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An Asthma Overview

by Simon Lessard, B.Pharm., MBA

Learning Objectives:

Upon successful completion of this lesson, technicians will be able to:

1. Describe the pathophysiologic mechanisms leading to asthma
2. Compare the safety and efficacy of the different treatments for asthma
3. Identify the main reasons why a technician should recommend a valved spacer
4. Take an active role in the follow-up of children and adults with asthma.

Introduction

Asthma is a worldwide problem with an estimated 300 million affected individuals.⁽¹⁾ In Canada, two million individuals have asthma, with 10 to 15% of these being children. Asthma is one of the principal causes of hospitalization and causes more than 500 deaths in Canada every year.⁽²⁾

Asthma is a variable disease characterized by periods of generally well-controlled asthma interspersed with worsening and, if allowed to progress, more severe exacerbations. The current management of asthma focuses on achieving optimal control through the use of maintenance therapies and fast-acting bronchodilators.⁽³⁾

What is Asthma?

The Canadian Thoracic Society defines asthma as a condition with paroxysmal or persistent symptoms, such as dyspnea, chest tightness, wheezing, sputum production and cough, associated with variable airflow limitation and airway hyper-responsiveness to endogenous or exogenous stimuli.⁽⁴⁾ Although complex, this definition clearly explains the symptoms that a person with asthma may experience, as well as the concept of aggravating factors (allergens, cold air, virus, cigarette smoke, etc.) that lead to excessive response from the lungs and narrowing of the airway. Narrowing of the airway develops in one of two ways (see Figure 1 online):

1. The airway becomes swollen and plugged with mucus (inflamed), therefore reducing and

constricting the opening. This inflammation can last from just a few hours, to a few days.

2. The muscles in the walls of the airway tighten and go into spasm (bronchoconstriction).⁽⁵⁾

What impact does the environment have?

Factors that can influence the development and expression of asthma can be divided into two groups: those that cause the development of asthma and those that trigger asthma symptoms (some do both). The former include host factors (primarily genetic) and the latter are often environmental. As a pharmacy technician, your most important role is to identify triggers that may lead to asthma exacerbations in patients and educate them on how to avoid these triggers. Table 1 lists some of the most important triggers.⁽¹⁾

Diagnosis

The diagnosis of asthma is often based on the presence of characteristic symptoms. However, assessment of symptoms such as dyspnea and wheezing by physicians may be inaccurate so measurements of lung function and, in particular, the demonstration of reversibility of lung function abnormalities, greatly enhance diagnostic confidence.⁽¹⁾ Lung function measurement also provides an assessment of the severity of airflow limitation, its reversibility and its variability, as well as providing confirmation of the diagnosis of asthma.⁽⁴⁾

Various methods to assess airflow limitation exist, but two have gained widespread

acceptance for use in patients over five years of age: spirometry & peak flow meter. Spirometry is the recommended method of measuring airflow limitation and reversibility to establish a diagnosis of asthma in both adults and children.⁽⁶⁾ Measurements of forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) are undertaken during a forced expiratory maneuver using a spirometer. Because of lack of sensitivity, it is recommended to do repeat testing at different visits.⁽⁶⁾

Peak expiratory flow (PEF) measurements are made using a peak flow meter and can be an important aid in both diagnosis and monitoring of asthma. The device is inexpensive, portable and easy to use for day-to-day home follow-up. However, PEF underestimates the degree of airflow limitation, particularly as airflow limitation and gas trapping worsens.⁽¹⁾

Measurements of airway responsiveness to methacholine, histamine or exercise may be useful in diagnostic dilemmas, such as individuals with persistent asthma symptoms despite normal spirometry, and to evaluate work-related asthma. But methacholine challenge testing is not necessary if reversible airflow obstruction is demonstrated and is contraindicated if the FEV1 is below 60% predicted. By inhaling methacholine, this test measures the lung response to a trigger factor (methacholine) and expresses the results as the provocative concentration that can cause a given fall of the lung function.

A trial of therapy with a short-acting bronchodilator and an inhaled corticosteroids is acceptable to confirm a clinical diagnosis, particularly in young children and when methacholine challenge testing is not feasible. Chest radiographs

are not routinely required to diagnose asthma, but may be useful to exclude other diagnoses in children (e.g., congenital malformations) and adults (e.g., congestive heart failure).⁽¹⁾

Asthma control

The primary goal of asthma therapy is to control the disease and, by doing so, prevent and minimize the risk of short-term and long-term complications, morbidity and mortality. The Canadian asthma guidelines set criteria that all patients should be encouraged to meet in order to control the disease and prevent any complications. Table 2 outlines these criteria.

More than 59% of Canadians with asthma do not have their asthma controlled.⁽⁶⁾ Techs can use or refer patients to the 30-second asthma test by GlaxoSmithKline to assess their control. (www.asthmacontroltest.com).

Pharmacotherapy

Route of administration Asthma treatment for adults can be administered in different ways—inhalation, orally or parenterally (by injection). The major advantage of inhaled therapy is that drugs are delivered directly into the airways, producing higher local concentrations with significantly less risk of systemic side effects.

Inhaled medications for asthma are available as pressurized metered-dose inhalers (MDIs), dry powder inhalers (DPIs) and liquids for nebulization. Inhalers differ in their efficiency of drug delivery to the lower respiratory tract, depending on the type of device, formulation of medication, particle size, velocity of the aerosol cloud and ease with which the device can be used by the patient. Patient preference, convenience and ease of use may influence the efficiency of

TABLE 1 – Asthma triggers *

Respiratory infection

Respiratory syncytial virus (RSV), rhinovirus, influenza, parainfluenza, mycoplasma pneumonia

Allergens

Airborne pollens (grass, trees, weeds), house-dust mites, animal danders, cockroaches, fungal spores

Environment

Cold air, fog, ozone, sulfur dioxide, nitrogen dioxide, tobacco smoke, wood smoke

Emotions

Anxiety, stress, laughter

Exercise

Particularly in cold, dry climate

Drugs/preservatives

Aspirin, nonsteroidal antiinflammatory drugs (cyclooxygenase inhibitors), sulfites, benzalkonium chloride, nonselective β -blockers

Occupational stimuli

Bakers (flour dust); farmers (hay mold); spice and enzyme workers; printers (arabic gum); chemical workers (azo dyes, anthraquinone, ethylenediamine, toluene diisocyanates, polyvinyl chloride); plastics, rubber, and wood workers (formaldehyde, western cedar, dimethylethanolamine, anhydrides)

*adapted from DiPiro JT, 2008

drug delivery and adherence to treatment and long-term control.⁽¹⁾

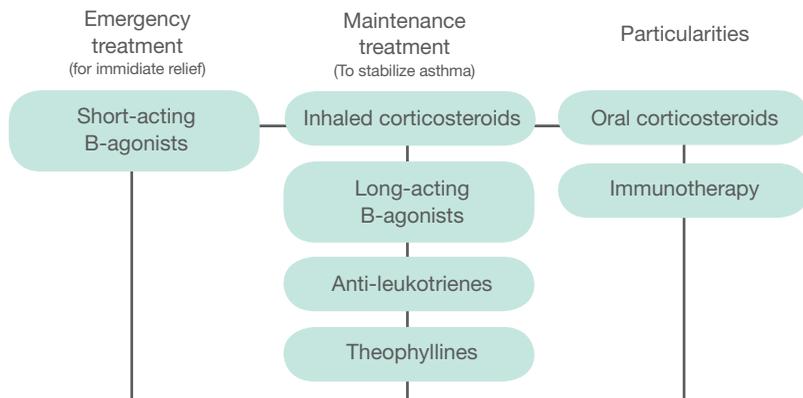
MDIs require training and skill to coordinate activation of the inhaler and inhalation. Dry powder inhalers are easier to use, but they require a minimum inspiratory flow rate and may prove difficult for some. Nebulized aerosols are rarely indicated for the treatment of chronic asthma in adults.

Controller medications Medications are classified as “controllers” or “relievers.” Controllers are taken regularly on a long-term basis to control the inflammatory effect related to asthma. As shown in Figure 2, they include: inhaled corticosteroids (ICSs), long-acting inhaled β_2 -agonists (LABAs), leukotriene receptor antagonists (LTRAs) and theophylline.

Immunotherapy and oral corticosteroids administered on a regular basis are used for severe asthma only and rarely in clinical practice.

Inhaled corticosteroids ICSs are the cornerstone of chronic maintenance asthma pharmacotherapy. Several ICSs are marketed in Canada: budesonide, fluticasone, ciclesonide and beclomethasone. There is robust evidence confirming that ICS therapy is effective at

FIGURE 2 - Treatments use to treat asthma



Source: Laval Respiratory Clinic (www.cliniquerespiratoire.ca)

TABLE 2 - Criteria for determining whether asthma is controlled⁽⁷⁾

	Controlled	Uncontrolled
Daytime symptoms	< 4 days / week	≥ 4 times / week
Night-time symptoms	< 1 night / week	≥ 1 night / week
Physical activity	Normal	Restricted in previous 3 months
Exacerbations	Mild, infrequent	Frequent
Absent from work or school due to asthma	None	Missed school/work or social engagement in previous 3 months
Need for a β_2 -agonist	< 4 times / week*	≥ 4 times / week*

* Include doses used to prevent exercise-induced symptoms

TABLE 3 - Choosing an inhaler device for children with asthma⁽¹⁾

Age Group	Preferred Device	Alternative Device
< 4 years old	Pressurized metered-dose inhaler PLUS spacer with face mask	Nebulizer with face mask
4-5 years old	Pressurized metered-dose inhaler PLUS spacer with mouthpiece	Pressurized metered-dose inhaler PLUS spacer with face mask or Nebulizer with mouthpiece of face mask
> 5 years old	Diskus or dry powder inhalers	Pressurized metered-dose inhaler PLUS spacer with mouthpiece

reducing asthma symptoms, improving quality of life, improving lung function, decreasing airway hyper-responsiveness, controlling airway inflammation, reducing the frequency and severity of exacerbations, and reducing asthma mortality. What is most surprising is that most people with asthma can control their disease by using only low doses of ICSs.⁽⁷⁾

The majority of studies evaluating the systemic effects of ICSs have been undertaken in children older than 5⁽⁹⁾. The potential for adverse effects on linear growth appear to be the most important concern raised by parents for their children. Although, ICS therapy may be associated with a possible, but not predictable, adverse effect on linear growth, the clinical significance of this potential systemic effect has yet to be determined^(10, 11). In general, the efficacy of ICSs is sufficient enough to outweigh any concerns about growth or other systemic effects^(9,10,11). However, they should be titrated to as low a dose as needed to maintain good asthma control. Other potential side effects include oropharyngeal candidiasis, dysphonia (e.g., hoarseness) and upper airway irritation. Mouth rinsing with water after inhalation may reduce these potential side effects.

Leukotriene receptor antagonists (LTRAs) Two LTRAs are currently on the Canadian market: montelukast and zafirlukast. LTRAs have a small and variable bronchodilator effect, reduce

symptoms (including cough), improve lung function, and reduce airway inflammation and asthma exacerbations.⁽¹⁾ They may be used as an alternative treatment in patients with mild persistent asthma, especially when ICSs are contraindicated or not tolerated. LTRAs are generally safe and well tolerated, as most clinical trials have consistently shown a low incidence of mild adverse effects compared with placebo. However, possible psychiatric adverse effects include agitation, aggressive behaviour or hostility, anxiousness, depression, disorientation, dream abnormalities, hallucinations, insomnia, irritability, restlessness, somnambulism, suicidal thinking and behaviour (including suicide), and tremor.⁽⁷⁾

Long-acting inhaled β_2 -agonists (LABAs) LABAs including formoterol and salmeterol are not recommended as maintenance monotherapy in asthma⁽⁷⁾ and they do not appear to influence airway inflammation in asthma. When used alone in asthma, they have been associated with an increased risk of death and hospitalization. They are most effective when combined with an ICS. The greater efficacy of combination treatment has led to the development of fixed combinations, such as salmeterol-fluticasone (Advair) and budesonide-formoterol (Symbicort) inhalers, that deliver both ICS and LABA simultaneously. Even when combined with an ICS, LABAs can still cause

cardiovascular stimulation, skeletal muscle tremor, and hypokalemia (low potassium concentrations in blood) in some patients⁽¹⁾.

Theophylline Theophylline is a bronchodilator with a modest anti-inflammatory effect. It is given when combination treatments do not result in adequate asthma control and after considering the risk/benefit ratio. Data are lacking on the relative efficacy of theophylline as a long-term controller.⁽¹⁾ Nausea and vomiting are the most common side effects, but loose stools, cardiac arrhythmias, seizures and even death can occur. This is why patients require proper dose selection with careful monitoring of theophylline blood levels.

Reliever medications Relievers are medications used on an as-needed basis. They act quickly to reverse bronchoconstriction and relieve its symptoms. All patients with asthma should have access to a fast-acting bronchodilator as needed to treat acute symptoms. Relievers include rapid-acting inhaled β_2 -agonists (salbutamol and terbutaline) and inhaled anticholinergics (ipratropium bromide).

β_2 -agonists have the same potential side effects as LABAs. Consequently, they should only be used on an as-needed basis at the lowest dose and frequency required. Anticholinergics are less effective in asthma than β_2 -agonists,^(1,7) but are alternative bronchodilators for patients who experience adverse effects such as tachycardia, arrhythmia and tremor from β_2 -agonists. In addition, they also have their own risks, such as constipation, dryness of the mouth and a bitter taste.

2010 Canadian Clinical Guidelines update In 2010, Canadian experts met to review the latest data and published guidelines on asthma.⁽⁷⁾ What have we learned and what are the options?

1. Most patients can achieve asthma control by using low doses of ICSs (250 $\mu\text{g}/\text{day}$ or less of HFA beclomethasone) providing an excellent risk/benefit ratio.
2. Failure to demonstrate a clinical response to ICSs is often related to:
 - a. Erroneous diagnosis of asthma,
 - b. Poor inhaler device technique,
 - c. Poor adherence to maintenance ICS treatment,
 - d. Exposure to environmental triggers,
 - e. Comorbidities.
3. Once asthma control has been achieved, it is reasonable to consider reducing the

TABLE 4 – Role of the technician in caring for patients with asthma

- Alert the pharmacist when you notice that a patient with asthma:
 - Bought several bottles of dextromethorphan in the OTC section (this could indicate that the patient is experiencing frequent cough, which is a symptom of asthma)
 - Used several antibiotics in the last year
 - Has early refills of β 2-agonists (requests a refill in < 2-3 months)
 - Irregular refills of ICSs
 - Late refills of smoking cessation products (e.g., nicotine products, bupropion or varenicline)
- Ask patients to complete the 30-second asthma test while waiting for their prescriptions.
- Make sure that you have enough patient education materials (from the Lung Association, pharmaceutical companies, etc.) on asthma in the waiting area (to help reinforce the verbal message).
- Confirm that all patients are using their MDIs with an inhalation device.
- Educate patients on how to use all asthma devices.

dose of ICS to the lowest level that maintains optimal asthma control.

- When control is not achieved with low-dose ICSs, after everything has been verified (point #2), a combination inhaler containing both an ICS and a LABA is the preferred

option versus increasing the ICS dosage.

More recent evidence suggests that single-inhaler maintenance and reliever therapy (SMART) with budesonide/formoterol is also an effective strategy for the prevention of asthma worsening and may be an optimal strategy for the prevention of exacerbations. In patients requiring maintenance and relief therapy, the substitution of single-inhaler budesonide/formoterol for a rapid-acting inhaled β 2-agonist allows the dose of maintenance therapy to be increased quickly in response to symptoms, while simultaneously offering rapid intervention to decrease inflammation. Asthma treatment guidelines advocate a stepwise approach to asthma management. The use of SMART for maintenance and relief mirrors this recommendation.⁽⁷⁾

Inhalation spacer devices When a metered-dose inhaler (MDI) is prescribed to a child, we should always recommend a valved spacer.⁽¹¹⁾ Do you know how to convince your patients and their relatives as to why they should use it?

- It reduces the oropharyngeal dose by five-fold, which may reduce oropharyngeal side effects.⁽¹¹⁾
- More than 70% of all users of MDIs do not use them appropriately and, among these patients, 50% have difficulty coordinating the spray with inhalation.⁽¹²⁾ The use of a spacer makes this coordination unnecessary.

- Medical visits for worsened asthma or ER visits are more frequent in misusers with poor coordination, than in misusers without poor coordination or good users.⁽¹²⁾

- It allows a two to three-second delay between the activation of the MDI and the inhalation of the dose, and maximizes lung medication deposition.⁽¹³⁾

Role of the technician

The pharmacy technician is involved in several steps of the drug distribution process. Every step requires a careful assessment of how the technician can assist the pharmacist with the analysis of the patient's file. Table 4 provides a list of activities in which the technician should be involved.

You have to reinforce patients' good habits and ensure they understand how to use their inhalers, and are knowledgeable about their disease and how to control it. There is discrepancy between the reality of asthma control and how doctors and patients believe it is being controlled; 97% of adults think that their asthma is controlled, and 88% of general practitioners and 90% of the pneumologists agree. In reality only 47% of patients have controlled asthma.⁽¹⁴⁾ That leaves opportunity for the pharmacy team to intervene and erase this discrepancy.

Figure 1 plus references are available at www.CanadianHealthcareNetwork.ca, CE section, Quick search CCCEP # 1065-2011-220-I-T

QUESTIONS

Please select the best answer for each question or answer online at www.CanadianHealthcareNetwork.ca for instant results.

- Which one of the following best describes asthma symptoms?
 - Cough, cyanosis, wheezing and dyspnea
 - Dyspnea, cough, chest tightness and colored sputum
 - Wheezing, chest tightness, dyspnea and cough
 - Low oxygen saturation, dyspnea, cough and chest tightness
- The pathophysiological mechanism leading to asthma is best described by using two words, they are:
 - Inflammation and bronchoconstriction
 - Inflammation and dyspnea
 - Bronchoconstriction and dyspnea
 - Cough and bronchoconstriction
- Which potential trigger of asthma is *not* likely to provoke an asthma attack?
 - Influenza
 - Tobacco smoke
 - Exercices
 - All of the above is likely to provoke an attack
- Among all available tests used to confirm the diagnosis asthma, which is the method of first choice?
 - Spirometry
 - Peak flow
 - X-ray of the lungs
 - Methacholine challenge
- A patient comes with a prescription of fluticasone 125 μ g 2 puffs twice a day and salbutamol 100 μ g 2 puffs up to 4 times a day if needed, both for 14 days. He just had his lung function tests done and he has been diagnosed with asthma. Is it a chronic or an acute disease in this case?
 - Chronic
 - Acute
- Paul, 27-years-old, comes in with a confirmation that he has asthma, just like his mother. He remembers that his mother was using nebulized aerosols when he was young. Is this still the best method of drug delivery?
 - Yes
 - No
- Two weeks later, Paul comes back to see you with his two sample inhalers: budesonide and terbutaline. Are these medications relievers or controllers?
 - Budesonide = reliever; Terbutaline = reliever

QUESTIONS (Continued)

- b) Budesonide = controller;
Terbutaline = reliever
c) Budesonide = controller;
Terbutaline = controller
d) Budesonide = reliever;
Terbutaline = controller

8. Based on the Canadian asthma guidelines, choose one patient that has his asthma under control

- a) Patient using salbutamol 100 µg 3 puffs per week (including puff used before exercise) & no night-time symptoms
b) Patient renewing his usual salbutamol 100 µg MDI (200 doses) every month
c) Patient who has had 3 exacerbations during the last year & no night-time symptoms
d) Patient who continues to do his normal activity with his friends and his dog, but has been away from work 2 days following an episode of asthma exacerbation.

9. Paul read a newspaper article warning about a class of asthma medication that has an increased risk of death and hospitalization when used alone. Which class of medication is it?

- a) ICSs b) LTRAs
c) LABAs d) Theophylline

Please select the best answer for each question or answer online at www.CanadianHealthcareNetwork.ca for instant results.

10. Which class of asthma medication has recently been linked with psychiatric concerns by Health Canada?

- a) ICSs b) LTRAs
c) LABAs d) Theophylline

11. Which statement is true about reliever medications?

- a) β₂-agonists and inhaled anticholinergics are used & prescribed equally in asthma.
b) Inhaled anticholinergics (ipratropium bromide) carry the same potential side effects as LABAs.
c) Inhaled anticholinergics are a second option when β₂-agonists are contraindicated
d) β₂-agonists can lead to constipation and dry mouth

12. At times we have to convince patients to take their meds appropriately. Which argument would you *not* use when proposing a valved spacer?

- a) 50% of patients with asthma have poor coordination when using their MDI
b) More than 70% appropriately use their MDI
c) It reduces the risk of oropharyngeal infection
d) It allows a 2- to 3-second delay between

the activation of the MDI and the inhalation of the medication.

13. What is the preferred device for a 3-year-old child?

- a) Nebulizer with face mask
b) Dry powder inhaler
c) MDI with a spacer with face mask
d) MDI alone

14. How many family doctors think that their patients have controlled asthma?

- a) 50% b) 70% c) 88% d) 90%

15. Many people are in line at the pharmacy. Among them is Sarah, who wants to renew her salbutamol & corticosteroid inhalers. What can you do to help the pharmacist?

- Print out any irregular refills of ICSs
 - Print out any early refills of reliever obtained recently
 - Provide the patient with educational materials about her disease
 - Make sure that she is using an inhalation device with her two MDIs
- a) 1,3,4 b) 1,2,3,4
c) 2,3,4 d) 1,2,4

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| 2. a b c d | 5. a b | 8. a b c d | 11. a b c d | 14. a b c d |
| 3. a b c d | 6. a b | 9. a b c d | 12. a b c d | 15. a b c d |

First Name _____		Last Name _____	
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Type of practice

- Drug chain or franchise Grocery store pharmacy
 Banner Hospital pharmacy
 Independent Other (specify): _____
 Mass merchandiser

- Full-time technician
 Part-time technician

- Are you a certified technician?
 Yes No

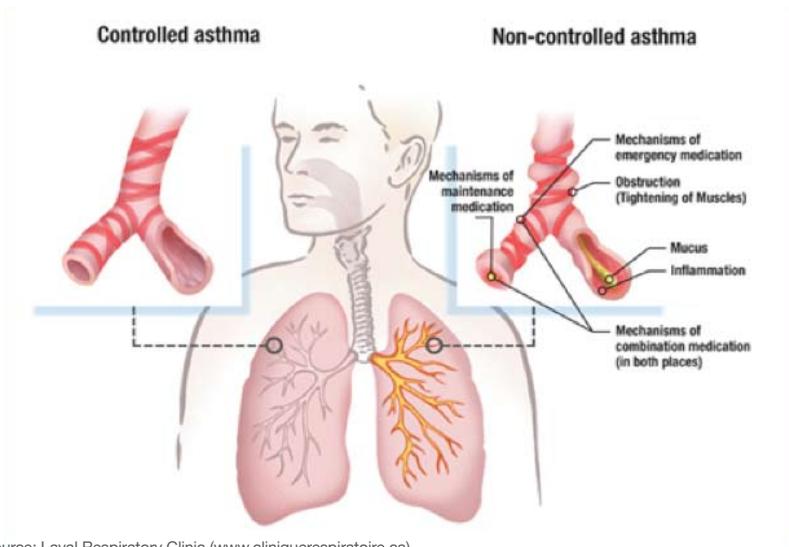
Please help ensure this program continues to be useful to you by answering these questions.

- Do you now feel more informed about asthma? Yes No
- Was the information in this lesson relevant to you as a technician? Yes No
- Will you be able to incorporate the information from this lesson into your job as a technician? Yes No N/A
- Was the information in this lesson... Too basic Appropriate Too difficult
- How satisfied overall are you with this lesson?
 Very Somewhat Not at all
- What topic would you like to see covered in a future issue? _____

HOW TO ANSWER: Answer ONLINE for immediate results at www.CanadianHealthcareNetwork.ca

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FIGURE 1 - Asthma pathological mechanisms



Source: Laval Respiratory Clinic (www.cliniquerespiratoire.ca)

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