma deaths.

Given the frequency with which junior doctors encounter patients with exacerbations of asthma, understanding the management of these patients is vital to optimise outcomes and reduce mortality. In July 2019, the British Thoracic Society and Scottish Intercollegiate Guidelines Network updated the guidance on the assessment and management of asthma. This article outlines the gold standard management of acute asthma, highlighting updates in the new guidelines.

Initial assessment

The aim of the initial assessment is to assess severity and identify life-threatening or near-fatal features. Criteria for defining severity of asthma exacerbations have not changed and are summarised in Table 1.

History

The history should establish any characteristics which put patients at high risk of developing near-fatal or fatal asthma (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019), including:

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Table 1. Levels of severity of acute asthma attacks in adults

Moderate acute asthma	■ Increasing symptoms ■ Peak expiratory flow rate >50–75% best or predicted No features of acute severe asthma			Consider discharge if: peak flow is >75% of the best recorded or predicted at 1 hour post treatment, and if they are not requiring beta 2 agonists more than 4-hourly And have none of the features described in Table 2
Acute severe asthma	Any one of: ■ Peak expiratory flow rate 33–50% best or predicted ■ Respiratory rate ≥25/min ■ Heart rate >110/min Inability to complete sentences in one breath			Admit for treatment and monitoring
Life-threatening asthma	Any one of the following in a patient with severe asthma:	Clinical signs	■ Altered conscious level ■ Exhaustion ■ Arrhythmia ■ Hypotension ■ Cyanosis ■ Silent chest ■ Poor respiratory effort	Admit Arterial blood gas
		Measurements	■ Peak expiratory flow rate <33% best or predicted ■ Oxygen saturations <92% ■ Arterial partial pressure of oxygen <8 kPa ■ 'Normal' arterial partial pressure of carbon dioxide (4.6–6.0 kPa)	
Near-fatal asthma	Raised arterial partial pressure of carbon dioxide, and/or requiring mechanical ventilation with raised inflation pressures			Admit and refer to critical care

Adapted from British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019)

- Previous admissions to hospital with asthma
- Previous admissions with respiratory acidosis or requiring ventilation
- Three or more different medications for their asthma
- Frequent use of short acting beta-2 agonist
- Repeated emergency department attendances
- Psychosocial risk factors (Table 2) – the National Review of Asthma Deaths (Royal College of Physicians, 2014) identified that psychosocial risk factors were common to patients who died of asthma.

Identifying triggers for exacerbations, for example infection, allergens or exercise, guides treatment, and could also prevent future exacerbations. Triggers should be documented in personalised asthma action plans. The National Review of Asthma Deaths (Royal College of Physicians, 2014) shows that triggers were documented in just 51% of cases of patients who died.

If the patient is able to provide this, additional information to clarify the history of a patient's asthma includes:

1. Previous episodes of shortness of breath, wheeze, chest tightness or cough
2. Diurnal variation
3. Personal history of atopy
4. Other past medical history that could contribute to their presentation.

This information is helpful later when making decisions with the patient about ongoing treatment.

Table 2. Adverse behavioural or psychosocial factors increasing risk of developing near-fatal or fatal asthma
Non-adherence with treatment or monitoring
Failure to attend GP appointments
Fewer GP contacts
Frequent home visits
Self-discharge from hospital
Psychosis, depression, other psychiatric illness or deliberate self-harm
Current or recent major tranquiliser use
Denial
Alcohol or drug abuse
Obesity
Learning difficulties
Employment problems
Income problems
Social isolation
Childhood abuse
Severe domestic, marital or legal stress

Adapted from British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019)

Examination

This centres around identifying features of life-threatening or near-fatal asthma such as tachypnoea, tachycardia, cyanosis, use of accessory muscles, inability to complete sentences and reduced Glasgow Coma Scale score. A silent chest on auscultation, arrhythmias and oxygen saturations <92% are also red flags. Peak flow is useful if the patient is well enough and should be compared to the patient's documented best or predicted if not available (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019).

Initial investigations

Arterial blood gas should be performed if there are any features of life-threatening asthma (Table 1) to assess ventilation. Normocapnia or hypercapnia are signs that the patient is decompensating and tiring, and necessitate urgent referral to critical care (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019).

Chest X-rays should be performed, specifically looking for evidence of consolidation or pneumothorax (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019), and in a first presentation with asthma to exclude structural causes for the symptoms..

Initial treatment

Treatment should be initiated while assessment is being performed, especially if there are features of life-threatening asthma.

Oxygen

Aim for saturations 94–98% to avoid over-oxygenation, as this can be detrimental and has been linked to increased mortality (Kane et al, 2013).

Short-acting beta-2 agonists

High dose inhaled short-acting beta-2 agonists (SABA) should be given as early as possible. Nebulisers should be oxygen driven at 6 litres/minute to minimise the risk of desaturation

that occurs with air-driven nebulisers. If oxygen is not available, do not delay giving the nebulisers. Salbutamol and terbutaline are equally effective (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019).

'Back to back' or continuous SABA nebulisation can be used if patients remain significantly symptomatic with severe features after the first nebuliser. Practically, this means repeat doses of salbutamol 2.5–5 mg at 15–30-minute intervals. There is no evidence to support using higher doses for each bolus (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019; National Institute for Health and Care Excellence, 2020).

Corticosteroids

The earlier the better in terms of using corticosteroids. Corticosteroids reduce mortality, relapse, hospital admission and the need for SABA (Rowe et al, 2001, 2007). The Global Initiative for Asthma (2020) advises that steroids should be given within the first hour of presentation (Rowe et al, 2001).

- Oral steroids are as effective as intravenous steroids (Rowe et al, 2001).
- Prednisolone 40–50 mg daily should be administered for a minimum of 5 days. There is no evidence that higher doses are more effective (Manser et al, 2001). Alternatively, if there are swallowing difficulties, 100 mg intravenous hydrocortisone should be given every 6 hours,
- Continue regular inhaled corticosteroids while giving systemic steroids. There is no evidence that this gives significant benefit, but it does not cause any harm (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019), reinforces the need for use of inhaled corticosteroids, and provides an opportunity to observe the patient's technique.

Ipratropium bromide

Nebulised ipratropium bromide 500 micrograms should be combined with a nebulised beta-2 agonist every 4–6 hours in severe or life-threatening exacerbations. This promotes greater bronchodilation, faster recovery and shorter admissions (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019). Temporarily hold long-acting antimuscarinics while giving ipratropium bromide.

Magnesium

British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) and the Global Initiative for Asthma (2020) advise a single dose of intravenous magnesium (1.2–2 g intravenous infusion over 20 minutes) can be considered in cases of acute severe asthma when the patient has not had a good response to initial inhaled therapies. There is no evidence for the use of inhaled magnesium. British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) caution against the use of repeated doses of intravenous magnesium, as high levels can contribute to muscle weakness and fatigue.

Aminophylline

In near-fatal or life-threatening asthma, where there has been a limited response to initial treatment, the British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) cite some benefit in using intravenous aminophylline. This requires loading followed by an infusion and close monitoring (Table 3).

However, the Global Initiative for Asthma (2020) update advises aminophylline should not be used because of the significant risk of life-threatening side effects and limited evidence of benefit compared to use of SABA. Therefore, care needs to be taken and initiation of aminophylline should be discussed with a senior.

Intensive care

If patients do not improve or deteriorate, despite initial therapies described above, they should be discussed with the critical care team.

The British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) highlight parameters which indicate deterioration and should therefore trigger discussion with the intensive care team (summarised in Table 4).

Table 3. Advice for use of aminophylline
Electrocardiogram before starting – calculate QTc
Loading dose 5 mg/kg over 20 minutes
Infusion 0.5–0.7 mg/kg/hour, diluted in sodium chloride 0.9% or glucose 5%
Check aminophylline levels at 24 hours, aiming for 10–20 mg/litre, and every 24 hours the infusion is continued
Patients may need antiemetics
If the patient is on maintenance oral aminophylline or theophylline, loading is not required but levels should be checked on admission

Table 4. Parameters indicating that referral to critical care is required
Deteriorating peak flow
Persistent hypoxia
Hypercapnia
Acidosis
Exhaustion
Reduced Glasgow Coma Scale
Respiratory arrest

From British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019)

Non-invasive ventilation

Non-invasive ventilation is commonly used in patients with type 2 respiratory failure associated with diseases like chronic obstructive pulmonary disease. However, in asthmatic patients its use is not recommended.

Hypercapnia in a patient with asthma should trigger urgent referral to critical care, where decisions about intubation and ventilation can be made.

Reassessment and ongoing management

Reassessing the clinical situation enables prompt escalation of treatment and involvement of critical care, or de-escalation and initiating plans for discharge. Several parameters need to be monitored closely (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019):

- Peak flow – performed before and 15–30 minutes after use of nebulisers. This allows an objective measure of whether the patient is improving or if further urgent action is required
- Oxygen saturations – continually if the asthma is severe or life-threatening. Target saturations are 94–98%; if saturations drop below 92% perform an arterial blood gas
- Arterial blood gas – repeat within an hour if:
  - PaO2 <8 kPa initially, unless saturations have consistently been >92%
  - PaCO2 is normal or raised on the first arterial blood gas
  - The patient deteriorates – desaturates, tires, silent chest, reduced Glasgow Coma Scale
- Potassium – salbutamol and corticosteroids drive potassium down
- Blood sugar monitoring – corticosteroids elevate blood sugar levels, even in patients who do not have diabetes
- Theophylline levels need to be monitored every 24 hours and the patient reviewed for side effects (Table 3).

Acute asthma and pregnancy

Pregnancy has an unpredictable impact on asthma: symptoms worsen in one third of patients, improve in one third and the remainder see no change (Juniper and Newhouse, 1998).

Table 5. Management of acute asthma in pregnancy	
The course of asthma in pregnancy can be unpredictable; have a low threshold for admission for treatment and monitoring and discussion with local respiratory teams	
Assess severity of asthma using the criteria outlined in Table 1	
Initiate treatment alongside assessment as in non-pregnant patients:	■ Deliver oxygen aiming for oxygen saturations of 94–98% ■ Short-acting beta-2 agonists: use as normal during pregnancy, ie 2.5–5 mg nebulised salbutamol at 15–30-minute intervals if needed ■ Inhaled corticosteroids ■ Oral corticosteroids: prednisolone 40–50 mg should be used when there are any features of severe asthma (this is metabolised by placental enzymes so only 10% reaches the fetus). Not giving oral steroids increases the risk of a prolonged asthma attack, thus increasing risk to mother and fetus ■ Intravenous magnesium – a single dose 1.2–2 grams over 20 minutes if poor response to initial therapy
Early escalation to critical care if not improving or if there are any features described in Table 4	
Liaise closely with local respiratory and obstetric teams to optimise asthma control and minimise risk to both mother and fetus	
While breastfeeding, asthma medications can be used as normal, including for the management of acute exacerbations	

Adapted from British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019)

Poorly controlled asthma in pregnancy is associated with multiple maternal and fetal complications, so optimising management is a priority and requires close collaboration with local respiratory and obstetric teams. The usual drug therapy for asthma is safe for use in pregnancy and exacerbations should be managed as described for the non-pregnant patient. The approach to managing exacerbations in pregnancy is summarised in Table 5 (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019).

Planning for discharge

Deciding when it is safe to discharge can be challenging – if too early, there is a risk that the patient will deteriorate and reattend with a worsening exacerbation. The National Review of Asthma Deaths (Royal College of Physicians, 2014) reports that 10% of deaths from asthma occurred within 28 days of discharge following treatment for asthma exacerbations and 21% of patients who died from asthma had attended the emergency department at least once in the preceding 12 months. The British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) identified that >15% of those reattending do so within 2 weeks. Table 6 lays out the criteria that should be met before discharge.

Table 6. Criteria for discharge	
Improvement of symptoms and physiological parameters, with no features of severe asthma (Table 1)	
Reduced inhaled beta-2 agonist use – with no requirement for nebulised beta-2 agonists for 24 hours	
Established on discharge medication for 12–24 hours, including a course of oral prednisolone (40–50 mg) for a minimum of 5 days, inhaled corticosteroids and inhaled bronchodilators	
Peak expiratory flow rate >75% predicted or best at 1 hour post-treatment, with <25% diurnal variability	
Inhaler technique checked, identification and education regarding triggers and self-management with a written personalised asthma action plan and peak expiratory flow meter for use at home	
Follow up	GP follow up arranged for 2 days post-discharge and details of admission, discharge and best peak flow sent to GP
	Respiratory clinic follow up within 4 weeks

Adapted from British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019)

Once the patient has adequately improved and is stable, it is important to make a clear plan for ongoing management and follow up. This can be divided into three domains: treatment, education and personalised asthma action plans, and follow up.

Treatment

1. Asthma medication: ensure use of correct inhaler technique and an adequate supply of inhaled corticosteroids and SABAs (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019). Inhaled corticosteroids significantly reduce the risk of severe exacerbations and should be initiated if not already prescribed (Reddel et al, 2019). If there are concerns about longstanding poor asthma control, liaise with the local respiratory team regarding changes to inhaled therapy
2. Oral prednisolone for a minimum of 5 days. If a patient has had multiple courses of oral steroids within a matter of weeks or is on a longer course (more than 10 days), these should be weaned under the guidance of a respiratory clinician.

Education and personalised asthma action plans

These reduce relapse rates, prevent future hospital admissions and improve adherence with appointments and self-management (although not presentations to emergency department) (Tapp et al, 2007; Global Initiative for Asthma, 2018). Table 7 lays out important points to cover and can be used as a checklist. The National Review of Asthma Deaths identified widespread lack of use of written management plans in patients who died from asthma (Royal College of Physicians, 2014).

Follow up

Follow up ensures ongoing care to prevent readmission.

- GP – before discharge, appointments should be made for follow up within 2 days. GPs should be informed of the admission within 24 hours of discharge, including details of admission, discharge and best peak flow (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019; Global Initiative for Asthma, 2020)
- Specialist asthma nurse or chest clinic – all patients who have been admitted to hospital with asthma or treated in emergency department with moderate asthma should be referred to a specialist asthma nurse or respiratory physician for follow up within 1 month (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019)
- Any patient admitted with a severe asthma attack should be followed up by a respiratory physician for 1 year, while those with near-fatal asthma should remain under specialist care indefinitely (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2019).

Biologic therapy

Four biologic agents have been licenced for use in patients with severe asthma: omalizumab, reslizumab, mepolizumab and benralizumab. Their use is restricted to specialist centres, with strict inclusion criteria including adherence, exacerbation history and biological parameters. They reduce exacerbation frequency and improve lung function, but there is

Table 7. Patient education and personalised asthma action plan – important points to cover

Check inhaler technique and understanding of treatment	
Discuss peak flow diary and document best peak flow	
Identify and document triggers and discuss modifiable risk factors	
Personalised asthma action plan	■ Explains when and how medications should be changed ■ When to seek help ■ Ongoing management after symptoms have improved ■ Global Initiative for Asthma (2020) update makes recommendations for personalised action plans depending on level of treatment. Asthma UK (2019) has a personalised action plan that can be printed off and filled in with the patient

Key points

- Asthma is an extremely common presentation to the unselected medical take. A good understanding of the British Thoracic Society guidelines can help reduce avoidable death in asthma.
- Assess severity early and initiate therapy early.
- Reassess the situation regularly to allow prompt escalation of treatment if required.
- Early discussion with critical care if the situation is not improving allows decisions to be made about intubation and ventilation.
- When improving, start planning for discharge early, including reviewing regular medication, arranging appropriate follow up, patient education and personalised asthma plans.
- During COVID-19 it is important that patients continue all regular asthma medication.
- Biologic therapy helps prevent exacerbations, but has no evidence for use to treat exacerbations.

no evidence for their use in managing acute exacerbations. If a patient on a biologic agent is admitted, a scheduled dose can be given before discharge if they are well enough.

All other asthma medication should be continued while on a biologic agent, unless instructed by a specialist asthma centre.

COVID-19

The Global Initiative for Asthma (2020) update includes guidance on management of asthma in view of the COVID-19 pandemic. Patients should continue all regular medication, especially inhaled corticosteroids or oral steroids. There is some concern that nebulised therapy may increase the risk of transmission, therefore the Global Initiative for Asthma (2020) advise that a pressurised metered dose inhaler using a spacer should be trialled before escalating therapy.

Conclusions

Asthma continues to make up a significant proportion of the medical take. Understanding the UK asthma guidelines ensures patients are managed safely and appropriately, reducing the risk of mortality and morbidity. Planning a safe discharge, incorporating patient education and self-management, has a significant impact on the patient's outcomes by improving symptom control, reducing exacerbations and admissions to hospital. This article outlines the gold standard management of asthma exacerbations, including updates from the British Thoracic Society/Scottish Intercollegiate Guidelines Network (2019) guidelines and the Global Initiative for Asthma (2020) update, with a view to optimising the management of these patients and reducing avoidable asthma deaths.

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Conflicts of interest

The authors declare no conflicts of interest.

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Top tips

- Complete a thorough assessment of severity, including peak flow and if appropriate arterial blood gas. This makes tracking progress and identification of deterioration more accurate and straightforward.
- Identify psychosocial risk factors as these may influence whether a patient is admitted or discharged.
- Administer steroids (oral or intravenous) within the first hour of presentation. These should continue for a minimum of 5 days.
- Back-to-back nebulisers involve 5 mg salbutamol every 15 minutes. Ipratropium should only be given four times a day.
- Escalation of treatment to include intravenous magnesium and aminophylline can be considered but needs careful monitoring and discussion with seniors.
- All patients should be on an inhaled corticosteroid as minimum regular management.
- Patients who present with acute asthma while pregnant should be managed as per non-pregnant patients, with a lower threshold to admit, and close collaboration with the local respiratory and obstetric teams to optimise asthma control and minimise risk to mother and fetus.
- Discharge planning should allow for appropriate follow up to be arranged (GP, asthma nurse, chest physician) and time for patient education. Ensure patients have a good understanding of their personalised asthma action plan.

Curriculum checklist

This article addresses the following requirements from the general internal medicine training curriculum:

- Managing medical problems in patients in other specialties and special cases
- Managing a multidisciplinary team including effective discharge planning
- Delivering effective resuscitation and managing the acutely deteriorating patient.

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