Asthma: guidelines, and learning from asthma deaths

Nurse, to patient: “Say, for example, your asthma has been pretty good, but in the middle of the night your asthma is suddenly really bad, and you are struggling to breathe. What would you do?”

Patient: “Take my inhaler? The blue one… I’d probably take a few puffs.”

Nurse: “What if that doesn’t improve things?”

Patient: “Take some more puffs? I’m not sure… can I have more than 4 puffs?”

Nurse: “Well in situations like this you can take up to 10 puffs, but if things are not getting better, you should think about calling 999.”

Patient: “But 999 is just for emergencies!”

Nurse: “This IS an emergency! You can’t breathe, your inhaler isn’t helping!! How about, if your asthma has been getting a bit worse for a few days, you are breathless when you climb the stairs, but OK walking around. You have taken your inhalers as usual, but things are no better. What would you do then?”

Patient: “I’d ring you!”

Nurse: “Excellent! Now let’s get this all written down as a plan. What we call a PAAP, it stands for Personalised Asthma Action Plan.

Learning from asthma deaths

These learning points are from the National Review of Asthma Deaths (UK) (2014).

- The number of asthma deaths in the UK is higher than in other European countries.
- Most deaths occur before admission to hospital.
- Most deaths occur in those with chronically severe asthma – however, a minority occur suddenly in those with a background of mild or moderate disease.
- Most who die have either had:
  - inadequate doses of inhaled or oral steroids OR
  - no objective assessment/monitoring of their asthma (peak flows, etc.).
- Some patients still die due to attacks triggered by NSAIDs or beta-blockers. All beta-blockers are absolutely contraindicated in asthma. This includes cardioselective beta-blockers and even beta-blocker eye drops.
- In those who died, there was a severe underuse of written personalised asthma action plans (PAAPs).
- Heavy or increasing use of beta-agonists was associated with asthma deaths (patients, doctors or nurses missing a vital cue).
- Behavioural and adverse psychosocial factors were present in the majority of patients who died (e.g. frequent DNAs/self-discharge from hospital, social isolation, unemployment/low income, obesity, severe relationship or legal stress).
- Those who have had a near fatal asthma attack should be under specialist monitoring indefinitely.
- Those who have had a severe asthma attack should be under specialist care for at least a year.

Interpreting lung function tests
**British Thoracic Society/SIGN asthma guidelines**

This guidance was published in October 2014 (SIGN 2014, 141). I have summarised it into a table that you are welcome to photocopy and pin up on your wall or use as the basis of your practice protocol. This includes the diagnosis, investigations and referral criteria (one page for adults, one for children, and a single page on management).

The key changes are:

- **All patients with asthma should have a PAAP AND KNOW HOW TO USE IT!** Asthma UK have a good version based on traffic lights.
- **Checking inhaler technique is crucial** – a patient who doesn’t know how to use an inhaler correctly may as well not bother having one! Get a device that actually checks that people are doing it properly (we have one on every desk in our surgery and it is one of the best bits of kit we have bought for a long time, and now we have a cohort of asthmatics who actually use their inhaler correctly!!).
- **TIDAL breathing is now recommended for those using a spacer** (several normal breaths rather than one long/fast intake of breath is preferred).
- **Drug therapy has not changed significantly, but do remember that...**
  - In all but mild exacerbations, use oral steroids in preference to increased inhaled steroid doses. Trials have shown that doubling inhaled steroids during an acute exacerbation does not reduce the chance of needing oral steroids.
  - NEVER use long acting beta-agonists (e.g. salmeterol, formoterol) without inhaled steroids in asthma (risk of death).
  - Breathing exercise programmes including Buteyko and the ‘Papworth method’ (physio-taught programme) can be offered alongside, not instead of, drug therapy. They can improve quality of life and patients’ perception of asthma control, but not lung function or exacerbations.
  - Bronchial thermoplasty is recommended in those with moderate or severe asthma unresponsive to maximal other therapies.
  - **In people with asthma, do not recommend house dust mite avoidance.** There is no evidence it improves asthma control.

### Lung function tests: what they involve and how to interpret (from SIGN 2014, 141)

**Obstruction** is shown by an FEV₁/FVC ratio of <0.7.

**Reversibility**: do FEV₁ and symptoms, before and after 400mcg of inhaled salbutamol.

- **In adults**: positive reversibility is shown by >400ml improvement in FEV₁.
- **In children**: look for a significant increase in FEV₁ (>12% from baseline).

Reversibility makes asthma very likely. Improvements of <400ml do not rule out asthma, but are less discriminatory. However, some with asthma have normal lung function when asymptomatic.

If there is an incomplete reversibility to salbutamol, consider either inhaled or oral steroids:

- Inhaled beclometasone 200mcg twice daily (or an equivalent) for 8–10w.
- Oral prednisolone 30mg daily for 2w (preferred in those with significant obstruction, where there is more likely to be resistance to inhaled steroids).

Reversibility can also be assessed using peak flows, and the drugs listed here, but spirometry is preferred. If using PEFR, reversibility is defined as >60ml/min increase in PEFR.

### Diagnosis, investigations and monitoring of asthma in ADULTS (SIGN 2014, 141)

The diagnosis of asthma is based on a really good history. These are the features that makes asthma more or less likely:

<table>
<thead>
<tr>
<th>Features that increase the probability of asthma in adults</th>
<th>Features that reduce the probability of asthma in adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 1 of the following present:</td>
<td></td>
</tr>
<tr>
<td>- Wheeze/breathlessness/ chest tightness/cough.</td>
<td>- Chronic productive cough in the absence of wheeze/breathlessness.</td>
</tr>
<tr>
<td>- Night or early morning symptoms</td>
<td>- Voice deterioration</td>
</tr>
</tbody>
</table>

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---
Especially if symptoms:
- Worse at night & early morning/tone on with triggers
  (exercise, allergen exposure, after aspirin/beta-blockers).

And the adult has:
- A personal or family history of atopy.
- Widespread wheeze on auscultation (when symptomatic).
- Otherwise unexplained low FEV₁/PEFR.
- Otherwise unexplained eosinophilia on FBC.

Symptoms with colds only (=viral induced wheeze).
- Significant smoking history (e.g. >20 pack years).
- Cardiac disease.
- Prominent diaphoresis/heatiness/edema/numbness/feet/lowing.
- Repeatedly normal chest exam/peak flow testing: spirometry when patient is symptomatic (normal tests when asymptomatic does NOT exclude asthma).

Based on a really good history (see above), decide if the adult has:

<table>
<thead>
<tr>
<th>High probability of asthma</th>
<th>Intermediate probability of asthma</th>
<th>Low probability of asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start trial of treatment</td>
<td>Do spirometry to look for</td>
<td>Consider further</td>
</tr>
<tr>
<td>Test only if failure to respond</td>
<td>obstruction (FEV₁/FVC &lt;0.7).</td>
<td>investigations/specialist referral</td>
</tr>
<tr>
<td>(although O2F requires variability or reversibility testing from 8y)</td>
<td>If obstruction present: test for reversibility. &gt;400ml improvement in FEV₁ after 400mcg salbutamol is highly suggestive of asthma.</td>
<td></td>
</tr>
</tbody>
</table>

Interpreting spirometry
N.B. Some with asthma will have NORMAL lung function when asymptomatic!

<table>
<thead>
<tr>
<th>Obstruction and reversibility</th>
<th>Obstruction but no reversibility</th>
<th>No obstruction (FEV₁/FVC&gt;0.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More useful for MONITORING disease than for making the initial diagnosis.</td>
<td>Consider tests for other conditions</td>
<td>Consider tests for other conditions</td>
</tr>
</tbody>
</table>

Possible differential diagnoses in adults if spirometry does not show typical changes of asthma (obstruction and reversibility):
- Obstruction on spirometry: COPD, obliterative bronchiolitis, large airway stenosis.
- NO obstruction on spirometry: chronic cough syndromes, hypothemia, vocal cord dysfunction, pulmonary fibrosis, rhinitis, reflux, heart failure.

Obstructive or non-obstructive spirometry: lung cancer, bronchiectasis, sarcoidosis, inhaled foreign body.

Investigations in adults

<table>
<thead>
<tr>
<th>PEFR</th>
<th>More useful for MONITORING disease than for making the initial diagnosis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CXR</td>
<td>In any adult with atypical presentation or additional symptoms or signs.</td>
</tr>
</tbody>
</table>

Other tests: NICE suggest other tests (lull lung function tests, blood eosinophilia count, serum IgE and allergen skin prick tests) may be useful in "certain patients" - they don't elaborate on which! Probably those who are likely to be referring (see below), so perhaps this is for secondary care to do...

Tests for airway responsiveness (e.g. methacholine challenge test) are useful if near normal spirometry.

Tests for eosinophilic airway inflammation are useful if diagnostic uncertainty and no evidence of obstruction: tested by sputum eosinophil count (>2%) or exhaled nitric acid concentration (>25 parts per billion at 50 ml/sec). (NICE agree exhaled nitric oxide testing is an add-on test, in those with intermediate probability of asthma and should not replace current tests. Machines cost £2-£2000 + consumables (NICE 2014; DG12)).

Refer adults if:
- Diagnosis clear BUT severe asthma attack or poor response to treatment or suspected occupational asthma.
- Diagnosis unclear or in doubt.
- Shadow on CXR.
- Unexpected clinical findings (e.g. crackles, clubbing, cyanosis, cardiac disease, monophasic wheeze or stridor).
- Persistent non-variable breathlessness.
- Prominent systemic features (myalgia, fever, weight loss).
- Chronic sputum production.
- Unexplained restrictive spirometry.
- Marked blood eosinophilia (>1 x 10⁹/L).
### Diagnosis, investigations and monitoring of asthma in children (SIGN 2014, 141)

The diagnosis of asthma is based, particularly in children, when tests can be difficult, on a really good history.

N.B. Wheeze is a continuous high pitched musical sound coming from the chest. Parents often use the term wheeze to describe other noises such as stridor/loud breathing.

These are the features that make asthma more or less likely:

<table>
<thead>
<tr>
<th>Features that increase the probability of asthma in children</th>
<th>Features that reduce the probability of asthma in children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>More than 1 of the following present:</strong></td>
<td><strong>Symptoms with colds only (for management of viral induced</strong></td>
</tr>
<tr>
<td>• Wheeze/breathlessness/chest tightness/cough.</td>
<td><strong>wheeze; see Child Health chapter).</strong></td>
</tr>
<tr>
<td><strong>Especially if symptoms:</strong></td>
<td><strong>Isolated cough without wheeze/difficulty breathing.</strong></td>
</tr>
<tr>
<td>• Are frequent and recurrent.</td>
<td><strong>History of persistent moist cough.</strong></td>
</tr>
<tr>
<td>• Worse at night &amp; early morning.</td>
<td><strong>Prominent dizziness/light headedness/peripheral tingling.</strong></td>
</tr>
<tr>
<td>• Come on with triggers (exercise, allergen exposure or cold/</td>
<td><strong>Normal chest exam/pneum flow whenever symptomatic.</strong></td>
</tr>
<tr>
<td>• Symptoms improve with trial of treatment.</td>
<td><strong>No response to trial of treatment.</strong></td>
</tr>
<tr>
<td><strong>And the child has:</strong></td>
<td><strong>Clinical features suggestive of another disease (e.g.</strong></td>
</tr>
<tr>
<td>• A personal or family history of atopy.</td>
<td><strong>present from birth congenital disease), excessive vomiting</strong></td>
</tr>
<tr>
<td>• Widespread wheeze is heard on auscultation.</td>
<td><strong>(reflux?), abnormal cry (laryngomalacia), failure to thrive</strong></td>
</tr>
<tr>
<td>• Symptoms improve with trial of treatment.</td>
<td><strong>(cystic fibrosis), focal chest signs (developmental anomaly</strong></td>
</tr>
<tr>
<td></td>
<td><strong>bronchioclisis, TB).</strong></td>
</tr>
</tbody>
</table>

### Based on really good history (see above), decide if the child has:

- **High probability of asthma**
  - Start trial of treatment
    - Test only if failure to respond (although QOF requires variability or reversibility testing from 8y)

- **Intermediate probability of asthma**
  - Try one of the following:
    - Watchful waiting
    - Trial of treatment
    - Spirometry/reversibility testing
    - (BTS say this can be done from 5y)

- **Low probability of asthma**
  - Consider further investigations/specialist referral

### Investigations in children:

- **Spirometry**
  - Look for obstruction (FEV₁/FVC <0.7) and reversibility (>12% change in FEV₁ from baseline). Reversibility strongly suggests asthma (and a good response to inhaled steroids) BUT LACK of reversibility does not mean that they do not have asthma!

- **CXR**
  - Only if severe disease or clinical clue suggesting other conditions.

- **Airway hyper-responsiveness testing**
  - E.g. methacholine challenge test, exercise challenge test. Useful if negative!

- **Exhaled nitric oxide concentration**
  - Not sufficient evidence to recommend at present.

- **Eosinophil count in sputum**
  - Not sufficient evidence to recommend at present.

### Refer children if (possible differential diagnoses shown in brackets):

- **Failure to respond to conventional treatment (particularly inhaled corticosteroids above 400mcg per day or frequent use of steroid tablets).**
- **Diagnosis unclear or in doubt.**
- **Symptoms present from birth or perinatal lung problem (cystic fibrosis, chronic lung disease of prematurity, ciliary dyskinesia, developmental lung anomaly).**
- **Excessive vomiting or persisting (reflux +/- aspiration).**
- **Persistent wet or productive cough (cystic fibrosis, bronchioclisis, bronchitis, recurrent aspiration, ciliary dyskinesia, etc.).**
- **Failure to thrive (Reflex? cystic fibrosis).**
- **Family history of unusual chest disease (cystic fibrosis, neuromuscular disorder).**
- **Nasal polyps.**
- **Breathlessness with lightheadedness and peripheral tingling (hyperventilation/panic attacks).**
- **Unexpected clinical findings, e.g. focal signs, abnormal voice or cry (laryngomalacia), inspiratory stridor (laryngomalacia or tracheal problem), dysphagia (malacia or tracheal problem), dysphonia (foveolarising problem +/- aspiration).**
- **Parental anxiety or need for reassurance.**

### Stepwise management of asthma (BTS/SIGN 2014, 141)
**Step up:**
Using salbutamol or symptomatic 3x a week or more. Waking 1 night/aw because of asthma.

**Step down (important but often forgotten):**
Once stable aim to reduce inhaled steroids by 25-50% every 3m to the lowest possible maintenance dose.

### Adults and children aged 5y and over

**Before stepping up, check compliance, inhaler technique and eliminate triggers (such as smoking).**

ICS = inhaled steroids  
LABA = long acting beta agonist

**Step 1**
Inhaled salbutamol as needed

**Step 2**
ADD regular preventer: ICS  
Usual maintenance doses & range  
**ADULTS:** 400mcg/d  
**200-800mcg/d**  
**CHILD:** 5-12y: 200 mcg/d  
**200-400mcg/d**

**Step 3**
ADD second preventer: LABA, e.g. salmeterol/formoterol  
**NEVER** use LABA without ICS. (Risk of death). Use a combination inhaler

**Step 4**
Use high dose ICS  
**ADULTS:** 2000mcg/d  
**OR** (in adults) ACD 4th drug: see ‘other drugs.’  
In children 5-12y:  
Use high dose ICS AND REFER  
**CHILD** 5-12y: 800mcg/d

**Step 5**
(Adults only; children have been referred)  
ADD daily oral steroids (+/- steroid spacers in adults)  
AND REFER! Continue high dose inhaled steroids

### Under 5s

LTRA = leukotriene receptor antagonists (e.g. montelukast)

**Step 1**
As above; inhaled salbutamol as needed

**Step 2**
As above; add regular preventer: ICS are best (200-400mcg/d) but LTRA an alternative

**Step 3**
If on ICS add LTRA  
If on LTRA add ICS  
**DO NOT USE LABA!**  
<2y consider referral

**Step 4**
REFER

### Notes on drugs and steps

- **Salbutamol**: as needed use is as good as regular use in mild asthma.  
- **Inhaled corticosteroids**: give twice daily initially, then reduce to some dose once daily, then titrate to lowest effective dose.  
- **Doses are for beclometasone. 200mcg beclemethasone = 200mcg of budesonide; 100mcg of QVAR/mometasone/fluticasone PROPIONATE: 100-150mcg of fluticasone 20mcg fluticasone FURCATE (in Relvar)  
At step 4, refer children of all ages, and monitor children’s growth and check for cataracts, because of steroid dose.  
If daily/frequent oral steroids (>3-4x/y) monitor for systemic effects: BP, diabetes screen, consider bone protection if >3m use.

### Other drugs

- **Inhaled ipratropium** is an alternative to salbutamol but remember a Cochrane review in 2004 showed it was ineffective.  
- Sodium cromoglicate/balocromol are not as effective as ICS and there is no evidence of benefit in under 5s.  
- LTRA useful at step 2 if eosinophilic inflammation and in children with viral induced wheeze (licensed from 6m for asthma).  
- Slow release salbutamol tablets can be used in adults only but side-effects are more common and caution if on inhaled LABA.  
- Slow release theophylline can be considered from step 2 if alternatives are not suitable but I’d seek advice first.  
- If 4th drug needed in adults (step 4) consider: LTRA, theophyllines, slow release beta-agonist tablets (but see cautions above).  
- Antihistamines (including ketotifen) are NOT beneficial.

### Inhalers

Children use a pMDI + spacer.  
**Adults** use the device they find easiest to use. Try to stick to same type of inhaler for all drugs to reduce confusion over technique.  
**With a spacer:** tidal breathing (taking 5 NORMAL breaths) is as effective as a single breath. DISCOURAGE large deep breaths!

### Monitoring in primary care (at least annually)

- **MOST IMPORTANTLY:** Do they have and do they know how to use their PAAP? PAAPs improve outcomes in people with asthma: they reduce GP use, AEG attendances and admissions.  
- **Symptoms:** use a symptom score, e.g. Royal College of Physicians 3 questions, Asthma Control Questionnaire (use discussed later) and (in adults) lung function (spirometry/peak flow).  
- **Disease control:** asthma attacks, oral steroid use and time off nursery/school/work due to attacks since last review. Do not use newer tests to monitor control (e.g. exhaled nitric oxide concentration): insufficient evidence.  
- **Inhaler technique & adherence:** Use a device to check technique. >1 salbutamol/month suggests poor control: review urgently.  
- **Exposure to tobacco smoke.**
In children: measure growth (height and weight centile) at least annually.

**Acute severe asthma**

This is Mill Steam Surgery’s practice protocol for acute severe asthma, based on the BTS/SIGN guidance. It is a practical way to summarise the management. Feel free to photocopy it for your treatment room wall or to use it as the basis of your practice protocol.

If you use a protocol that improves on this, please get in touch, we’d love to share it in the handbook and give you a mention too! – mail@gp-update.co.uk.
### Assess severity
Don’t rely on a single sign. Look at the whole picture!

<table>
<thead>
<tr>
<th>MODERATE ASTHMA</th>
<th>ACUTE SEVERE ASTHMA</th>
<th>LIFE-THREATENING ASTHMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak flow 50–75% predicted</td>
<td>Peak flow 33–50% predicted</td>
<td>Any one of the following:</td>
</tr>
<tr>
<td>Talking normally</td>
<td>Can’t finish sentence in 1 breath</td>
<td>PEFR &lt;33% predicted</td>
</tr>
<tr>
<td>O₂ sats ≥92%</td>
<td>O₂ sats ≥92%</td>
<td>O₂ sats &lt;92% or cyanosis</td>
</tr>
<tr>
<td>RR &lt;25/min</td>
<td>RR ≥25/min</td>
<td>Feeble respiratory effort/silent chest</td>
</tr>
<tr>
<td>P &lt;110</td>
<td>P ≥110/min</td>
<td>Hypotension or arrhythmia</td>
</tr>
</tbody>
</table>

#### Management

**Oxygen** not needed.
**SALBUTAMOL**: 4 puffs via spacer then 2 puffs every 2 min if needed. Maximum 10 puffs.
**PREDNISOLONE**: 40–50mg orally for at least 5 days.
**ANTIBIOTICS**: only if evidence of infection.

**OXYGEN** to keep O₂ sats at 94–98%.
**SALBUTAMOL**: 5mg nebulised via oxygen gr 4 puffs via spacer, then 2 puffs every 2 minutes if needed. Maximum 10 puffs.
**PREDNISOLONE**: 40–50mg orally for at least 5 days or HYDROCORTISONE 100mg iv
**ANTIBIOTICS**: give only if evidence of infection.

Note on nebulising: If you don’t have a nebuliser machine, you can still nebulise drugs. Just plug the tube from the nebuliser “pot” onto the oxygen cylinder and turn up the flow (usually to above 6l/min).

In adults, if no oxygen is available, you may use a nebuliser without oxygen (may cause hypoxia in children).

#### Admission?

Have a lower threshold for admission if:
- Afternoon/evening attack.
- Recent nocturnal symptoms or recent hospital admission.
- Patient unable to assess own symptoms/condition or concerned about social situation.

If admitting: stay with patient until ambulance arrives and ensure written handover/referral letter.

<table>
<thead>
<tr>
<th>MODERATE ASTHMA:</th>
<th>ACUTE SEVERE ASTHMA:</th>
<th>LIFE-THREATENING ASTHMA:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most can go home if improving. Review drugs: do they need stepping up? Admit if history of near-fatal asthma.</td>
<td>Consider admission depending on response to treatment.</td>
<td>Arrange immediate admission</td>
</tr>
</tbody>
</table>

#### After an admission

Primary care follow-up within 2 working days of discharge. At review:
- Check symptoms and peak flow.
- Check inhaler technique and understanding of inhalers.
- Ensure patient has a written PAAP and knows how to use it.
- Address potentially preventable contributors to admission.
**Mill Stream Surgery ACUTE ASTHMA PROTOCOL for CHILDREN (2014)**
Based on the SIGN/BTS Guidelines (SIGN 2014, 114)

### Assess severity
If signs and symptoms are scattered across severity criteria, treat according to the most severe symptom.
**WARNING:** some children with severe asthma do not look distressed and some clinical signs may be normal

<table>
<thead>
<tr>
<th>MODERATE ASTHMA</th>
<th>ACUTE SEVERE ASTHMA</th>
<th>LIFE-THREATENING ASTHMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$O_2$ sats ≥92%</td>
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<td>$O_2$ sats &lt;92% or cyanosis</td>
</tr>
<tr>
<td>Talking normally</td>
<td>Can’t finish sentence in 1 breath</td>
<td>Feeble respiratory effort/silent chest</td>
</tr>
<tr>
<td>Peak flow 50–75% predicted</td>
<td>Peak flow 33–60% predicted</td>
<td>PEFR &lt;33% predicted</td>
</tr>
<tr>
<td>2–5y</td>
<td>2–5y</td>
<td>Agitation/altered consciousness</td>
</tr>
<tr>
<td>RR ≤40</td>
<td>RR &lt;30</td>
<td>• Arrange immediate admission</td>
</tr>
<tr>
<td>$P$ ≤140</td>
<td>$P$ &lt;125</td>
<td></td>
</tr>
</tbody>
</table>

### Management

#### Oxygen not needed.

**SALBUTAMOL**
Via spacer & face mask: 1 puff every minute. 5 normal breaths via spacer after each puff. Maximum 10 puffs.

**Consider soluble PREDNISOLONE:**
Aged 2–5y: 20mg for 3d
Aged >5y: 30–40mg for 3d

**ANTIBIOTICS:** only if evidence of infection.

#### OXYGEN to keep $O_2$ sats at 94–98%.
**SALBUTAMOL via spacer/nebuliser**
Via spacer & face mask: 1 puff every minute. 5 normal breaths via spacer after each puff. Maximum 10 puffs.

**Nebulised salbutamol:**
Aged 2–5y: 2.5mg salbutamol
Aged >5y: 5mg salbutamol

**Give soluble PREDNISOLONE:**
Aged 2–5y: 20mg for 3d
Aged >5y: 30–40mg for 3d

**ANTIBIOTICS:** give only if evidence of infection.

#### OXYGEN to keep $O_2$ sats at 94–98%.
**SALBUTAMOL AND IPRATROPium**
Give together via nebuliser:
Aged 2–5y: 2.5mg salbutamol
Aged >5y: 5mg salbutamol
IPRATROPium 0.25mg for all ages.

**Give soluble PREDNISOLONE:**
Aged 2–5y: 20mg for 3d
Aged >5y: 30–40mg for 3d

**gt iv HYDROCORTISONE**
Aged 2–5y: 50mg iv
Aged >5y: 100mg iv

**ANTIBIOTICS:** give only if evidence of infection.

### Note on nebulising:
If you don’t have a nebuliser machine, you can still nebulise drugs. Just plug the tube from the nebuliser ‘pot’ onto the oxygen cylinder and turn up the flow (usually to above 8L/min)! Always nebulise children with oxygen (risk of hypoxia otherwise).

### Admission?

#### MODERATE ASTHMA and ACUTE SEVERE ASTHMA:
Assess response to treatment after 15min:
If poor response, ADMIT. If good response to treatment, may go home.
If going home continue salbutamol as needed but not more than every 4h (if needed more often than this, seek help). Arrange follow-up to review.

Have a lower threshold for admission if:
• Allergy/ evening attack.  
• Recent hospital admission or previous admission with severe attack.  
• Concern over social situation/ability to cope.

If admitting: stay with patient until ambulance arrives and ensure written handover/referral letter.

#### LIFE-THREATENING ASTHMA:
Arrange immediate admission.

### After an admission
Primary care follow-up within 2 working days of discharge. At review:
• Check symptoms and peak flow.  
• Check inhaler technique and understanding of inhalers.  
• Ensure patient/parent has a written PAAP AND KNOWS HOW TO USE IT.  
• Address potentially preventable contributors to admission.

**PAAPs/self management**
Personalised asthma action plans (PAAPs) are a major focus of the new SIGN/BTS guidelines. They consist of a written management plan that reminds people what to do if their asthma gets worse. Clearly, education is a large part of developing a PAAP: people need to know what to do and when, and to feel the document is useful to them (so they keep it somewhere they can access in a time of need).

**PAAPs:**
- Improve asthma control.
- Reduce emergency use of health services (GPs, A&E, admissions).

The guidelines stress that everyone with asthma should have one and that anyone being discharged from hospital after an asthma admission should have their PAAP reviewed before discharge. Patient education is a crucial part of PAAPs – the plans should be developed in conjunction with each patient and tailored to their circumstances/triggers/medication/peak flows.

**A simple traffic light-based PAAP is available from Asthma UK** (see Practical tools box below).

*Do all your patients with asthma have a PAAP and do they understand it?*

I find testing patients on the two scenarios outlined at the start of this article gives me a real insight into what people really understand about their asthma, and helps me to tailor the information they need to stay safe and manage their asthma better.

**Which inhaler device?**

*Never prescribe an inhaler without ensuring the patient knows how to use it AND has demonstrated they can satisfactorily use it!* You can get devices such as the In-check dial that test inhaler technique – see Practical tools box (probably the most useful kit we have bought in recent years and they are not expensive (£30 + consumables)).

- Training people how to use inhalers does actually improve inhaler technique.
- In **children** a pMDI + spacer is the preferred method of drug delivery. Remember that young children will need to use a device with a mask until they are able to use a mouthpiece (pMDI = pressurised metered dose inhaler – what most asthmatics have as their ‘blue’ inhaler).
- For **STABLE asthma in ADULTS** the bottom line is that you should use whichever inhaler your patient can use best.
- However, remember that in an asthma **ATTACK** (mild to moderate) drugs should be given via a pMDI + spacer (or nebuliser). This means that a pMDI + spacer may be the best choice for ALL patients unless they can’t actually use them.
- Using combined inhalers may reduce the risk of confusion (and should be encouraged in anyone on a long acting beta-agonist).
- Reduce confusion by issuing the same type of inhalers to each patient (i.e. all dry powder inhalers or all pMDI + spacer).

**Using a spacer**

- **Tidal breathing** (taking 5 NORMAL, not big breaths) is as effective as a single breath. **DISCOURAGE** large deep breaths!
- Clean spacers MONTHLY (not weekly as suggested in manufacturers instructions). Wash in detergent and allow to dry in air (I’ve always been told, and I don’t know whether this is true, that you mustn’t wipe them dry with a cloth because doing so causes static to build up inside although it seems that this is based on expert recommendation not evidence!) – they don’t say whether putting it in the dishwasher is OK and I know some patients do! Metal spacers do not have these problems.
- Plastic spacers should be replaced at least every 12m.

**Drug dilemma: LABAs in asthma**
Relvar: new drug

- Relvar is a new combined ICS/LABA inhaler like Symbicort or Fostair, but with the advantage that it is only used once daily (the others are used twice daily). It contains the steroid fluticasone furoate and the long acting beta-agonist (LABA) vilanterol.
- Fluticasone Furoate is more potent than fluticasone Propionate, so is equivalent to medium to high potency inhaled steroids (92mcg once daily is roughly equivalent to a daily dose of 500mcg of fluticasone propionate or 1000mcg of beclomethasone).
- It comes in two strengths: 92mcg fluticasone Furoate and 22mcg vilanterol for use in asthma and COPD and a higher dose (184mcg fluticasone, 22mcg vilanterol) for use in asthma only.
- Because of the strength of the steroid, even at the lowest dose, it is only suitable for Step 4 asthma control.

The DTB reviewed it and found several causes for concern (DTB 2014;52(8):93):

- When first produced it came as a blue inhaler (think reliever!) but it is a preventer. It is now yellow in colour.
- Its name (Relvar) suggests it is a reliever, but it is a preventer.
- It contains fluticasone Furoate, but not fluticasone propionate and so the dose looks 'low' when it is actually higher than the equivalent dose of fluticasone propionate.
- The steroid dose is such that it is only suitable for Step 4 asthma control.

Lots of potential for confusion I feel!

The evidence

In asthma evidence is limited to 3 main trials, which ran for 18m or less. The main focus was on FEV1 results, not important clinical outcomes. Only one trial, running for 24w, compared Relvar with another combined ICS/LABA inhaler. There was no difference in important outcomes (Scottish Medicines Consortium 2014: 966).

In summary

Cheaper than currently available combined ICS/LABA inhalers BUT high potency steroid (BTS step 4 only) and limited experience of use/safety data. No evidence of superiority to other currently available combined ICS/LABA inhalers, for which there is much greater evidence. A not-yet drug?

Tiotropium for asthma?

Tiotropium, widely used in COPD, is now licensed for use in asthma in adults (not children). Importantly: only the Respimat (mist) device is licensed for use in asthma. The Handihaler (dry powder) device is NOT. The recommended dose in asthma is 2 puffs (5mcg) daily. The BTS/SIGN guidelines suggest tiotropium can be used as an option if step 4 treatment is not sufficient, although the evidence is currently based on short-term trials. These patients also need referral so this may, for now, be a drug to be initiated in secondary care in asthma, until there is more experience of its use in asthma?

SIT: Single Inhaler Therapy for maintenance and relief

Many of you will be familiar with SMART regimens using Symbicort (Symbicort for Maintenance And Reliever Therapy): the idea is that asthmatics have a single inhaler containing a steroid and a LABA (in the case of Symbicort, budesonide and formoterol), and use it for daily maintenance, but can use additional doses of the same inhaler to manage exacerbations.
As alternatives to Symbicort have become available the preferred name is now SIT (Single Inhaler Therapy). The main alternative is a combination of formoterol and beclometasone (Fostair).

SIT regimens are NOT recommended in those under the age of 18y.

Formoterol is used in SIT regimens because its onset of action is close to that of salbutamol.

Do NOT use salmeterol inhalers as part of a SIT regimen: salmeterol takes longer to start working than formoterol and will not therefore give sufficiently speedy relief. As far as I am aware, vilanterol is not currently recommended for SIT therapy (lack of evidence) although it may have a faster onset of action than salmeterol.

A Cochrane review concluded that (Cochrane 2013;CD007313):

- SIT reduces the number of exacerbations requiring oral steroids.
- Although promoted as a means to reduce hospitalisations the evidence for this is weak.
- More people stopped SIT because of minor adverse events, although there was no increase in serious adverse events.

**Schools providing salbutamol**

Twenty school-age children die of asthma each year in England and Wales, usually before reaching hospital. From October 2014 schools have been allowed to purchase a stock of salbutamol inhalers and spacers for emergency use from pharmacies. This follows a survey by Asthma UK that showed that 64% of children with asthma did not have access to salbutamol because they had left it at home/it was broken/run out, etc. (DTB 2014;52(10):110). Whether this will have any impact on asthma deaths in children is not yet known.

**Osteoporosis and oral steroids**

The SIGN guidance recommends that if oral steroids are used continuously, or more than 3–4 courses are given over a 12m period, you should monitor for systemic side-effects: monitor BP, diabetes screen and that bone protection should be considered if steroid use is continued beyond 3m. However, an alternative approach would be to assess their risk of osteoporotic fractures using FRAX and offer bone protection if indicated by FRAX (ensuring you tick the 'steroids' box). This is discussed in the section on osteoporosis in the Older People chapter.

**Growth and inhaled steroids in children**

In children with asthma, the guidelines recommend annual measurement of height and weight centiles to monitor growth. We know that whilst using inhaled steroids growth rate is slowed, but do children catch up? This cohort study followed 1000 children who had been in a study where they had been randomised to inhaled steroids (budesonide), nedocromil or placebo during childhood (5–13y at randomisation) (NEJM 2012;367:904).

- **Mean adult height was 1.2cm lower in those using budesonide** (CI 0.5–1.9cm lower) than those using placebo/nedocromil.
- Most of this impact on growth appears to have occurred in the first 2y of treatment, with prolonged treatment not having a greater effect on growth.

**Bronchial thermoplasty**

Bronchial thermoplasty is recommended in adults with moderate or severe asthma unresponsive to maximal other therapies. These will be under the respiratory physicians. Bronchial thermoplasty is performed using a bronchoscope: heat is used to reduce excessive smooth muscle, which results in reduced constriction of the airways. It reduces frequency of exacerbations, A&E attendances, days lost from work and improves quality of life (with data on reduced A&E visits persisting for at least 5y after treatment). It does NOT reduce the number of severe exacerbations, or consistently improve symptoms, or improve FEV1 or PEFR.

**Omalizumab**

Omalizumab (an anti-IgE monoclonal antibody) can be tried in specialist centres only. There is NICE guidance covering its use (NICE 2013, TA278). It is expensive!

**Immunotherapy**

Subcutaneous or sublingual immunotherapy (using small doses of allergens to desensitise the immune system) is NOT recommended until there are better data, and in particular data comparing its benefits against standard drug therapy.

**Which tool to assess symptomatic control?**

The guidance outlines a number of tools to help monitor asthma control (NOT to aid diagnosis) (p33–37 of the BTS/SIGN guidance if
you want to look at all the options yourself). However, most of them are not freely available to use (often behind a paywall), so most GPs/practice nurses are unlikely to have access to them. QOF requires us to use the Royal College of Physicians’ (RCP) 3 question test which is freely available and so this will be the one that we are likely to want to use. Although widely used, the RCP 3 questions test has not actually been well validated in adults, or validated at all in children. It is, however, very easy to remember and administer and it is free!

Royal College of Physicians 3 Questions (RCP 3Q)

In the last week/month:
- Have you had your usual asthma symptoms during the day (cough, wheeze, chest tightness or breathlessness)?
- Have you had difficulty sleeping because of your asthma symptoms/cough?
- Has your asthma interfered with your usual activities (housework, work, school)?

‘No’ to all 3 suggests good control. Take action if ‘Yes’ to any questions

Tip: I remember this as ‘day/night/life’.

Do NOT use the following for monitoring:

Exhaled nitric oxide is NOT recommended as a monitoring tool until more data are available.

Airway responsiveness (methacholine) is only available in secondary care and is NOT recommended until more evidence is available.

Primary prevention of asthma (to prevent the development of asthma)

As GPs we often get asked ‘What can I do to prevent my child getting asthma?’. The BTS/SIGN guidance offers the following advice to families with a high risk of developing asthma:
- Encourage breast-feeding because it may reduce the incidence of asthma in the infant.
- Avoid tobacco exposure: it increases the chance of children having wheeze in infancy and of having asthma long term (and has other long-term harms).
- Avoid obesity: it increases the risk of developing asthma.
- Ensure routine immunisations are given (there is no evidence they have any impact on the development of asthma).
- Allergen avoidance:
  - Do not recommend avoidance of single allergens (e.g. house dust mite or pets or a single food allergen) in pregnancy or early childhood to prevent the development of asthma in later life: no evidence on benefit.
  - However, a complex multifaceted approach to reduce allergen exposure may be tried if the family can afford it and can cope with the inconvenience and the demands of such a complex programme because there is some evidence it may reduce the incidence of asthma.
There is not yet enough evidence to recommend any of the following to reduce the risk of asthma:
- Food allergen avoidance in pregnancy or whilst breast-feeding.
- Early exposure to a household pet (i.e. buying a pet).
- Fish oils, selenium, vitamin E or other dietary changes in pregnancy or breast-feeding.

Does early antibiotic exposure cause asthma?

Some trials have suggested that use of antibiotics in early childhood increases the risk of asthma. However, such studies are prone to confounding by other factors. This Swedish study used siblings to try to eliminate some of the confounding factors and showed no increased risk of asthma with early antibiotic use (BMJ 2014;349:g6979).

Secondary prevention (in those with asthma)

In those who have asthma, what can be done to reduce the severity/frequency? The BTS/SIGN guidance offers the following advice:
- Avoid tobacco exposure.
- Breathing exercise programmes including Buteyko and the ‘Papworth method’ (physio-taught programme) can be offered alongside, not instead of, drug therapy. They can improve quality of life and patients’ perception of asthma control, but not lung function or exacerbations.
- If overweight, weight loss can improve asthma symptoms (and health generally).
- Do not recommend house dust mite avoidance. There is no evidence that even rigorous house dust mite avoidance (chemical treatment, mattress covers, freezing/washing/vacuuming bedding, ionisers, air filtration) improves asthma control.

Prognosis: will my child grow out of it?

The earlier the onset of wheeze the better the prognosis – most children who present with wheeze before the age of 2y will be asymptomatic by mid-childhood. However, if a child has atopy, then this is a risk factor for having long-term wheeze, regardless of age at presentation. (Clearly this applies to children who are well between episodes of wheeze – not those who also have features of
other diseases such as cystic fibrosis.)

Boys are more likely to grow out of asthma than girls.

Those who have more frequent or more severe episodes tend to have symptoms that persist into adolescence.

Those with a strong family history of atopy, especially maternal atopy, are most likely to have symptoms that persist.

**Pregnancy and breast-feeding: asthma management**

In pregnancy, about one-third of women will find their asthma is worse, one-third will find their asthma is better and one-third will notice no difference. Ninety percent of women with asthma will have no symptoms of their asthma during labour/delivery.

- FEV1 and peak flow rates do not change significantly as a result of pregnancy and so can still be used for assessing severity (NEJM 2009;360:1862).

The BTS/SIGN guidelines remind us:

- “In general the medicines used to treat asthma in pregnancy are safe. The risk of harm to the fetus from severe or chronically under-treated asthma outweighs any small risk from the medications used to control asthma.”

- Acute exacerbations should be managed as in non-pregnant patients.
- Short and long acting beta-agonists, steroids (inhaled and oral), cromoglicates and oral and intravenous theophyllines can be used in pregnancy.
- Leukotrienes should be used, if needed, to achieve adequate asthma control.
- Breast-feeding should be encouraged, and during breast-feeding, asthma medications can be used as normal.

**Exercise-induced asthma**

For most people exercise-induced asthma is a sign of poorly controlled asthma and the aim should be to increase usual therapies to stop the exercise-induced asthma.

Standard asthma treatments are effective in exercise-induced asthma, with the exception of ipratropium, which does not seem to be effective.

**Occupational asthma**

“Do your symptoms improve when away from work, or deteriorate when at work?”

The BTS/SIGN guidelines ask us to consider occupational asthma in someone with:

- New onset asthma in adulthood
- Re-emergence of asthma in someone who had ‘grown out of’ their asthma.

About 1 in 10 people who meet these criteria will have occupational asthma.

**High risk occupations include:**

- Food processing, especially baking/pastry making.
- Laboratory work.
- Metal work especially welding/soldering.
- Chemical processing.
- Farming and other jobs with exposure to dust/fumes.
- Spray painting.
- Health/dental care.
- Woodwork.
- Textiles/plastics/rubber manufacture.

**Diagnosis and management**

- 4x daily serial peak flows aid diagnosis, showing a dip on starting work and improvements when away from the workplace.
- Early referral to a chest physician/occupational physician is recommended.
- A history of rhino-conjunctivitis can precede the diagnosis of occupational asthma – the risk of developing occupational asthma is highest in the first year after developing the rhinitis.
- Early avoidance of the cause is important: once diagnosed, the person should be moved away from working in the environment that triggers their asthma.

**Difficult to treat asthma**

This BMJ clinical review is old, but I have included it here because it helpfully reminds us what to consider when we see an adult with asthma that is difficult to control (defined here as BTS steps 4 and 5). Referral is also likely! (BMJ 2009;338:b494). It is in line
with the advice in the BTS/SIGN guidelines.

- **Do they really have asthma?** Review history and examination findings, consider investigating for other causes (see end of this section).
- **Are they taking the drugs?** Are they taking them properly?
- **Are lifestyle or occupational factors exacerbating the asthma?** Obesity and smoking are two important contributory factors. Is this occupational asthma (see above)?
- **Is it drug-induced?** NSAIDs, aspirin, and beta-blockers can all make asthma worse. The chronic cough from ACE inhibitors can mimic an asthmatic cough.
- **Do they have asthma and another co-existing condition?**
  - Bronchiectasis
  - Sinusitis
  - Allergic rhinitis
  - Psychological distress
  - Vocal cord dysfunction
  - Reflux
  Investigate for other causes (which tests you do depends on clinical features):

Possible blood tests:

- Eosinophil count
- Aspergillus serology/RAST
- Theophylline levels for compliance
- Alpha 1 antitrypsin
- Immunoglobulins and functional antibody tests
- Anti-neutrophil cytoplasmic antibody

Pulmonary function

- Complex lung function tests (e.g. flow volume loops, lung volumes, transfer factors)

Radiology

- CXR
- Chest CT (bronchiectasis or interstitial lung disease?)

Other tests

- Nasal endoscopy (polyps, rhinosinusitis?)
- Bronchoscopy (tumour, foreign body?)
- Laryngoscopy (vocal cord dysfunction?)
- Echo (failure?)
- Psychiatric assessment
Asthma

- Spirometry is preferred to PEFR when diagnosing asthma.
- All patients with asthma should have a Personalised Asthma Action Plan AND KNOW HOW TO USE IT! Asthma UK have a good version based on traffic lights.
- Checking inhaler technique is crucial: use a device to do this.
- TIDAL breathing is now recommended for those using a spacer (several normal breaths rather than one long/fast intake of breath is preferred).
- Drug therapy has not changed significantly, but do remember that:
  - In all but mild exacerbations, use oral steroids in preference to increased inhaled steroid doses. Trials have shown that doubling inhaled steroids during an acute exacerbation does not reduce the chance of needing oral steroids.
  - NEVER use long acting beta-agonists (e.g. salmeterol, formoterol) without inhaled steroids in asthma (risk of death).
  - Do not recommend house dust mite avoidance in those with asthma. There is no evidence it improves asthma control.

Professional development

There is much in asthma management you could reflect on, review or audit. Consider the following:
- Do all your asthmatics have a PAAP? If not, how about ensuring that over the next year you develop one with each patient with asthma?
- Do you record everything suggested by an asthma review on your asthma template?
- Are any of your patients on a LABA without inhaled steroids, or on separate LABA and steroid inhalers?
- Using more than one salbutamol inhaler/month suggests poor control.
  - Look at salbutamol use of the next 5 asthmatics you see.
  - How many have used more than 12 salbutamol inhalers in the last 12m?
  - Do they need their asthma care reviewing (or do they just have multiple unused inhalers scattered round their house?)
- Inhaler technique:
  - Do you check inhaler technique as part of asthma reviews?

Practical tools

- PAAPs can be downloaded from Asthma UK: [http://tinyurl.com/GPU2015-PAAP](http://tinyurl.com/GPU2015-PAAP)
- The technique needed for each type of inhaler is described in a leaflet from the National Asthma Council Australia and is available at: [http://tinyurl.com/GPU2015-Inhalers](http://tinyurl.com/GPU2015-Inhalers)
- Inhaler technique can be checked using devices such as the In-check DIAL from Clement Clarke ([www.clement-clarke.com](http://www.clement-clarke.com)). Don’t forget you also need appropriate mouthpieces (one-off inspiratory). (We don’t make any money from recommending these!)
- Schoolchildren – Asthma UK offer a downloadable School Asthma Card, designed to help schools keep an asthma register available to all staff. This resource supports schools who have a standalone asthma policy:
  - [www.asthma.org.uk/Sites/healthcare-professionals/pages/schools-and-early-years](http://www.asthma.org.uk/Sites/healthcare-professionals/pages/schools-and-early-years)
  - [www.asthma.org.uk](http://www.asthma.org.uk) has an interactive demonstration of inhaler technique and downloadable self-management cards, along with many other useful resources, too numerous to mention individually!!

*We make every effort to ensure the information in these pages is accurate and correct at the date of publication, but it is of necessity of a brief and general nature, and this should not replace your own good clinical judgement, or be regarded as a substitute for taking professional advice in appropriate circumstances. In particular check drug doses, side effects and interactions with the British National Formulary. Save insofar as any such liability cannot be excluded at law, we do not accept any liability for loss of any type caused by reliance on the information in these pages.*

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