



An overall review on chronic asthma

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Abstract:

Asthma is chronic disease which mainly affects lungs. All over the world 300 million people are suffering from asthma. Every year 255,000 people are losing their lives around the world because of this chronic disease. Asthma is a disease that causes the airways of the lungs to swell and narrow, leading to wheezing, shortness of breath, chest tightness, and coughing. Asthma is caused by inflammation (swelling) in the airways. When an asthma attack occurs, the lining of the air passages swells and the muscles surrounding the airways become tight. This reduces the amount of air that can pass through the airway. In persons who are sensitive airways, asthma symptoms can be triggered by breathing allergens or triggers. This review mainly explains about the main reasons, symptoms, Diagnosis, Precautions to be taken to avoid further progression, Pathogenesis and treatment of chronic asthma.

Keywords:

Introduction

Asthma is a disease affecting the airways that carry air to and from lungs. People who suffer from this chronic condition (long-lasting or recurrent) are said to be asthmatic. The inside walls of an asthmatic's airways are swollen or inflamed. This swelling or inflammation makes the airways extremely sensitive to irritations and increases the susceptibility to an allergic reaction. As inflammation causes the airways to become narrower, less air can pass through them, both to and from the lungs. Symptoms of the narrowing include wheezing (a hissing sound while breathing), chest tightness, breathing problems, and coughing. Asthmatics usually experience these symptoms most frequently during the night and the early morning. According to recent estimates, asthma affects 300 million people in the world and more than 22 million in the United States. Although people of all ages suffer from the disease, it most often starts in childhood, currently affecting 6 million children in the US. Asthma kills about 255,000 people worldwide every year^{3,4}.

During asthma attack the following changes takes place

- The muscles around the airways tighten up, narrowing the airway.
- Less air is able to flow through the airway.
- Inflammation of the airways increases, further narrowing the airway.
- More mucus is produced in the airways, undermining the flow of air even more.



In some asthma attacks, the airways are blocked such that oxygen fails to enter the lungs. This also prevents oxygen from entering the blood stream and traveling to the body's vital organs. Asthma attacks of this type can

be fatal, and the patient may require urgent hospitalization. At the same time carbon dioxide deposition in the lungs leads to carbon dioxide poisoning⁵.

TYPES OF ASTHMA

Child-Onset Asthma



Asthma that begins during childhood is called child-onset asthma. This type of asthma happens because a child becomes sensitized to common allergens in the environment - most likely due to genetic reasons. The child is atopic - a genetically determined state of hypersensitivity to environmental allergens.

Allergens are any substances that the body will treat as a foreign body, triggering an immune response. These vary widely between individuals and often include animal proteins, fungi, pollen, house-dust mites and some kind of dust. The airway cells are sensitive to particular materials making an asthmatic response more likely if the child is exposed to a certain amount of an allergen^{1,2}.

Adult-Onset Asthma

This term is used when a person develops asthma after reaching 20 years of age. Adult-onset asthma affects women more than men, and it is also much less common than child-onset asthma.

It can also be triggered by some allergic material or an allergy. It is estimated that up to perhaps 50% of adult-onset asthmas are linked to allergies. However, a substantial proportion of adult-onset asthma does not seem to be triggered by exposure to allergen(s); this is called non-allergic adult-onset asthma. This non-allergic type of adult onset asthma is also known as intrinsic asthma. Exposure to a particle or chemical in certain plastics, metals, medications, or wood dust can also be a cause of adult-onset asthma.

Exercise-Induced Asthma

Coughing, wheezing or feeling out of breath during or after exercise is called as exercise-induced asthma. Level of fitness also matters a lot. A person who is unfit and runs fast for ten minutes is going to be out of breath. asthma.

As with other types of asthma, a person with exercise-induced asthma will experience difficulty in getting air in and out of the lungs because of inflammation of the

bronchial tubes (airways) and extra mucus.

Cough-Induced Asthma

Cough-induced asthma is one of the most difficult asthmas to diagnose. The doctor has to eliminate other possibilities, such as chronic bronchitis, post nasal drip due to hay fever, or sinus disease. In this case the coughing can occur alone, without other asthma-type symptoms being present. The coughing can happen at any time of day or night. If it happens at night it can disrupt sleep.

Occupational Asthma

This type of asthma is triggered by something in the patient's place of work. Factors such as chemicals, vapors, gases, smoke, dust, fumes, or other particles can trigger asthma. It can also be caused by a virus (flu), molds, animal products, pollen, humidity and temperature. Another trigger may be stress.

Nocturnal Asthma

Nocturnal asthma occurs between midnight and 8 AM. It is triggered by allergens in the home such as dust and pet dander or is caused by sinus conditions. Nocturnal or nighttime asthma may occur without any daytime symptoms recognized by the patient. The patient may have wheezing or short breath when lying down and may not notice these symptoms until awoken by them in the middle of the night - usually between 2 and 4 AM.

Nocturnal asthma may occur only once in a while or frequently during the week. However, when there are no daytime symptoms to suggest asthma is an underlying cause of the nighttime cough, this type of asthma will be more difficult to recognize - usually delaying proper therapy. The causes of this phenomenon are unknown, although many possibilities are under investigation.

Steroid-Resistant Asthma (Severe Asthma)

While the majority of patients respond to regular inhaled glucocorticoid (steroid) therapy, some are steroid resistant. Airway inflammation and immune activation play an important role in chronic asthma. Current guidelines of asthma therapy have therefore focused on the use of anti-inflammatory therapy, particularly inhaled glucocorticoids (GCs). By reducing airway inflammation and immune activation, glucocorticoids are used to treat asthma. However, patients with steroid resistant asthma have higher levels of immune activation in their airways than do patients with steroid sensitive (SS) asthma.

CAUSES OF ASTHMA

Allergies

Common sources of indoor allergens include animal proteins (mostly cat and dog allergens), dust mites, cockroaches, and fungi. It is possible that the push

towards energy-efficient homes has increased exposure to these causes of asthma. Allergic reactions triggered by antibodies in the blood often lead to the airway inflammation that is associated with asthma⁶.

Tobacco Smoke

Tobacco smoke has been linked to a higher risk of asthma as well as a higher risk of death due to asthma, wheezing, and respiratory infections. In addition, children of mothers who smoke - and other people exposed to second-hand smoke - have a higher risk of asthma prevalence. Adolescent smoking has also been associated with increases in asthma risk.

Environmental Factors

Allergic reactions and asthma symptoms are often the result of indoor air pollution from mold or noxious fumes from household cleaners and paints. Other indoor environmental factors associated with asthma include nitrogen oxide from gas stoves. In fact, people who cook with gas are more likely to have symptoms such as wheezing, breathlessness, asthma attacks, and hay fever.



Pollution, sulfur dioxide, nitrogen oxide, ozone, cold temperatures, and high humidity have all been shown to trigger asthma in some individuals.

Weather changes have also been known to stimulate asthma attacks. Cold air can lead to airway congestion, bronchoconstriction (airways constriction), secretions, and decreased mucociliary clearance (another type of airway inefficiency). In some populations, humidity causes breathing difficulties as well.

Obesity

Overweight adults - those with a body mass index (BMI) between 25 and 30 - are 38% more likely to have asthma compared to adults who are not overweight. Obese adults - those with a BMI of 30 or greater - have twice the risk of asthma. According to some researchers, the risk may be greater for nonallergic asthma than allergic asthma.

Stress

People who undergo stress have higher asthma rates. Part of this may be explained by increases in asthma-related behaviors such as smoking that are encouraged by stress. However, recent research has suggested that the immune system is modified by stress as well.

Genes

It is possible that some 100 genes are linked to asthma - Genes linked to asthma also play roles in managing the immune system and inflammation. There have not, however, been consistent results from genetic studies across populations - so further investigations are required to figure out the complex interactions that cause asthma. Three-fifths of all asthma cases are hereditary. The Centers for Disease Control (USA) say that having a parent with asthma increases a person's risk by three to six times.

Genetics may also be interacting with environmental factors. For example, exposure to the bacterial product endotoxin and having the genetic trait CD14 (single nucleotide polymorphism (SNP) C-159T) have remained a well-replicated example of a gene-environment interaction that is associated with asthma.

Airway Hyperreactivity

Researchers are not sure why airway hyperreactivity is another risk factor for asthma, but allergens or cold air may trigger hyperreactive airways to become inflamed. Some people do not develop asthma from airway hyperreactivity, but hyperreactivity still appears to increase the risk of asthma.

Common asthma triggers include:

- Animals (pet hair or dander)
- Dust mites
- Certain medicines (aspirin and other NSAIDS)
- Changes in weather (most often cold weather)
- Chemicals in the air or in food
- Exercise
- Mold
- Pollen
- Respiratory infections, such as the common cold
- Strong emotions (stress)
- Tobacco smoke

Diagnosing Asthma

Common symptoms and signs include:

- Wheezing
- Coughing
- Breathing difficulty
- Tightness in the chest
- Worsening symptoms at night
- Worsening symptoms due to cold air
- Symptoms while exercising
- Symptoms after exposure to allergens

It is also wise to make note of health conditions that can interfere with asthma management such

Physical Exam

A physical examination will generally focus on the upper respiratory tract, chest, and skin. A doctor will use a stethoscope to listen for signs of asthma in your lungs as you breathe. The high-pitched whistling sound while you exhale - or wheezing - is a key sign of both an obstructed airway and asthma.

Physicians will also check for a runny nose, swollen nasal passages, and nasal polyps. Skin will be examined for conditions such as eczema and hives, which have been linked to asthma.

Physical symptoms are not always present in asthma sufferers, and it is possible to have asthma without presenting any physical maladies during an examination¹⁰

Asthma Tests

Lung function tests, or pulmonary function tests, are the third component of an asthma diagnosis. Spirometry is a noninvasive test that requires taking deep breaths and forcefully exhaling into a hose connected to a machine called a spirometer. The spirometer then displays two key measurements:

Forced vital capacity (FVC) - the maximum amount of air one can inhale and exhale
Forced expiratory volume (FEV-1) - the maximum amount of air exhaled in one second

The measurements are compared against standards developed for a person's age, and measurements below normal may indicate obstructed airways.

It is common for a doctor to administer a bronchodilator drug to open air passages before retesting with the spirometer. If results improve after the drug, there is a higher likelihood of receiving an asthma diagnosis.

Children younger than 5 years of age are difficult to test using spirometry, so asthma diagnoses will rely mostly on symptoms, medical histories, and other parts of the physical examination. It is common for doctors to prescribe asthma medicines for 4 to 6 weeks to see how a young child responds⁹.

Other Tests

A "Challenge Test" (or bronchoprovocation test) is when a physician administers an airway-constricting substance (or something as simple as cold air) to deliberately trigger airway obstruction and asthma symptoms. Similarly, a challenge test for exercise-induced asthma would consist of vigorous exercise to trigger symptoms. A spirometry test is then administered, and if measurements are still normal, an asthma diagnosis is unlikely.

TREATMENT

Asthma medications are generally considered to fall into two classes: bronchodilators, which stop asthma attacks after they've started and help in preventing the attacks

patient to inhale forcefully to pull the powder from the

and anti-inflammatories, which control the airway inflammation and prevent asthma attacks from starting.

Bronchodilators

Bronchodilators provide relief during an asthma attack. They relax muscles in the air tubes, forcing them to open up and allowing the patient to breathe. Bronchodilators also may help to clear mucus from the lungs, allowing it to move more freely and be more easily coughed out.

Some examples of bronchodilators include short-acting beta-agonists used to prevent exercise-induced asthma, anticholinergics used in addition to or as an alternative to short-acting beta-agonists and theophylline a long-acting drug used to treat severe asthma.

Anti-Inflammatories

Anti-inflammatories prevent asthma attacks by keeping air tubes open all of the time. They are designed to reduce swelling in the air tubes and decrease the amount of mucus. Cromolyn and nedocromil are two examples of anti-inflammatory medicines.

Corticosteroids are the most popular class of anti-inflammatories and are the drug of choice for persistent asthma. Other anti-inflammatories include mast cell stabilizers^{7,8}.

Side Effects

There is always a risk of side effects associated with taking medicine. These may include sore throat, nervousness, nausea, rapid heartbeat, loss of appetite, or staying awake. A doctor will modify the treatment plans if side effects become severe.

Over-The-Counter

Over-the-counter asthma drugs such as "Primatene Mist" and "Bronkaid" are widely available bronchodilators that provide short term relief. These medicines, however, do not control long-term asthma and should not be used every day to relieve asthma symptoms. Check with a physician before using over-the-counter medicines.

Metered-Dose Inhalers

The most common device used to deliver medicine to the lungs of asthmatics is the metered-dose inhaler. Inhalers have two parts: 1) a canister consisting of a propellant, the medicine, and stabilizers, and 2) an actuator or mouthpiece consisting of a discharge nozzle and a dust cap. Inhalers are easily used by pressing down the top of the canister and inhaling the gas that is released. Usually the medicine administered by metered-dose inhalers is a bronchodilator, corticosteroid, or a mast cell stabilizer.

Dry Powder Inhalers

As an alternative to the aerosol-based metered-dose inhalers, dry powder inhalers deliver medicine from a capsule in powder form. These devices require the

association studies have identified variations in several

device into the lungs and can be more complicated to use than metered-dose inhalers.

Nebulizer

Medication may also be administered using a nebulizer, providing a larger, continuous dose. Nebulizers vaporize a dose of medication in a saline solution into a steady stream of foggy vapor that is inhaled by the patient. Nebulizers are more common in hospital settings for patients who have difficulty using a metered-dose inhaler.

Asthma Spacer

Asthma spacers are attachments that can be added to metered-dose inhalers. The spacer goes between the patient's mouth and the mouthpiece of the inhaler and it acts as a reservoir that briefly holds the medication. Spacers allow a patient to inhale the medicine without having to coordinate the breathing and mechanical actions needed to use an inhaler. Spacers also help patients deliver the medication directly to the lungs, avoiding medicine on the side of the mouth and the condition known as "thrush".

Managing asthma

Identifying and avoiding asthma triggers will help you to maintain an active and healthy lifestyle with asthma. The following list discusses common triggers and suggests ways to handle them:^{8,11}

Tobacco smoke - avoid inside and outside of the home

Air pollution - try antihistamine medications and staying indoors

Pollen - try antihistamine medications and staying indoors

Animal dander - keep pets outside, wash them often, find them a new home

Viral infections - see a physician

Heavy exercise - lower the impact of your exercise routine and consult a doctor

Stress - many methods of stress reduction exist, including breathing, meditation, progressive relaxation, and exercise.

Dry or cold air - wear a scarf over your mouth and nose during winter months

Dust mites - keep sheets, blankets, pillows, and stuffed toys clean

Sulfites in dried food and wine - avoid foods with allergens

CONCLUSIONS:

Asthma is a heterogeneous group of conditions that result in recurrent, reversible bronchial obstruction. Although the disease can start at any age, the first symptoms occur during childhood in most cases. Asthma has a strong genetic component, and genome-wide

genes that slightly increase the risk of disease. In this review detailed discussion was made on the pathogenesis, causes, symptoms and management of chronic asthma.

REFERENCES

1. Frew AJ: Allergen immunotherapy. *J Allergy Clin Immunol* 2010, 125:S306-313.
Kaplan AG, Balter MS, Bell AD, Kim H, McIvor RA: Diagnosis of asthma in adults. *CMAJ* 2009, 181:E210-E220.
2. Kovesi T, Schuh S, Spier S, Bérubé D, Carr S, Watson W, McIvor RA: Achieving control of asthma in preschoolers. *CMAJ* 2010, 182:E172-E183.
3. Global Initiative for Asthma (GINA): Global strategy for asthma management and prevention. 2009.
4. Lemanske RF, Busse WW: Asthma: Clinical expression and molecular mechanisms. *J Allergy Clin Immunol* 2010, 125:S95-102.
5. McFadden ER Jr. A century of asthma. *Am J Respir Crit Care Med.* 2004;170(3):215-221.
6. Wardlaw AJ, Brightling C, Green R, Woltmann G, Pavord I. Eosinophils in asthma and other allergic diseases. *Br Med Bull.* 2000;56(4):985-1003.
7. Djukanovic R, Homeyard S, Gratziau C, et al. The effect of treatment with oral corticosteroids on asthma symptoms and airway inflammation. *Am J Respir Crit Care Med.* 1997;155(3):826-832.
8. ten Brinke A, Zwinderman AH, Sterk PJ, Rabe KF, Bel EH. "Refractory" eosinophilic airway inflammation in severe asthma: effect of parenteral corticosteroids. *Am J Respir Crit Care Med.* 2004;170(6):601-605.
9. O'Byrne PM, Pedersen S, Lamm CJ, Tan WC, Busse WW. Severe exacerbations and decline in lung function in asthma. *Am J Respir Crit Care Med.* 2009;179(1):19-24.
10. Bousquet J, Bousquet PJ, Godard P, Daures JP. The public health implications of asthma. *Bull World Health Organ.* 2005;83(7):548-554.
11. Asthma UK. High cost of asthma in West Midlands. Available from: http://www.asthma.org.uk/news_media/media_releases/high_cost_of_asthm_3.html. Updated 2009 Oct 22.