Pediatric Asthma:
Control and Prevention

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Asthma guidelines[1] define our goals to balance achieving and maintaining control without unnecessary side-effects. Canada has had guidelines for 18 years[2] and young children were the focus in 2005.[3,4]

Asthma is defined clinically, physiologically and pathologically. Asthma is characterized by:

- paroxysmal or persistent dyspnea,
- chest tightness,
- cough,
- wheezing and/or
- sputum production.

Physiologically, there is variable airflow limitation and airway hyperresponsiveness. Pathologically, inflammation results in airway obstruction and irreversible changes.

Asthma is characterized by paroxysmal or persistent dyspnea, chest tightness, cough, wheezing and/or sputum production.

The main thrust is to prevent and reduce the inflammatory process. This requires:

- Regular assessment of the degree of control
- The triggers precipitating exacerbations or perpetuating the condition
- Reduction of exposure to the triggering factors
- Compliance with therapeutic interventions
- Ongoing reassessment of inhaler technique
- Assessment and management of comorbidities

Each intervention is considered a "trial" and modified if and when control is achieved.

Canadian and worldwide studies demonstrate that good control of asthma is elusive. Surveys from 1999[5] and 2004[6] show 76% of patients do not have acceptable control—fewer yet have optimal control. Optimal control includes:

- no daytime symptoms,
- no nighttime symptoms,
- no limitations of physical exercise,
- no exacerbations,
- no absence from school work,
- no need for short-acting β-agonist rescue and
- normal lung function (*i.e.*, forced expiratory volume in one second [FEV_1] or peak expiratory flow).

Is it possible or worthwhile to treat mild asthma?

Extremely mild clinical asthma, otherwise left untreated, when given inhaled corticosteroids, has a very significant decrease of poorly controlled days and even a decrease in severe exacerbations.

Guidelines state,[1-4] "introduction of inhaled corticosteroids should be considered early, even for symptoms fewer than three times per week and to patients who appear to have adequate control."

Parental resistance to the use of inhaled corticosteroids in children is accommodated in the guidelines with the use of montelukast as first-line for children who cannot or will not use inhaled corticosteroids.[2-4]

Environmental management

Environmental management is a foundation of asthma control, but asthmatics allergic to cats still have them at home, parents of asthmatic children continue to smoke and many of the dust mite proof encasings are in fact not dust mite proof and should be sourced from a reliable supplier.[7] Medications should not be used as a substitute for control of the environment.[3,4]

The united airway

The connection between the upper airways (nose, sinus, oropharynx) and the lower airways (lungs) is being rediscovered. The fact that grass pollen exposure causes nasal symptoms and involvement of the chest has been known since 1873.

Allergic rhinitis patients are four times as likely to develop asthma as those without. Rhinitis patients develop bronchial hyperreactivity and decreases in lung functions (FEV_1, middle and small airway flow obstruction [$FEF_{25\%-75\%}$]).

Treatment of rhinitis will improve asthma symptoms. Even non-atopic rhinitis is an independent risk factor for asthma. The possibility of asthma must be considered in any child who presents with rhinitis and asthmatic children must have evaluation and management of their rhinitis.

Allergy shots

The role of immunotherapy in asthma management is much underappreciated. Allergen-specific vaccine immunotherapy is the only treatment active on the pathophysiological immunological mechanism of allergic disease.

The Cochrane analysis of allergy shots in asthma[8] has repeatedly shown that immunotherapy reduces asthma symptoms and use of asthma medications and improves bronchial hyperreactivity. Most recently, the Preventive Allergy Treatment (PAT) study has shown subcutaneous immunotherapy can prevent the development of asthma in children with seasonal allergic rhinitis.[9]

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Clinical efficacy and safety is supported by The World Health Organization. The Canadian Pediatric Asthma Guidelines state that immune modulation is the only currently available therapy aimed at modifying the underlying disease process in asthma and that no pharmacological therapeutic agents have been shown to do this.[3,4]

Early treatment and prevention of progression

We now know a delay in the initiation of treatment for asthma cannot make up for the gains of early intervention. The annual improvement in FEV_1 is better the shorter the duration of asthma before treatment starts. With early treatment, less inhaled corticosteroids are required

to achieve control and subsequently to maintain control. More patients can come off steroids completely and the pulmonary function is significantly better. The introduction of additional therapies, specifically long-acting β-agonists is tenfold less with early treatment.

Treating smaller airways

The small airways of the lungs produce the cytokines, chemokines and other mediators that initiate and perpetuate inflammation—the hallmark of asthma. The peripheral airway inflammation may be more severe than in the larger sized airways and the distal lung is the predominant site of airway obstruction. Remodeling occurs in the periphery of the lungs.

Clinical studies of dry powder steroid-treated asthmatics with inflammation in the small airways demonstrate even further improvement when treated with an ultra-fine steroid aerosol, such as ciclesonide or beclomethasone.

Systemic treatment with montelukast improves the conduction and residual volumes which are measures of small airway function.

It is reasonable to consider which steroid preparation delivers a better proportion of the dose to the lungs and of the delivered proportion which steroid most improves the distal airways.

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Take-home message

Clearly, the level of asthma control in Canada is poor. Asthma, a disease of the entire respiratory track, requires targeting rhinitis, sinusitis, otitis media and both the conducting airways and the distal lung if a strategy is going to provide effective treatment.

Proper long-term management requires control of the environment, strict criteria for control, treating mild disease, treating asthma early, treating the full length of the airways, getting treatment to the small airways and achieving and maintaining control. Immunotherapy could and should be incorporated to change the immune system, both to treat the disease and even prevent the evolution to asthma in those at risk.

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