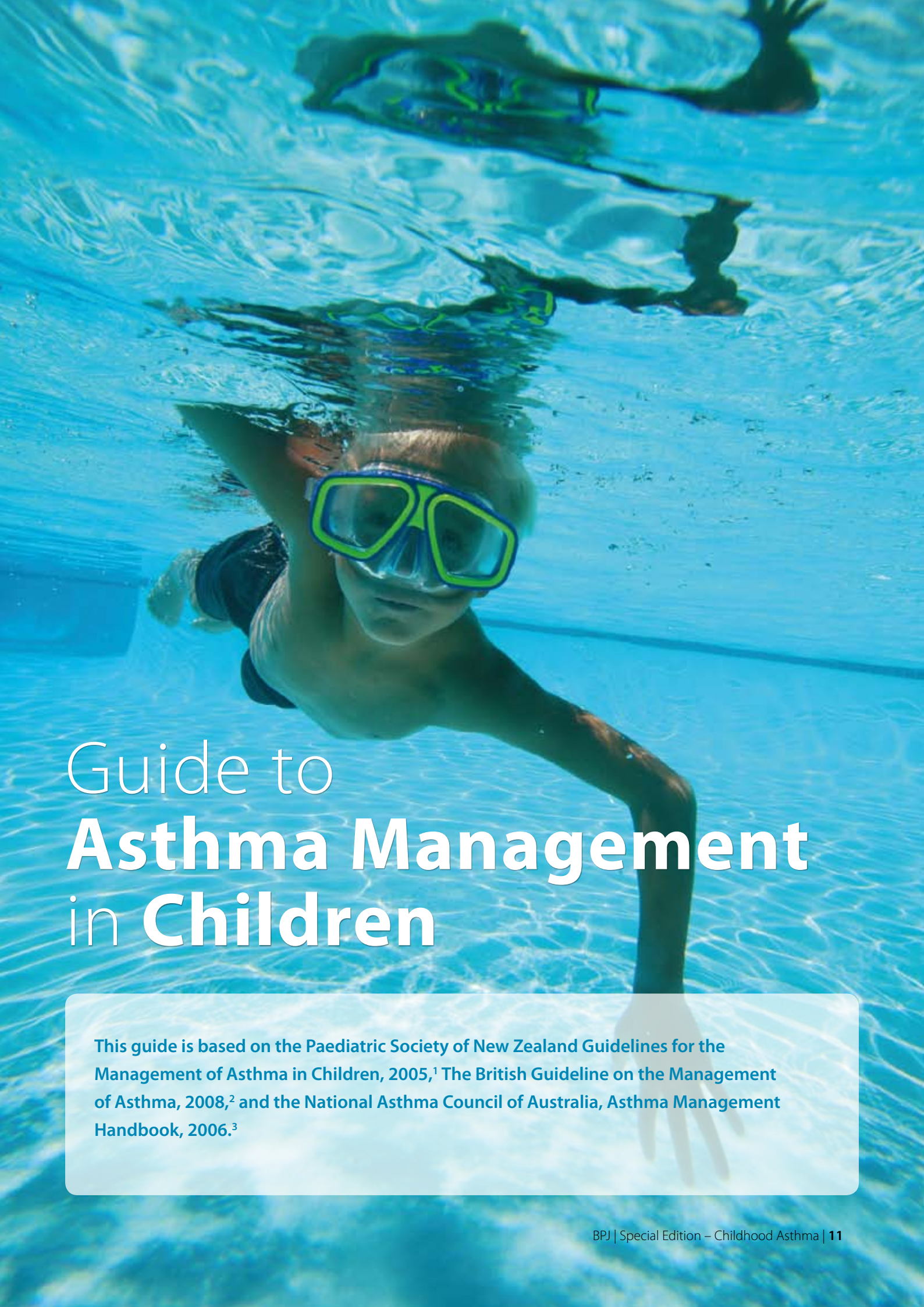

Guide to **Asthma Management** in **Children**

This guide is based on the Paediatric Society of New Zealand Guidelines for the Management of Asthma in Children, 2005,[1] The British Guideline on the Management of Asthma, 2008,[2] and the National Asthma Council of Australia, Asthma Management Handbook, 2006.[3]

Diagnosis of asthma in children

The initial assessment in children who are suspected of having asthma should focus on the presence of key features and clinical findings from the history or examination, and careful consideration of alternative diagnoses.

The key features of asthma are:

- Recurrent wheeze and breathlessness with or without cough
- Variation in the intensity and duration of symptoms
- Symptom free periods

Wheeze

Asthma should be suspected in any child with recurrent or persistent wheeze whether audible or detected on auscultation. However, alternative causes of wheeze should be considered especially in young children (Table 1). Wheeze due to asthma is often accompanied by cough, shortness of breath or both.

Asthma can occur in infants aged less than one year, but it is more difficult to diagnose because of the number of different causes of wheeze at this age. Instigation of inhaled corticosteroid treatment in infants should only be done with caution if the likelihood for asthma is high and preferably in consultation with a paediatrician.

In very young children be especially aware of non-asthma causes of wheeze. The diagnosis of the cause of recurrent wheezing in infants is often difficult.

For more information please refer to Pattemore P. Wheeze in infants and young children. Diagnosis and management options. New Zealand Family Physician 2008; August 35(4):264-69.

Cough

Cough is a common symptom of asthma, it can be the main symptom in children but it is very rare for it to be the

Table 1. Some non-asthma causes of wheeze in young children

Associated Signs/Symptoms	Possible causes
Fever, cough	Respiratory tract infections, e.g. bronchiolitis
Persistent wet cough	Cystic fibrosis, recurrent aspiration, bronchiectasis
Excessive vomiting or spilling	Reflux (with or without aspiration)
Dysphagia	Swallowing problems (with or without aspiration)
Transient infant wheezing (onset in infancy, no associated atopy)	Maternal smoking or other irritants
Abnormal voice or cry	Laryngeal problems
Focal signs in the chest	Developmental delay, post-viral pneumonia, bronchiectasis, tuberculosis
Inspiratory stridor as well as wheeze	Central airway or laryngeal disorder Inhaled foreign body
Recurrent wheeze and failure to thrive	Cystic fibrosis, gastroesophageal reflux
Clubbing	Cystic fibrosis, bronchiectasis

(adapted from [1,3])

only symptom. Cough due to asthma is usually associated with wheeze and episodes of breathlessness. A diagnosis of asthma is unlikely if cough is present without associated clinical findings consistent with asthma, especially wheeze.

Recurrent non-specific cough, without accompanying wheeze, is very common particularly in pre-school age children, and can lead to a misdiagnosis of asthma. It is not usually associated with atopy or a family history of asthma and often occurs after a respiratory tract infection. Recurrent non-specific cough is typically dry, worse in the early morning and during exercise, and occurs in short paroxysms sometimes followed by vomiting. In between episodes the child is well with no wheeze.

Most children with acute cough are likely to have an uncomplicated viral acute respiratory tract infection, but the possibility of a more serious problem such as foreign body aspiration, should always be considered.

When cough is the predominant symptom of suspected asthma, careful assessment is required to avoid making an incorrect diagnosis of asthma.[3] Chronic or recurrent cough in the absence of wheeze is unlikely to be due to asthma.[9]

Clinical Features in the diagnosis of asthma

In addition to the key features of asthma, the presence or absence of other factors and clinical findings assist in determining the probability of a diagnosis of asthma.

Factors that increase the probability of asthma

- More than one of the following symptoms – wheeze, cough, breathlessness, chest tightness – particularly if these are frequent and recurrent; are worse at night and in the early morning; occur in response to or worsen after exercise or other triggers, such as emotional upsets; or occur apart from colds
- Audible wheeze or widespread wheeze heard on auscultation
- Clinical findings; increased respiratory rate, prolonged expiratory phase, chest shape (over-inflation, Harrison's sulcus), use of accessory muscles
- Personal history of atopic disorder
- Family history of atopy or asthma, especially maternal
- Improvement in symptoms or lung function in response to reversibility testing or adequate treatment

Factors that lower the probability of asthma

- Isolated cough in absence of wheeze or difficulty breathing
- History of moist cough
- Prominent dizziness, light-headedness, peripheral tingling
- Repeatedly normal physical examination of chest when symptomatic
- Normal peak expiratory flow (PER) or spirometry when symptomatic
- No response to a trial of asthma treatment
- Clinical features suggesting alternative diagnosis
- Asymmetrical findings on chest examination

The diagnosis of asthma is a clinical one. It is based on recognising a characteristic pattern of episodic symptoms in the absence of an alternative explanation.[2]

Reversibility Testing

This can help with the diagnosis of asthma and can be viewed as a trial of treatment.

If the child presents with a history of symptoms and has clinical findings at the time of examination, one suggested method is:

- One puff of salbutamol MDI via a spacer, followed by six breaths through the spacer
- Repeat above
- Review and assess the response after 20 minutes
- Base confirmation of clinical asthma on easing of signs and symptoms following treatment
- Practices vary and some practitioners consider that up to six puffs (given separately) are required for reliable testing

If the child presents with a history of symptoms but no clinical findings consistent with asthma at the time of examination, instruct caregiver to administer salbutamol as above recording response to treatment in an asthma symptoms diary.

Management options

Low probability of asthma

Consider alternative causes of wheeze, cough or dyspnoea. Further investigations or specialist referral may be required.

Intermediate probability of asthma

Consider the need for lung function testing and the possibility of other diagnoses such as chest infection and foreign body inhalation. If asthma is still the most likely diagnosis and there are no features to suggest an alternative diagnosis, consider a trial of treatment with a beta-2 agonist as above. If treatment is not beneficial, consider further investigation and/or specialist referral.

In some children, particularly those less than five years of age, with insufficient evidence to confirm a diagnosis of asthma but no features to suggest an alternative diagnosis, possible approaches include:

- Watchful waiting with review
- Reversibility testing if possible
- A trial of treatment with a beta-2 agonist and, if not beneficial, further investigation or specialist referral.

High Probability of Asthma.

Consider a trial of as required treatment with a beta-2 agonist as above.

Peak Expiratory Flow (PEF) and Spirometry

Children under 5 are unlikely to be able to perform PEF or spirometry in a consistent and reliable way to give objective assessment of lung function and bronchodilator response.

In children over 5 years, spirometry may be used to assist the initial diagnosis, when assessing the response to treatment (especially during acute episodes), and monitoring in case of poor perception of airways obstruction.

Observation of symptoms is recommended as the primary judgment of asthma control over PEF monitoring which provides variable and potentially unreliable results. PEF can be used to compliment symptomatic monitoring of asthma control and when assessing response to treatment changes.

- A PEF measured at < 80% of predicted PEF may be indicative of asthma that is not well controlled
- A PEF measured at < 60% of predicted may be indicative of severe asthma

Some cautions regarding the use of PEF:

- Long periods of monitoring often result in fabrication of results
- There may be too much reliance on results at the expense of symptomatic monitoring.
- PEF meters vary in their readings
- Single readings are not reliable

Maintenance therapy for childhood asthma

This summary broadly follows the stepwise approach described in the Paediatric Society of New Zealand guidelines with modifications and updates where appropriate.

The stepwise approach aims to eliminate intermittent symptoms as quickly as possible by starting treatment at the level most likely to achieve this. The aim is to achieve the best possible lung function and to maintain control by stepping up treatments as necessary, and stepping down when control is good.

Before changing drug treatment, always check compliance with existing therapies, inhaler technique and minimise any trigger factors.

Stepwise pharmacological management in children

1 Step One — short acting beta-2 agonist (SABA)

All children with symptomatic asthma should be prescribed an inhaled short acting beta-2 agonist (SABA) to be taken as required for symptoms. Most children have infrequent intermittent asthma, with mild episodes of symptoms requiring treatment less often than once every 1 – 2 months, and do not require regular preventer treatment.

For most cases, salbutamol metered dose inhaler (MDI) is suitable. The inhaler device and the method of delivery depend on the age of the child and mastery of technique.

- Most children aged 8 years and younger will require salbutamol MDI with spacer and a mask or mouthpiece. It is recommended that children use a mouthpiece with their spacer as soon as they can. Older children in this range may be able to master a terbutaline (Bricanyl) turbuhaler, which is breath activated.
- For children aged 8 – 15 years, MDI via a spacer and a mouthpiece is the preferred method of delivery.
- For children over 8 years, terbutaline may be considered if MDI plus spacer is inconvenient or if a dry powder inhaler is preferred. A dry powder inhaler may be more convenient for school or sport. Terbutaline is only available as a turbuhaler and cannot be used with a spacer.
- Older children might prefer to use a MDI without a spacer, although some authorities recommend a spacer is best for everyone with asthma

2 Step Two — Inhaledcorticosteroid (ICS)

The exact threshold for the introduction of regular preventer therapy is unclear and is a clinical decision based on the severity and frequency of symptoms. The following is a guide.

ICS are generally indicated when the child is:

- Using a short acting beta-2 agonist 3 times a week or more
- Symptomatic 3 times per week and exacerbations restrict activity or sleep
- Unresponsive to short acting beta agonists after 2 – 4 weeks
- Waking one night per week or more due to asthma
- Experiencing attacks more than every 4 – 6 weeks
- Having infrequent but severe attacks or shows reversible airflow obstruction between attacks

(adapted from [3, 10])

ICS preparations in New Zealand

Table 2 describes the ICS preparations (excluding combination products) which are available in New Zealand.

Dose of ICS

There are a number of assumptions made with respect to the dose response curve of ICS and also dose equivalence. This is compounded by differences in technique and methods of drug delivery. These general points should be taken as a guide in combination with individual clinical response.

- The starting dose of ICS should be titrated against the severity of the disease (as assessed by clinical symptoms). The lowest dose to achieve and maintain control should be used.
- The dose response curve for fluticasone starts to plateau between 100 and 200 mcg/day.[11] Similarly the dose response curve for beclomethasone and budesonide flattens out between 200 and 400 mcg/day.
- A suitable starting dose is 100 – 200 mcg/day fluticasone or 200 – 400 mcg/day beclomethasone or budesonide. Use the higher dose for greater severity
- Over 80% of children will respond to 200 mcg/day fluticasone or 400 mcg/day beclomethasone or budesonide

Alternative preventers

The mast cell stabilisers, cromones, such as nedocromil (Tilade) and sodium cromoglycate (Intal or Vicrom) may be useful as an alternative if an ICS cannot be used or if there is resistance to their use (see page 7). They are not as clinically effective as ICS for most people with asthma.

The Leukotriene receptor antagonist (LTRA) montelukast is also a possible alternative to ICS on specialist advice (see below).

Table 2 Inhaled corticosteroid preparations available in New Zealand

Generic Name	Brand Name	Dose Equivalence	Comments
Fluticasone propionate (FP)	Flixotide	100 mcg	MDI is CFC free. Breath activated Accuhaler also available (partly subsidized)
Beclomethasone dipropionate (BDP)	Beclazone	200 mcg	Available as MDI only for use with or without spacer.
Budesonide dipropionate (BUD)	Pulmicort (as turbuhaler)	200 mcg	Turbuhaler is a useful alternative to MDI or MDI plus spacer. Cannot be used with a spacer.
Beclomethasone dipropionate (BDP-HFA)*	QVAR	100 mcg	Not currently subsidized CFC free

*For the purposes of this article dose equivalents refer to beclomethasone which is the CFC containing preparation of beclomethasone (Beclazone). Beclomethasone-HFA (QVAR) is the CFC free preparation of beclomethasone and is about twice as potent as beclomethasone (i.e. half the dose is required) due to smaller particle size. Some guidelines have started to use beclomethasone-HFA as the dose equivalence standard.

3 Step Three — Add on therapy.

If the child is under 2 years, consider referral to a paediatrician.

In children under 5 years, if there has been no response to the maximum dose of ICS which is 200 mcg/day fluticasone or 400 mcg/day beclomethasone or budesonide and adherence and technique is good, consider referral to a paediatrician.

For children aged 5 – 15 years add a Long Acting beta-2 Agonist (LABA) if optimal response has not been achieved with a trial of ICS.

In some cases, the child will have been tried on the maximum dose of ICS at step two (200 mcg/day fluticasone or equivalent). However, the addition of a LABA can improve asthma symptom control when added to lower doses of ICS.

LABA are fully subsidised in children under 12 years if asthma is poorly controlled despite using ICS for at least 3 months at a total daily dose of 100 mcg/day of fluticasone or equivalent.

LABA are not preventers and need to be given concurrently with an ICS.

It is unsafe for a LABA to be used without inhaled corticosteroids

Assess the response to the LABA and continue if there is a good response to treatment. If there is some benefit from LABA at maximum dose (eformoterol 12 mcg BD or salmeterol 50 mcg BD) but control is still not adequate, increase the dose of ICS to 200 mcg/day fluticasone or equivalent, if not already on this dose.

If there is no response to the LABA, stop their use and proceed to step four.

4 Step Four—Persistent Poor Control

Increase the dose of ICS to 300 – 400 mcg/day fluticasone or 600 – 800 mcg/day beclomethasone or budesonide. Continue to review add on therapy and refer to a paediatrician if there is no improvement.

In most guidelines a trial of montelukast (not subsidised) or theophylline is suggested if there has been no response to LABA at step 3. GPs could consider this on the advice of a specialist especially if there was resistance to further increase in the dose of ICS or no response to the ICS doses advocated in step 4.

Montelukast can be used as sole therapy in children with frequent intermittent or mild persistent asthma which may be an option if there are reasons not to use an ICS. It may also be useful when compliance with an ICS is poor as it is given orally once per day.

Theophylline has significant systemic adverse effects and drug interactions; it is best prescribed by those experienced in its use.

5 Step Five—Continued Poor Control

- Urgent discussion with a paediatrician is mandatory
- Maintain high dose ICS
- Consider oral steroids in the lowest dose to provide adequate control
- Montelukast (not subsidised) or Theophylline may be considered in the interim

Assessment of Asthma Control

The aims of management are;

- Minimal symptoms at night
- Minimal need for reliever medication
- No limitation of physical activity
- Normal lung function

These parameters can be used as benchmarks for management. For example increased use of relievers, troublesome night-time symptoms or reduced exercise tolerance may all indicate worsening control.

As well as increased use of short acting beta agonists, any change in response to a dose should be noted. If the child's usual dose provides symptom relief for less than 3–4 hours this might indicate worsening asthma. It is important that the child or caregiver understand that decreasing symptom relief from the usual short acting beta agonist doses indicates worsening asthma. A symptom diary may be useful and keeping one should be encouraged.

In young children under 5 years an accurate record of response to initial treatment is very important as transient infant wheeze or intermittent viral- induced wheezing may not respond to a short acting beta agonist reliever or ICS preventer. It is important to recognize this group as they may be misdiagnosed as having asthma and do not require ongoing asthma treatment.[3]

Avoid making an assessment of asthma control based on any symptom in isolation, particularly nocturnal cough. Although cough may be a useful marker of asthma control it is important to also consider symptoms of airflow limitation (wheeze, dyspnoea, exercise limitation). Cough does not reliably predict onset of an asthma exacerbation in all children and nocturnal wheezing and dyspnoea are more reliable than cough in assessing the pattern and severity of asthma.

Stepping Down Treatment

Stepping down treatment can be considered when control of asthma has been achieved and maintained. Children should be maintained on the lowest possible dose of ICS but any reductions should be slow. Consider reducing the ICS dose by 25 – 50% every 3 months, particularly if the ICS dose is at the higher end of the range.

After a period of complete symptom control (e.g. 6 months) and at times where there are fewer asthma triggers (e.g. pollen) it may be appropriate to withdraw treatment with ICS.

If the child is on a LABA, reducing the dose of ICS is reasonable if the use of LABA has improved response or if the asthma control has improved over time. However, use of a LABA without any ICS may confer greater risk of asthma exacerbation or even asthma death.

Summary of stepwise pharmacological management in children

STEP 1

Infrequent intermittent asthma*

Inhaled short acting beta-2 agonist (SABA) to be taken as required.

STEP 2

Regular preventer therapy (refer to indications on page 15)

Add inhaled steroid 100–200 mcg fluticasone or 200–400 mcg beclomethasone or budesonide daily. Use the higher dose with greater severity.

In children under 5 years if there is no response to the maximum dose of ICS (with good technique and compliance), consider referral to a paediatrician.

Nedocromil or sodium cromoglycate may be a useful alternative if an ICS cannot be used. Montelukast is also a possible alternative to ICS on specialist advice.

STEP 3

Add on therapy

1. Add inhaled long acting beta-2 Agonist (LABA).
2. Assess response to LABA:
   - Good response to LABA — continue LABA
   - Some benefit from LABA in maximum dose but control still inadequate—increase inhaled steroid to 400 mcg/day BDP or BUD, or 200 mcg/day FP (if not already on this dose)

STEP 4

Persistent poor control**

Double check compliance with existing treatments, inhaler technique and minimise any trigger factors including smoking.

Increase the dose of ICS to 300 – 400 mcg/day fluticasone or 600 – 800 mcg/day beclomethasone or budesonide. Continue to review add on therapy and refer to a paediatrician if there is no improvement.

STEP 5

Continued poor control

- Urgent discussion with a paediatrician is required
- Maintain high dose ICS
- Consider oral steroids in the lowest dose to provide adequate control

* Also referred to as mild infrequent asthma in the New Zealand Guidelines 2005

** In most guidelines a trial of montelukast or theophylline is suggested if there has been no response to LABA at step 3. GPs could consider this on the advice of a specialist especially if there was resistance to further increase in the dose of ICS or no response to the ICS doses advocated in step 4.

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