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A Brief Review on Chronic Asthma

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Abstract

Asthma is a chronic condition that mostly affects the lungs. There are 300 million asthma sufferers in the world. This chronic illness claims the lives of 255,000 people annually throughout the world. The symptoms of asthma include wheezing, chest tightness, coughing, and shortness of breath when the lung's airways enlarge and narrow. Inflammation (swelling) in the airways is what causes asthma. The muscles surrounding the airways tighten and the lining of the airways expands during an asthma episode. The amount of air that can enter the airway is lowered as a result. Breathing allergens or triggers can cause asthma symptoms in people with sensitive airways. This review mostly discusses the primary causes, signs, a diagnosis, and the necessary precautions to prevent future progression, and the causes and treatments for persistent asthma. Asthma is treated with a variety of herbal remedies, including ginseng, ginko biloba, licorice, and cinnamon. In the future, we can use machine learning and artificial intelligence (AI) programs to cure asthma.

Keywords: Asthma, Chronic, Inflammation, Ginko Biloba, Licorice, Cinnamon.

Introduction

Breathing might be challenging due to the chronic airway illness known as "Asthma". The airways that deliver oxygen to the lungs temporarily narrow due to inflammation of the airways that occurs with asthma. As a result, people have asthma symptoms as coughing, wheezing, shortness of breath, and tightness in the chest. Asthma is also referred to as "bronchial asthma."The nights and early mornings are typically when asthmatics experience these symptoms the most frequently. By educating patients about their drugs, how to take them, and the significance of following the directions on the label, pharmacists, as members of the healthcare team, serve to enhance the pharmacologic management of asthma[1].According to recent estimates, there are 300 million asthma sufferers globally and more than 22 million in the United States. Although the illness affects people of all ages, it most often first appears in children, affecting 6 million kids in the US at the moment. Over 255,000 people worldwide pass away from asthma each year. Asthma is one of the most common chronic diseases, and it has a major socioeconomic impact on both patients and caregivers. Asthma affects people of all ages, including children, and has a negative effect on both academic and professional performance [2].

What is an Asthma attack?

Coughing, chest tightness, wheezing, and breathing difficulties can all be symptoms of an asthma attack. The attack takes place in the airways of your body, which are the channels through which air travels to your lungs. The airways in your lungs narrow as air passes through them, just as the branches of a tree are narrower than the trunk. Your lungs airways enlarge on the sides and constrict during an asthma attack. Less air enters and exits your lungs, and the mucus your body produces further obstructs the airways. By being aware of the symptoms of an asthma attack, avoiding triggers, and adhering to your doctor's recommendations, you can manage your condition. When your asthma is under control:

- You won't experience symptoms like coughing or wheezing;
- You'll sleep better;
- You won't be absent from work or school;
- You can engage in all physical activities [3].

During asthma attack following changes takes place

- The airway narrows as a result of tightened muscles surrounding it.
- The airway may move less air through it.
- The airways become even more constricted as a result of increased airway inflammation.
- The production of mucus in the airways increases, further obstructing airflow.

The airways may get obstructed during some asthma attacks, preventing oxygen from reaching the lungs. Additionally, oxygen cannot enter the bloodstream and reach the body's important organs as a result of this. These types of asthma episodes can be fatal, and the patient may require urgent hospitalization. At the same time carbon dioxide deposition in the lungs leads to carbon dioxide poisoning [4].

Causes of Asthma attack

May experience an asthma attack if you are exposed to "asthma triggers". The asthma triggers that apply to you might not apply to someone else. Learn how to avoid your triggers by being aware of them. Whenever you can't avoid the triggers, be on the lookout for an attack. Most common triggers include:

Environmental Factors

Asthma symptoms and allergic reactions are frequently brought on by strong fumes from household cleaners and paints or indoor air pollution from mold. Nitrogen oxide from gas stoves is another indoor environmental element linked to asthma. In actuality, those who use gas to cook are more likely to experience symptoms like hay fever, asthma attacks, and wheezing and to be breathless. Several factors, including smog, sulfate-dioxide, nitrogen oxide, ozone, chilly temperatures, and excessive humidity, have been demonstrated to make certain people get asthma [5].

Allergies

Animal proteins (primarily cat and dog allergens), dust mites, cockroaches, and fungi are common sources of indoor allergens. The aim for energy-efficient housing may have

increased exposure to these asthma triggers. The airway inflammation linked to asthma is frequently caused by allergic reactions sparked by blood antibodies. Most people who have asthma also have allergies. In actuality, nearly 25% of individuals with allergic rhinitis (hay fever) also develop asthma [6].

Tobacco smoke

Tobacco smoke has been associated to an increased risk of developing asthma, as well as an increased risk of dying from respiratory infections, wheezing and asthma. Additionally, there is a higher chance of asthma prevalence in children whose moms smoke as well as in other persons who are exposed to secondhand smoke. Smoking among teenagers has also been linked to higher asthma risk. Smoking tobacco is bad for everyone, but it's especially bad for asthmatics. If you smoke and have asthma, give up the habit [7].

Pregnancy

Your vulnerability to asthma seems to depend on how you enter the world. Compared to kids born vaginally, babies born by Caesarean sections have a 20% higher prevalence of asthma. This discrepancy may be brought on by immune system-modifying infections brought on by bacterial exposure during cesarean sections. Children who have mothers who smoke throughout pregnancy have less developed lungs. This could increase the risks for asthma. According to epidemiological studies, bronchial asthma is one of the most prevalent conditions that can complicate pregnancy (1–7%) [8].

Types of Asthma

Child onset asthma

Childhood asthma is referred to as child-onset asthma. This type of asthma develops when a youngster, most likely for hereditary reasons, becomes sensitive to common environmental allergens. The child has atopic dermatitis, which is a genetically predisposed condition of extreme sensitivity to environmental allergens. Any compounds that the body will mistake for a foreign object and react to with an immune reaction are considered allergens. These differ greatly between people and frequently consist of animal proteins, fungus, pollen, house-dust mites, and some type of dust. Asthma Symptoms in Young Children (0–6 Years) Nearly 80% of instances of asthma start in the first 6 years of life, according to studies on the disease's natural history. This age group's pediatric asthma symptoms are diverse and not always associated with asthma, making a diagnosis difficult [9].

Adult-onset asthma

When a person develops asthma after becoming 20 years old, this phrase is used. Adult-onset asthma is less common than child-onset asthma and affects women more than males. An allergy or another allergic item may also cause it. According to estimates, up to Allergies may be the cause of 50% or more of adult-onset asthma cases. However, a sizeable Exposure to a significant majority of adult-onset asthma does not appear to be caused by this type of adult-onset asthma is known as non-allergic asthma. This grownup is not allergic. Intrinsic asthma is another name for onset asthma. Exposure to an object or substance Adult-onset asthma can

also be brought on by specific polymers, metals, drugs, or wood dust. Asthma [10].

Exercise-induced asthma

You may have exercise-induced asthma if you cough, wheeze, or feel short of breath during or after activity. Naturally, your degree of fitness also plays a role; if you run quickly for ten minutes when unfit, you'll get out of breath. If, however, you're coughing, wheezing, or panting is uncharacteristic, it may be a sign of exercise-induced asthma. Exercise-induced asthma causes the bronchial tubes (airways) to inflame and produce more mucus, which makes it harder for the sufferer to breathe in and out of the lungs [11].

Cough induced asthma

One of the most challenging asthmas to identify is asthma brought on by coughing. Other options need to be ruled out, such as chronic bronchitis, hay fever-related postnasal drip, or sinusitis. In this situation, coughing may happen all by itself without the presence of any other asthma-like symptoms. Any time of day or night can bring on a coughing fit.

Occupational asthma

Something at the patient's place of employment causes this particular sort of asthma. Asthma can be brought on by substances like chemicals, vapors, gases, smoke, dust, fumes, or other particles. It a virus (the flu), molds, animal products, pollen, humidity, and temperature are additional potential causes. Stress may serve as another catalyst. Occupational asthma typically develops soon after a patient starts a new job and goes away quickly once that employment is left [12].

Nocturnal Asthma

Night time asthma strikes between midnight and 08:00. It is brought on by sinus disorders or set off by indoor irritants like dust and pet dander. It is possible for nocturnal or midnight asthma to develop without the patient noticing any symptoms during the day. When lying down, the patient may experience wheezing or shortness of breath, but they might not be aware of these symptoms until they awaken the patient in the middle of the night, generally between 2 and 4 AM [13].

Steroid-Resistant Asthma (Severe Asthma): Some patients are steroid resistant, even though the majority of patients benefit from routine inhaled glucocorticoid (steroid) medication. Inflammation of the airways and immunological activation are significant factors in persistent asthma. As a result, current recommendations for treating asthma have prioritized the use of anti-inflammatory medications, particularly inhaled glucocorticoid (GCs). Glucocorticoids are a type of medication used to treat asthma because they lower immune activation and airway inflammation. However, compared to people with steroid sensitive (SS) asthma, people with steroid resistant asthma have higher levels of immunological activation in their airways [14].

Receptors Working in Asthma

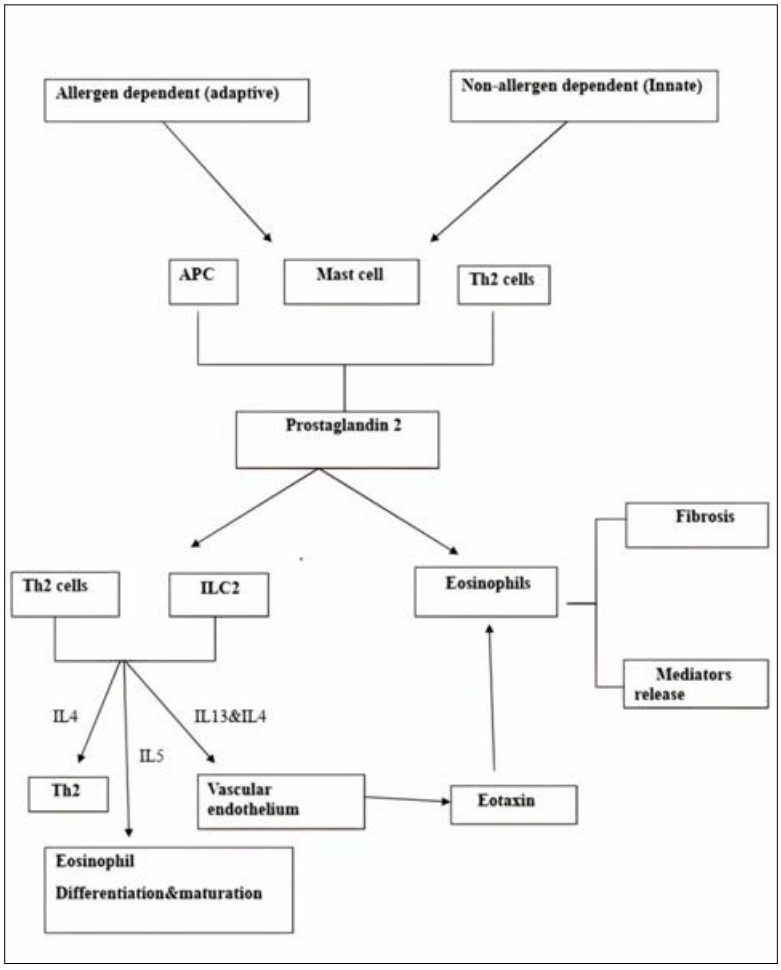

Figure No.1: Overview of DP2 (prostaglandin 2) receptor mediated immune cells in the inflammatory pathway [15-18]

Test and Diagnosis

Diagnosis

A complete medical history, physical examination, and objective evaluations of lung function (spirometry is recommended) are all required for the diagnosis of asthma. It may also be helpful to screen for indicators of airway inflammation during a bronchoprovocation challenge in order to diagnose the condition especially when asthma symptoms are present but objective tests of lung function are normal.

Medical history

Patients with recurrent coughing, wheezing, chest tightness, and shortness of breath should have asthma suspected. Strongly suggestive of asthma are symptoms that are unpredictable, intensify at night, happen after exposure to allergens or irritants, and react to effective asthma therapy. The following conditions should be ruled out as potential

causes of suspected asthma symptoms: heart disease, chronic obstructive pulmonary disease (COPD), bronchitis, chronic sinusitis, gastro esophageal reflux disease, and recurrent respiratory infections. Identification of patients with asthma can also be aided by a positive family history of asthma or other atopic diseases, as well as a personal history of atopic disorders, especially allergic rhinitis. It's crucial to look for potential asthma triggers during the history, such as dust mites, cockroaches, and animal dander, moulds, pollens, exercise, and exposure to tobacco smoke or cold air.

Physical examination

The physical examination of people with suspected asthma is frequently unremarkable since asthma symptoms might vary. Usually, a patient's symptoms are required for physical findings to become apparent. As a result, an asthma diagnosis cannot be ruled out in the absence of physical signs. Auscultation-confirmed wheeze indicates the presence of an airflow restriction and is the most typical aberrant physical result. Atopic disorders such allergic rhinitis or dermatitis should be checked for concurrently by doctors by checking the skin and upper respiratory system [19].

Tests

Challenge testing

Measurements of airway responsiveness utilizing direct airway challenges to inhaled bronchoconstrictor stimuli (such as methacholine or histamine) or indirect challenges with mannitol or exercise may help confirm a diagnosis of asthma when lung function tests are normal but symptoms imply asthma. Challenge testing needs to be done at a facility that is set up to handle acute bronchospasms and according to tight guidelines. Increased doses or concentrations of a stimulus are inhaled by the test subject until a predetermined degree of broncho constriction is reached, often a 20% decline in FEV1. To remove the obstruction, a rapid-acting bronchodilator is then administered via inhalation.

Allergy skin testing

Additionally advised is allergy skin testing to establish the patient's allergic status and to discover potential asthma triggers. The allergens specific to the patient's location are often used in testing. As an alternative to skin tests, allergen-specific IgE tests that detect a patient's specific IgE levels against particular allergens in vitro have been proposed; however, these tests are less sensitive and more expensive than skin tests [20].

Treatment

In order to prevent exacerbations, which are sudden and/or progressive worsenings of asthma symptoms that frequently call for immediate medical attention and/or the use of oral steroid therapy, and lower the risk of morbidity and mortality, it is important to achieve and maintain control of the disease. Utilizing the criteria in Table 2, the amount of asthma control should be evaluated at each visit, and treatment should be customized to achieve control. Most asthma patients can be controlled with a combination of avoidance strategies and pharmaceutical treatments. The pharmacologic treatments frequently used to treat asthma can be divided into two groups:

controllers (medications used regularly for a long period of time that primarily achieve control through anti-inflammatory actions) and relievers (medications used on a short-term basis to reduce symptoms).An as-needed basis for prompt symptom and bronchoconstriction alleviation). ICSs, leukotriene receptor antagonists (LTRAs), long-acting beta2-agonists (LABAs) combined with an ICS, and anti-IgE treatment are examples of controller drugs.

- Medication for relief [e.g.-SALMETEROL, SALBUTAMOL]
- Anti-IgE Therapy [e.g.-OMALIZUMAB]
- Inhaled Corticosteroids [e.g.-FLUTICASONE, THEOPHYLLINE]
- Allergen specific immunotherapy [e.g.-MONTELUKAST, ZAFIRLUKAST] [21].

Future perspectives for treating of asthma:

Artificial intelligence and machine learning program

1) Asthma screening and diagnosis

As expected, mostly clinical data have been used for the diagnosis and screening of asthma; these data specifically include information from the medical history, pattern of symptoms, pulmonary function tests, lung sounds from auscultation, etc. 37 research use clinical data, 12 of which focus on features related to lung or breath sounds. We note that only a few machine learning algorithms, such as ANNs, support vector machines, random forests, and decision trees, are used in the papers under the heading “Asthma screening and diagnosis.” It should be noted that the following additional material contains descriptions of various machine learning techniques as well as details on how the presented results were assessed. According to the “sample size” column, only a few research have enrolled bigger patient cohorts (only four studies have involved >1000 patients) [22].

2) Patient Classification

Examined in a pediatric population the connection between asthma control and exhaled biomarkers. The ability of fractional nitric oxide (FeNO), volatile organic compounds (VOCs), and cytokines/ chemokines to distinguish between children with persistently managed and uncontrolled asthma was specifically examined by the authors. Different feature sets were provided as input to a random forest in order to differentiate between the two patient groups during a year-long follow-up of 96 asthmatic children. An AUC of 0.86 was obtained while only using a certain collection of VOCs; however, adding the other two inputs did not improve the classification’s accuracy [23].

3) Asthma Management and monitoring

With 40 papers that predominantly address asthma exacerbations and asthma flare-ups, this area is also very populated. A summary of these investigations is presented. Twelve researches used decision trees, random forests, or variants of these methods in their machine learning analyses. Eleven studies used artificial neural networks (ANNs), four used support vector machines, three used Bayes networks or naïve Bayes techniques, and three used logistic regression. Used expert knowledge in an ensemble classifier to detect the asthma control level, which

produced an overall accuracy of 91.66%. The algorithm was created using information gathered from 96 asthmatic patients who were tracked for 9 months. The suggested model is intended to function as a real-time preventive system for asthma control, according to the scientists [24].

4) Asthma treatment

Studies using machine learning algorithms for all aspects of asthma treatment can be found in the last category. It is noteworthy that only one article by, which was also listed in earlier categories, is included in this category. By analyzing how different asthma phenotypes responded to treatment, the scientists hoped to better target the care given to their patients. We purposefully included this sparsely filled category to draw attention to the literature's lack of machine learning algorithms utilized for treating asthma. Of the study's participants, 56% had asthma; the remaining 44% did not. The total accuracy was increased by the application of machine learning techniques. The accuracy, sensitivity, AUC, and specificity of the XG Boost prediction model for the diagnosis of asthma were 87.1%, 82.5%, 93.0%, and 97.9%, respectively [25].

Conclusion

A variety of illnesses together referred to as asthma cause recurrent, reversible bronchial blockage. Despite the fact that the disease can develop at any age, the majority of the time the first symptoms appear in children. There are many genome-wide genes that somewhat raise the risk of asthma as well as a major hereditary component to the condition. In this review, the pathogenesis, causes, symptoms, and therapy of persistent asthma were thoroughly discussed. The most prevalent respiratory condition, asthma, significantly increases morbidity and mortality. Patients with recurrent cough, wheezing, chest tightness, and dyspnea should have asthma suspected, and the diagnosis should be validated with objective tests of lung function (spirometry is preferable).Testing for allergies is also advised to find potential causes of asthma symptoms. Most people can control their asthma with the use of preventative measures and the proper pharmaceutical interventions. For the vast majority of asthma patients, ICSs are the norm in terms of treatment. If patients are unable to regulate their symptoms with low-to-moderate ICS doses, and future perspectives for treating of asthma like Artificial Intelligence (AI)

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