



A COMPREHENSIVE REVIEW ON: ASTHMA

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ABSTRACT:

Asthma is the most common respiratory disorder in Canada. Despite significant improvement in the diagnosis and management of this disorder, the majority of Canadians with asthma remain poorly controlled. In most patients, however, control can be achieved through the use of avoidance measures and appropriate pharmacological interventions. Inhaled corticosteroids (ICS) represent the standard of care for the majority of patients. Combination ICS/long-acting beta2-agonist inhalers are preferred for most adults who fail to achieve control with ICS therapy. Biologic therapies targeting immunoglobulin E or interleukin-5 are recent additions to the asthma treatment armamentarium and may be useful in select cases of difficult to control asthma. Allergen-specific immunotherapy represents a potentially disease-modifying therapy for many patients with asthma, but should only be prescribed by physicians with appropriate training in allergy. In addition to avoidance measures and pharmacotherapy, essential components of asthma management include: regular monitoring of asthma control using objective testing measures such as spirometry, whenever feasible; creation of written asthma action plans; assessing barriers to treatment and adherence to therapy; and reviewing inhaler device technique. This article provides a review of current literature and guidelines for the appropriate diagnosis and management of asthma in adults and children.

KEYWORDS: Asthma, Pathophysiology, Symptoms, Treatment.

I.INTRODUCTION:

Asthma is defined as a chronic inflammatory disease of the airways. The chronic inflammation is associated with airway hyperresponsiveness (an exaggerated airway-narrowing response to specific triggers such as viruses, allergens and exercise) that leads to recurrent episodes of wheezing, breathlessness, chest tightness and/or coughing that can vary over time and in intensity. Symptom episodes are generally associated with widespread, but variable, airflow obstruction within the lungs that is usually reversible either spontaneously or with appropriate asthma treatment such as a fast-acting bronchodilator.[1]

Bronchial asthma is a significant public health problem which is found in all parts of the world. It most commonly begins in childhood, with an estimated worldwide prevalence of about 300 million cases, and found in approximately 10% of children and youths less than 18 years of age. The current reported prevalence in the Middle East region is somewhat lower, varying between 5.6% in Saudi Arabia and 8.5% in Kuwait. In Iraq, approximately 200,000 patients per year with asthma are either hospitalized or treated in an Emergency Room. In general, between 50% and 80% of cases of asthma are evident by 5 years of age. Although it is most problematic during childhood, up to 50% of those with relatively mild severity find that the symptoms disappear by late adolescence; while 80% of those with more severe symptoms will persist with the disease into adulthood. Fortunately, as immunologic capacity declines with age, the symptoms of asthma also usually decline in the older population.[2]

II. TYPES OF ASTHMA

Common types of asthma include:

1. Exercise-induced asthma
2. Allergic asthma
3. Occupational asthma
4. Seasonal asthma
5. Adult-onset asthma
6. Asthma-COPD overlap [3]

1.Exercise-induced asthma :Exercise is one of the best things you can do for your body, but there are some dangers that you need to be aware of. As it turns out, you can have asthma from exercising. This condition is known as exercise-induced asthma, or bronchoconstriction. Asthma from exercise might cause symptoms for 60 minutes or longer if they aren't treated. Exercise-induced asthma occurs because of the narrowing of the airways in the lungs during strenuous exercise. Suffering from exercise-induced asthma doesn't mean you can't remain active; just be sure you take the necessary treatment when you exercise.

2.Allergic asthma: Another type of asthma caused by allergens is called allergic asthma. This type of asthma is triggered by allergens such as dust, dust mites, mold, pollen, cockroaches, or pet dander. As it turns out, allergic asthma is the most common subcategory of the condition.

3.Occupational asthma: Occupational asthma is another type of asthma that can be directly related to your working environment. Some causes of occupational asthma that might be in your working environment include chemicals, enzymes, metals, animal substances, and plant substances. Some occupations that are at high-risk include food production workers, veterinarians, farmers, adhesive handlers, and others who can be exposed to these asthma-inducing substances on a regular basis.

4.Seasonal Asthma: Depending on where you live, the change in the seasons can bring out some health concerns you might need to take care of, like allergies. Seasonal asthma is exactly that—when asthma symptoms occur during different times of the year. This asthma is often due to the change in weather and can be triggered by different allergens such as trees, weeds, and grasses. Be wary of the seasonal changes to prepare for any side effects of seasonal asthma.

5.Adult-onset asthma:The first type of asthma we will be looking at is adult-onset asthma. While asthma typically developed during childhood, it can also develop as you get older in adulthood. Adult-onset asthma may occur because of certain chemicals and other irritants that you might be exposed to frequently in the workplace.

6.Asthma-COPD overlap: Another condition that can make breathing difficult is an asthma and chronic obstructive pulmonary disease (COPD) overlap. Some notable types of COPDs out there include emphysema and chronic bronchitis. Having conditions is known as ACOS and is often diagnosed when there is a mix of asthma and COPD symptoms.[4]

III.PATHOPHYSIOLOGY AND ETIOLOGY

Asthma is associated with T helper cell type-2 (Th2) immune responses, which are typical of other atopic conditions. Asthma triggers may include allergic (e.g., house dust mites, cockroach residue, animal dander, mould, and pollens) and non-allergic (e.g., viral infections, exposure to tobacco smoke, cold air, exercise) stimuli, which produce a cascade of events leading to chronic airway inflammation. Elevated levels of Th2 cells in the airways release specific cytokines, including interleukin (IL)-4, IL-5, IL-9 and IL-13, and promote eosinophilic inflammation and immunoglobulin E (IgE) production. IgE production, in turn, triggers the release of inflammatory mediators, such as histamine and cysteinyl leukotrienes, that cause bronchospasm (contraction of the smooth muscle in the airways), edema, and increased mucous secretion, which lead to the characteristic symptoms of asthma.[5-9]

- Asthma is more likely in people who have other allergic conditions, such as eczema and rhinitis (hay fever)
- Urbanization is associated with increased asthma prevalence, probably due to multiple lifestyle factors.
- Events in early life affect the developing lungs and can increase the risk of asthma. These include low birth weight, prematurity, exposure to tobacco smoke and other sources of air pollution, as well as viral respiratory infections.
- Exposure to a range of environmental allergens and irritants are also thought to increase the risk of asthma, including indoor and outdoor air pollution, house dust mites, moulds, and occupational exposure to chemicals, fumes or dust.

- Children and adults who are overweight or obese are at a greater risk of asthma.[10]

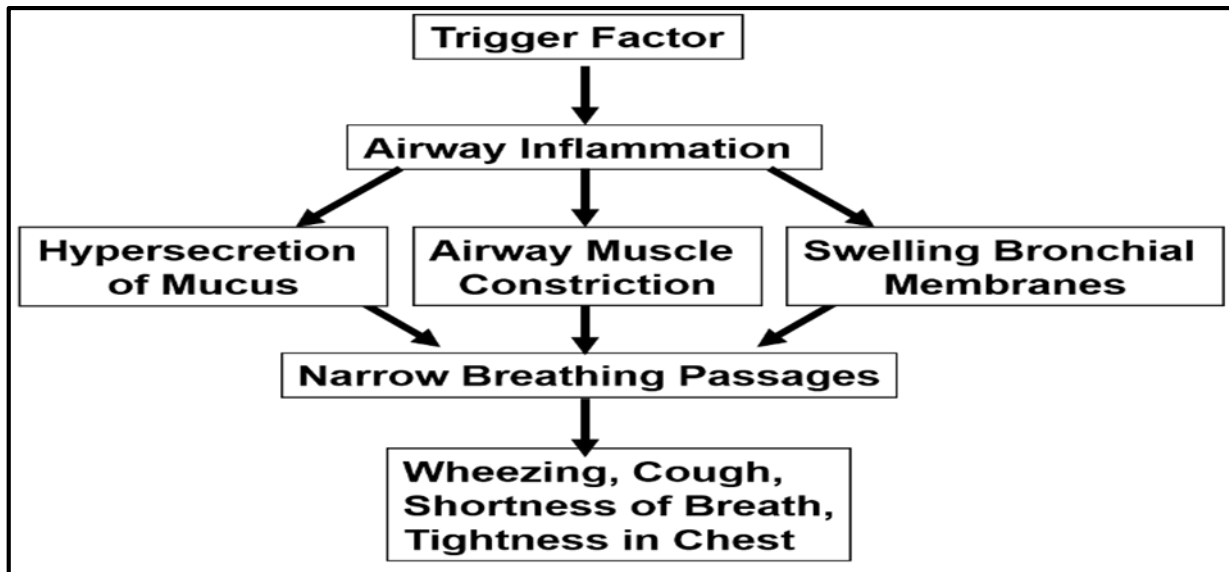


figure no.1: simple pathophysiology of asthma

IV.RISK FACTOR

Patients at high risk of asthma death require special attention and, in particular, intensive education, monitoring and care.

Risk factors for death from asthma are :[11]

1. Past history of sudden severe exacerbations.
2. Prior intubation for asthma.
3. Prior admission for asthma to an intensive care unit.
4. Two or more hospitalizations for asthma in the past year.
5. Three or more emergency care visits for asthma in the past year.
6. Hospitalization or an emergency care visit for asthma within the past month.
7. Use of >2 canisters per month of inhaled short-acting β_2 -agonist.
8. Current use of systemic corticosteroids or recent withdrawal from systemic corticosteroids.
9. Difficulty perceiving airflow obstruction or its severity.
10. Comorbidity, as from cardiovascular diseases or chronic obstructive pulmonary disease.
11. Serious psychiatric disease or psychosocial problems.
12. Low socioeconomic status and urban residence.
13. Illicit drug use
14. Sensitivity to alternaria.

V.SYMPTOMS:

Asthma symptoms vary from person to person. You may have infrequent asthma attacks, have symptoms only at certain times such as when exercising or have symptoms all the time.

Asthma signs and symptoms include:

- Shortness of breath
- Chest tightness or pain
- Wheezing when exhaling, which is a common sign of asthma in children
- Trouble sleeping caused by shortness of breath, coughing or wheezing
- Coughing or wheezing attacks that are worsened by a respiratory virus, such as a cold or the flu.

Signs that your asthma is probably worsening include:

- Asthma signs and symptoms that are more frequent and bothersome
- Increasing difficulty breathing, as measured with a device used to check how well your lungs are working (peak flow meter)
- The need to use a quick-relief inhaler more often

For some people, asthma signs and symptoms flare up in certain situations:

- Exercise-induced asthma, which may be worse when the air is cold and dry
- Occupational asthma, triggered by workplace irritants such as chemical fumes, gases or dust
- Allergy-induced asthma, triggered by airborne substances, such as pollen, mold spores, cockroach waste, or particles of skin and dried saliva shed by pets (pet dander).[12]

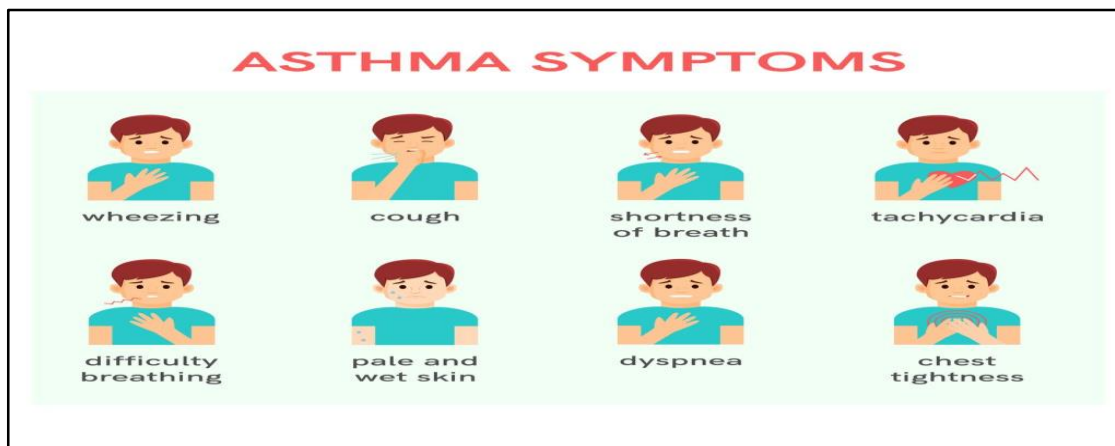


fig 2: symptoms of asthma

VI.COMPLICATIONS

Asthma which is not carefully managed can lead to:

- constant fatigue
- constant asthma flare-ups
- Pneumonia
- increased mucus production
- thickening and narrowing of bronchial tubes which can become permanent leading to respiratory failure
- respiratory failure
- severe chest pain. [13]

VII.DIAGNOSIS

To diagnose asthma, your doctor will ask you your medical history, including your family history, especially if anyone in your family has asthma. The doctor might also perform a general physical check-up and prescribe you to go for a lung function test, along with a sinus x-ray and chest x-ray.

If you or your child are having problems breathing on a regular basis, don't wait! Visit a doctor immediately. Knowing what to expect during the diagnostic process may help.

The lung function tests include:

- Spirometry
- Peak Airflow

Spirometry: This test estimates the narrowing of your bronchial tubes by checking how much air you can exhale after a deep breath and how fast you can breathe out.

Raman spectroscopy, together with the chemometric technique, has successfully been demonstrated for the screening of asthma disease.

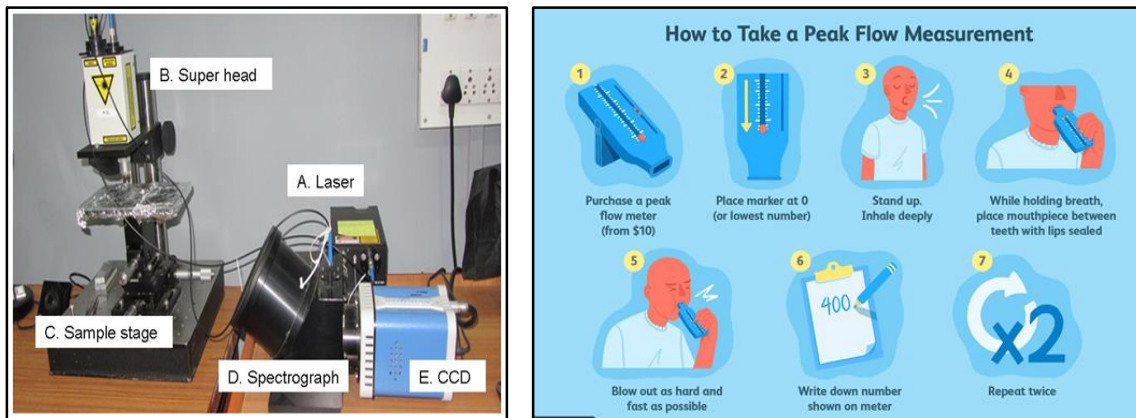


figure no. 3: spirometer and peak air flow measurement

Peak Airflow: A peak flow meter is a simple device that measures how hard you can breathe out. Lower than usual peak flow readings are a sign that your lungs may not be working as well and that your asthma may be getting worse. Your doctor will give you instructions on how to track and deal with low peak flow readings.[14]

VIII.TREATMENT:

The primary goal of asthma management is to achieve and maintain control of the disease in order to prevent exacerbations (abrupt and/or progressive worsening of asthma symptoms that often require immediate medical attention and/or the use of oral steroid therapy) and reduce the risk of morbidity and mortality. Other goals of therapy are to minimize the frequency and severity of asthma symptoms, decrease the need for reliever medications, normalize physical activity, and improve lung function as well as overall quality of life.

In most asthma patients, control can be achieved using both trigger avoidance measures and pharmacological interventions.

The pharmacologic agents commonly used for the treatment of asthma can be classified as: [15-17]

- **Controllers** (medications taken daily on a long-term basis that achieve control primarily through anti-inflammatory effects)
- **Relievers** (medications used on an as-Inhaled medication delivery devices.

Controller medications:

Inhaled corticosteroids (ICSs):ICSs are the most effective anti-inflammatory medications available for the treatment of asthma and represent the mainstay of therapy for most patients with the disease. Low-dose ICS monotherapy is recommended as first-line maintenance therapy for most children and adults with asthma. Regular ICS use has been shown to reduce symptoms and exacerbations, and improve lung function and quality of life. ICSs do not, however, “cure” asthma, and symptoms tend to recur within weeks to months of ICS discontinuation. Most patients will require long-term, if not life-long, ICS treatment [15,16,17].

Since ICSs are highly effective when used optimally, factors other than treatment efficacy need to be considered if ICS therapy is unsuccessful in achieving asthma control. These factors include: misdiagnosis of the disease, poor adherence to

ICS therapy, improper inhaler technique, continued trigger exposure or the presence of other comorbidities. If, after addressing such factors, patients fail to achieve control with low-to-moderate ICS doses, then treatment should be modified. For most children, ICS dose escalation (to a moderate dose) is the preferred approach to achieve control, while the addition of another class of medications (usually a LABA) is recommended for patients over 12 years of age [16,17,18]

Inhaled corticosteroids include:

- Fluticasone (Flovent HFA, Arnuity Ellipta, others)
- Budesonide (Pulmicort Flexhaler)
- Mometasone (Asmanex Twisthaler)
- Beclomethasone (Qvar RediHaler)
- Ciclesonide (Alvesco)

Reliever medications : Inhaled rapid-acting beta2-agonists are the preferred reliever medications for the treatment of acute symptoms, and should be prescribed to all patients with asthma. In Canada, several short-acting beta2-agonists (SABAs; e.g., salbutamol, terbutaline) and one LABA (formoterol) are approved for this indication. SABAs should only be taken on an as needed basis for symptom relief. Use of an as-needed SABA in the absence of a controller therapy should be reserved for patients with symptoms less than twice per month, without nocturnal waking in the past month, or an exacerbation within the past year. In children with well controlled asthma, a SABA should be used less than three times per week. Unlike other LABAs, formoterol has a rapid onset of action and, therefore, can be used for acute symptom relief. Given that LABA monotherapy has been associated with an increased risk of asthma-related morbidity and mortality, formoterol should only be used as a reliever in patients 12years of age or older who are on regular controller therapy with an ICS [15-18].

Short-acting anticholinergic bronchodilators, such as ipratropium bromide, may also be used as reliever therapy. These agents appear to be less effective than inhaled rapid-acting beta2-agonists and, therefore, should be reserved as second-line therapy for patients who are unable to use SABAs. They may also be used in addition to SABAs in patients experiencing moderate to severe asthma exacerbations. Short-acting anticholinergic bronchodilator therapy is not recommended for use in children [16].

Inhaled medication delivery devices : Inhaled asthma medications come in a variety forms including pressurized metered-dose inhalers (pMDIs) and dry powder inhalers (DPIs) (Turbuhaler, Diskus, Twisthaler, Ellipta). Not all medications are available in the same delivery devices. Also, some devices have dose counters included and others, such as pMDIs, do not. The most important factor in selecting a medication delivery device is to ensure that the patient uses it properly.

In children, it is recommended that pMDIs always be used with a spacer device since they are as effective as nebulizers; a pMDI with spacer is also preferred over nebulizers . A spacer with face mask is recommended for children 2–4 years of age, while a spacer with mouthpiece is recommended for children 4–6 years of age. To transition to a spacer with mouthpiece, children must be able to form a seal around the mouthpiece and breathe through their mouths. For children 6 years of age or over, a pMDI plus spacer with mouthpiece or DPI is recommended. Since children must have sufficient inspiratory force to use a DPI, these devices are generally not recommended for children under 6 years of age.[19]



figure no. 4: inhalation devices

Short Acting beta-Blockers

Short-acting beta-agonists are the most common quick-relief drugs for treating asthma attacks and are considered to be bronchodilators.

They can be used just before exercising to help prevent asthma symptoms caused by exercise. They work by relaxing the muscles of your airways, and this lets you breathe better during an attack.

Tell your provider if you are using quick-relief medicines twice a week or more to control your asthma symptoms. Your asthma may not be under control, and your provider may need to change your dose of daily control drugs.

Some quick-relief asthma medicines include:

- Albuterol (ProAir HFA, Proventil HFA, Ventolin HFA)
- Levalbuterol (Xopenex HFA)
- Metaproterenol
- Terbutaline

Short-acting beta-agonists may cause these side effects:

- Anxiety.
- Fast and irregular heartbeats. Call your provider right away if you have this side effect.
- Headache.
- Restlessness.
- Tumor (your hand or another part of your body may shake).

ORAL STEROIDS

Your provider might prescribe oral steroids when you have an asthma attack that is not going away. These are medicines that you take by mouth as pills, capsules, or liquids.

Oral steroids are not quick-relief medicines but are often given for 7 to 14 days when your symptoms flare-up.

Oral steroids include:

- Methylprednisolone
- Prednisone
- Prednisolone [20-23]

IX. LATEST TREATMENT AVAILABLE FOR MANAGE ASTHMA

Biologics:

Biologic drugs work with your immune system to treat asthma. They block the activity of immune system chemicals that make your airways swell up. These drugs can help prevent asthma attack and make the attacks you do have more mild.

Six monoclonal antibodies are currently approved to treat severe asthma:

- Reslizumab (Cinqair)
- Mepolizumab (Nucala)
- Omalizumab (Xolair)
- Benralizumab (Fasenra)
- Dupilumab (Dupixent)
- Tezepelumab (Tezspire)

Omalizumab treats severe asthma that's triggered by allergies. Mepolizumab, reslizumab, and benralizumab treat severe asthma caused by a type of white blood cell called an eosinophil (eosinophilic asthma). You take these drugs by injection or an IV inserted into a vein.

Dupliumb is an add-on maintenance treatment currently approved for patients between the ages of 6 to 11. This treatment is given through injection.

Tezepelumab is used as an add-on maintenance treatment for patients 12 and older. It's the first treatment not limited by the type of severe asthma. This treatment is also given through injection.

Tiotropium (Spiriva)

This inhaled medication has been used to treat chronic obstructive pulmonary disease (COPD) for more than a decade. In 2015, the FDA also approved it for the treatment of asthma.

A 2016_review Trusted_Source found that tiotropium improves asthma management when added to high doses of inhaled corticosteroids and short-acting beta-agonists.

Leukotriene modifiers

One group of asthma drugs works by blocking the action of leukotriene. This chemical tightens and narrows your airways during an allergy-induced asthma attack.

Three leukotriene_modifiers are approved to treat asthma:

- Montelukast (Singulair)
- Zafirlukast (Accolate)
- Zileuton (Zyflo)

You take these medications by mouth to prevent or treat asthma attacks.

Bronchial thermoplasty

Bronchial_thermoplasty is a surgical technique used for severe asthma that hasn't improved with other treatments.

During this technique, radiofrequency energy is applied to the airway. The heat that's generated destroys some of the smooth muscle lining the airway. This prevents the muscle from constricting and narrowing the opening.

Bronchial thermoplasty is delivered in three sessions, each given 3 weeks apart. Even though it isn't a cure for asthma, 2018_research Trusted_Source shows it does reduce symptoms.[24,25,26]

X.CONCLUSION

Asthma can be described as a chronic respiratory condition which can be identified by breathing difficulty, wheezing, cough and chest tightness. Narrowing and swelling of the airways and increased mucus production are the major episodes looked for to establish an asthma condition. Physical examinations, pulmonary function tests, blood tests and chest X-rays are also used to determine asthma. The medications used to manage asthma long term are symptom preventers and symptom controllers. Symptom reliever medications are used for the immediate control of its symptoms. Inhalation or ingestion of allergens and pollutants, exposure to cold weather, exercises, infections and occupational factors such as dust and chemicals can be considered asthma's risk factors, and healthcare professionals need to provide client education in order to prevent and minimize asthma attacks. Chronic asthma conditions affect client physical, psychological and social wellbeing.

Asthma is common and can start at any age but it can be effectively controlled. Effective asthma management includes patient education, objective measurement of lung function, environmental control, and pharmacologic therapy. A stepwise approach to pharmacological therapy is recommended. The aim is to accomplish the goals of therapy with the least possible medication. pharmacologic agents commonly used for the treatment of asthma is controllers medication, Reliever

medication, Inhaled medication delivery devices, Short acting beta-blockers, Oral steroids etc. A few newer treatments have made severe asthma easier to manage.

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