

# An Overview on Asthma

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**ABSTRACT:** *Asthma is Canada's most prevalent respiratory disease. Despite considerable advancements in asthma diagnosis and treatment, the majority of Canadians with asthma continue to have poor control. Control may be accomplished in the majority of individuals, however, via the use of avoidance tactics and suitable pharmaceutical treatments. For the vast majority of patients, inhaled corticosteroids (ICSs) constitute the mainstay of treatment. Most people who fail to establish control with ICS treatment prefer combination ICS/long-acting beta2-agonists (LABA) inhalers. Allergen-specific immunotherapy has the potential to be a disease-modifying treatment for many asthma patients, but it should only be given by allergy specialists. Asthma treatment also requires regular assessment of asthma control, adherence to medication, and proper inhaler technique. This article offers an overview of current research as well as recommendations for diagnosing and treating asthma.*

**KEYWORDS:** *Asthma, Diagnosis, Disease, Inhalers, Treatment.*

## 1. INTRODUCTION

Asthma continues to be the most prevalent chronic respiratory illness in Canada, afflicting about 10% of the population. Although asthma is commonly thought to be a lung disorder, new evidence suggests that it may be a component of systemic airway disease that affects the entire respiratory tract, which is supported by the fact that asthma frequently coexists with other atopic disorders, particularly allergic rhinitis [1], [2]. Despite substantial advances in asthma diagnosis and treatment over the last decade, as well as the availability of comprehensive and generally recognized national and international clinical practice guidelines, asthma control in Canada remains poor. According to the findings of the recent Reality of Asthma Control (TRAC) in Canada research, more than half of Canadians with asthma have uncontrolled illness. Unnecessary morbidity, restrictions to everyday activities, and a reduction in overall quality of life are all consequences of poor asthma management.

### 1.1 Asthma:

Asthma is a chronic inflammatory illness of the airways that affects people of all ages. Chronic inflammation is linked to airway hyper reactivity (an exaggerated airway constriction reaction to stimuli like allergens and exercise), which causes wheezing, dyspnea (shortness of breath), chest tightness, and coughing. Symptom bouts are typically accompanied by extensive, although varied, airflow obstruction in the lungs, which is usually reversible either spontaneously or with proper asthma therapy[3], [4].

### 1.2 Pathophysiology:

Asthma is linked to immunological responses including T helper cell type-2 (Th2) cells, which are common in other atopic diseases. Various allergic and non-allergic triggers (e.g., dust mites, cockroach leftovers, furred animals, moulds, pollens) generate a cascade of immune-mediated events that contribute to chronic airway inflammation. Increased numbers of Th2 cells in the airways produce cytokines such interleukin (IL)-4, IL-5, IL-9, and IL-13, which increase

eosinophilic inflammation and mast cell production of immunoglobulin E (IgE). IgE production, in turn, promotes the release of inflammatory mediators like histamine and cysteinyl leukotrienes, which induce bronchospasm (airway smooth muscle constriction), edema (swelling), and increased mucous secretion (mucous hypersecretion), all of which contribute to asthma symptoms[5]–[8].

### *1.3 Diagnosis:*

A comprehensive medical history, physical examination, and objective evaluations of lung function (spirometry is preferable) are used to confirm the diagnosis of asthma. When objective measures of lung function are normal despite the presence of asthma symptoms, bronchoprovocation challenge testing and screening for indicators of airway inflammation may be useful in identifying the condition.

### *1.4 Medical background:*

Patients who have a persistent cough, wheeze, chest tightness, or shortness of breath should be suspected of having asthma. Variable symptoms that increase at night, occur while exposed to allergens or irritants, and respond to proper asthma treatment are highly indicative of asthma. Chronic obstructive pulmonary disease (COPD), bronchitis, chronic sinusitis, gastroesophageal reflux disease, recurrent respiratory infections, and heart disease should all be ruled out as possible causes of suspected asthma symptoms.

### *1.5 Examination of the body:*

Because asthma symptoms vary so much, a physical examination of a patient with suspected asthma is frequently unimpressive. Physical findings are typically only visible while the patient is experiencing symptoms. As a result, the lack of physical evidence does not rule out an asthma diagnosis. Wheezing on auscultation is the most frequent aberrant physical finding, which indicates the existence of airflow restriction. Physicians should also look for indications of atopic disorders such as allergic rhinitis or dermatitis in the upper respiratory tract and on the skin.

### *1.6 Objectively measurements of Lung function:*

Spirometry is the recommended objective test for detecting reversible airway blockage (i.e., fast improvement in lung function after inhaling a rapid-acting bronchodilator) and confirming an asthma diagnosis. All patients above the age of 6 who are able to undergo pulmonary function tests should do so.

Spirometry must be carried out in accordance with established procedures. It's most frequently done in pulmonary function labs, although it may also be done in general care clinics. Spirometry requires the patient to take the deepest breath possible and then exhale as forcefully and completely as possible into the spirometer's mouthpiece.

### *1.7 Challenge Testing:*

Measurements of airway responsiveness utilizing direct airway challenges to inhaled bronchoconstrictor stimuli (e.g., methacholine or histamine) or indirect challenges with mannitol or exercise may assist confirm a diagnosis of asthma when lung function tests are normal but symptoms indicate asthma.

### *1.8 Non-invasive Airway Inflammation Markers:*

Inflammatory indicators including sputum eosinophilia (the number of eosinophils in the sputum) and exhaled nitric oxide (a gaseous substance generated by certain cells during an inflammatory reaction) may also help diagnose asthma. Exhaled nitric oxide levels may be more effective than basic lung function tests in identifying asthmatic patients, and they may also be helpful for monitoring patient response to asthma treatment. Despite the fact that these tests have been investigated for asthma diagnosis and monitoring, they are not yet routinely utilized in Canada. These indicators of airway inflammation will likely become more widely accessible as clinical evidence and usage grows[9], [10].

### *1.9 Skin Testing for Allergies:*

Allergy skin testing is also advised to assess the patient's allergy status and to identify potential asthma triggers. Typically, allergens relevant to the patient's geographic area are used in testing. Although allergen-specific IgE tests, which give an in vitro assessment of a patient's specific IgE levels against specific allergens, have been proposed as a replacement for skin testing, these tests are less sensitive and costlier.

### *1.10 Treatment:*

The major aim of asthma treatment is to establish and maintain disease control in order to avoid exacerbations (abrupt and/or gradual worsening of asthma symptoms that frequently require urgent medical care and/or oral steroid medication) and lower the risk of morbidity and death. Each visit should be used to evaluate the degree of asthma control, and therapy should be adjusted to achieve control. Most asthma patients may be controlled with a combination of avoidance strategies and pharmaceutical treatments. Controllers (medications used regularly for a long period of time to achieve control mainly via anti-inflammatory effects) and relievers are two types of pharmacologic medicines frequently used to treat asthma (medications used on an as-needed basis for quick relief of bronchoconstriction and symptoms).

ICSs, leukotriene receptor antagonists (LTRAs), long-acting beta2-agonists (LABAs) in conjunction with an ICS, and anti-IgE treatment are all examples of controller medicines. Rapid-acting inhaled beta2-agonists and inhaled anticholinergics are two types of pain relievers. In most individuals with allergic asthma, allergen-specific immunotherapy may be explored, but it must be recommended by doctors who are well-versed in allergy management. For the treatment of acute asthma exacerbations, systemic corticosteroid therapy may be needed.

### *1.11 Controller medications:*

#### *i. Inhaled Corticosteroids (ICSs):*

Inhaled corticosteroids (ICSs) are the most effective anti-inflammatory medicines available for the treatment of asthma, and they are the treatment of choice for the majority of asthma patients. For most children and adults with asthma, low-dose ICS monotherapy is suggested as a first-line maintenance treatment. The use of an inhaled corticosteroid (ICS) on a regular basis has been proven to decrease symptoms and exacerbations, as well as enhance lung function and quality of life. ICSs, on the other hand, do not “cure” asthma, and symptoms usually return within weeks to

months after stopping them. As a result, most patients will need ICS therapy for a long time, if not forever.

*ii. LTRAs (Leukotriene Receptor Antagonists):*

Montelukast and Zafirlukast, both LTRAs, are also useful in the treatment of asthma and are usually regarded safe and well tolerated. However, since these medications are less efficacious as monotherapy than ICSs, they are generally reserved for patients who refuse or are unable to take ICSs. If asthma is uncontrolled despite low-to-moderate dosage ICS treatment, LTRAs may be utilized as an add-on therapy. It's worth noting, however, that LTRAs are thought to be less successful as add-on treatment in adults than LABAs. However, since the evidence on children is less clear, the child's symptoms and the existence of co-morbidities may be used to guide therapy. If a kid with asthma also has allergic rhinitis, montelukast should be included to the treatment plan. If the child's airway blockage is chronic, however, adding a LABA may be preferable.

*iii. Inhalers that combine ICS and LABA:*

As previously stated, LABA monotherapy is not advised for asthma patients since it has no effect on airway inflammation and is linked to an increased risk of morbidity and death. Only when taken in conjunction with ICS treatment are LABAs advised. The combination of a LABA and an ICS has been shown to be highly effective in reducing asthma symptoms and exacerbations, and it is the preferred treatment option in adolescents and adults whose asthma is uncontrolled on low-dose ICS therapy, or in children over the age of 6 who are uncontrolled on moderate ICS doses.

*iv. Theophylline:*

Theophylline is an anti-inflammatory bronchodilator that is used orally. Its usage is usually reserved for individuals whose asthma is uncontrolled after a sufficient trial with ICS, LABAs, and/or LTRAs, because to its limited therapeutic window and frequent side effects (e.g., gastrointestinal symptoms, loose stools, seizures, cardiac arrhythmias, nausea, and vomiting).

*v. Anti-IgE treatment:*

Omalizumab, an anti-IgE monoclonal antibody, has been found to decrease the incidence of asthma exacerbations by around half. The medication is authorized in Canada for the treatment of moderate to severe, persistent allergic asthma in patients aged 12 and above. It is given subcutaneously once every 2-4 weeks. Omalizumab is currently reserved for individuals with difficult-to-control asthma who have confirmed allergies and whose asthma symptoms do not respond to ICS treatment.

*1.12 Immunotherapy for particular allergens:*

Subcutaneous administration of progressively increasing amounts of the patient's relevant allergens until a dosage is achieved that is successful in establishing immunologic tolerance to the allergen is used in allergen-specific immunotherapy. Despite its widespread usage in the treatment of allergic asthma, it is not uniformly approved by all clinical practice guideline committees owing to the risk of severe anaphylactic responses.

A Cochrane review of 75 randomized controlled studies evaluating the use of allergen-specific immunotherapy in asthma treatment found that it is effective in decreasing asthma symptoms and

medication needs, as well as improving airway hyperresponsiveness. Sublingual immunotherapy, which is likely to be authorized in Canada in the near future, has shown similar advantages. Evidence also indicates that allergen-specific immunotherapy may help atopic people avoid developing asthma.

Allergen-specific immunotherapy should be explored on a case-by-case basis for the time being. It may be used as a supplement to ICS treatment in patients with very mild allergic asthma and concurrent allergic rhinitis, as well as as an add-on therapy in those who are already taking ICSs. If asthma symptoms are managed, allergen-specific immunotherapy, such as combination inhalers, ICS/LTRAs, and/or omalizumab, may be explored. Because allergen-specific immunotherapy may cause anaphylactic responses, it should only be given by doctors who are well-versed in allergy treatment.

## 2. DISCUSSION

Asthma is a disease that causes your airways to constrict and swell, as well as generate excess mucus. This may make breathing difficult, resulting in coughing, whistling (wheezing) on exhalation, and shortness of breath. When the lining of your airways swells and the muscles surrounding them constrict, it causes asthma symptoms. Mucus subsequently clogs the airways, limiting the quantity of air that may flow through even more. Asthma "attacks," which include coughing and chest tightness may occur as a result of these diseases. Asthma medicines are divided into two categories: preventative and therapeutic. The most essential medicines used to keep asthma under control are long-term control medications such inhaled corticosteroids. Asthma symptoms are caused by airway inflammation, which is treated with these preventative medicines.

## 3. CONCLUSION

Asthma is Canada's most prevalent respiratory disease, causing substantial morbidity and death. Patients with persistent cough, wheezing, chest tightness, or dyspnea should be suspected of having asthma, and the diagnosis should be verified with objective lung function tests (spirometry preferred). It's also a good idea to have allergy testing to figure out what may be causing your asthma symptoms. Asthma management may usually be accomplished with the use of avoidance strategies and suitable pharmaceutical treatments in the majority of patients. For the vast majority of asthma patients, inhaled corticosteroids (ICSs) constitute the gold standard of treatment.

In most people, combined therapy with a LABA and an ICS is the recommended therapeutic option for individuals who fail to establish control with low-to-moderate ICS dosages. If asthma is uncontrolled despite low-to-moderate dosage ICS treatment, LTRAs may be utilized as an add-on therapy, especially in individuals with concomitant allergic rhinitis. In certain instances of difficult-to-control asthma, anti-IgE treatment may be beneficial. Allergen-specific immunotherapy has the potential to be a disease-modifying treatment, but it should only be given by allergy specialists. All asthma patients should have frequent follow-up appointments during which they should be evaluated for asthma control, adherence to treatment, and appropriate inhaler technique.

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