

Corticosteroid Inhalers Used For Asthma Management

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ABSTRACT

Asthma is a condition in which the airways become narrow and swollen and may produce extra mucus. This can cause difficulty breathing, coughing, wheezing and shortness of breath. It cannot be cured but the symptoms can be minimized to an extent

Exposure to various irritants and substances that cause allergies (allergens) can trigger asthma symptoms. Respiratory tract infections such as the common cold, Physical activity, If the weather is cold. Air which contain high amount of is a pollutant and a nuisance like smoke play an important role in asthma occurrence. Having any blood relative with the history of Asthma can be considered a risk factor for the occurrence of asthma in most patients. Smoking and secondary exposure are some of the other contributing factors in Asthma occurrence.

Steroid medications, also known as corticosteroids, are most often prescribed to treat the condition of asthma. Steroids are effective in reducing asthma symptoms in many people. Additionally, some steroid prescriptions can cause serious side effects. Steroids treats inflammation in two ways. It prevents body from producing more inflammatory chemicals and stimulates it to produce more of the anti-inflammatory chemicals. Our body has the inbuilt ability to assemble its own required steroids but steroid medications contain chemicals that have the potential to bind more effectively to the cell receptors.

It can not be used to treat asthma attacks when they occur, but can prevent any further future attacks. In most of the cases, longer the steroids are been used, more likely there is a need on a rescue inhaler.

KEYWORDS- Asthma, Corticosteroids, Inhalers, Rescue Inhalers, Inflammatory Chemicals

I. INTRODUCTION

Asthma is one of the most common respiratory disorders that is prevalent in India. Despite significant improvements in the diagnosis and treatment of the disorder, the majority of people in India with asthma remain poorly controlled. However, control can be achieved in most patients with preventive measures and appropriate pharmacological interventions. Inhaled corticosteroids (ICS) represent the standard of care for most patients^{[1][2]}. Combination ICS inhalers/long-acting beta2-agonists are preferred for most adults who fail to achieve control with ICS therapy. Currently, new products have recently been added to the treatment of asthma, such as biologics targeting immunoglobulin E or interleukin-5^{[3][4]}.

There are two phases of asthma exacerbation which include early phase and late phase. The first phase is always started by IgE antibodies that have been sensitized and released by the plasma cells. These antibodies act when they interact with some of the triggering factors in the environment. IgE antibodies then bind to mast cells and basophils with high affinity. When a pollutant or risk factor is inhaled, mast cells release cytokines and eventually degranulate. Histamine, prostaglandins and leukotrienes are released from mast cells^{[5][6]}. These cells in turn contract smooth muscle and cause the airways to constrict. Th2 lymphocytes play an integral role where they produce a number of interleukins (IL-4, IL-5, IL-13) and GM-CSF that help communicate with other cells and maintain inflammation. IL-3 and IL-5 help eosinophils and basophils survive^{[7][8]}.

Inhaled corticosteroids (ICS) are one of the most commonly prescribed and used treatment methods in the prevention of asthma exacerbations in most patients with persistent asthma. Persistent asthma condition is classified by the symptoms which has been lasting more than two days a week

with more than three nighttime awakenings per month and more than twice a week using short-acting beta-2 agonists to control symptoms, or with any limitation of normal status. daily activities due to exacerbations of asthma symptoms^{[9][10]}. Regular use of these drugs reduces the frequency of asthma symptoms, bronchial hyperreactivity, the risk of severe exacerbations and improves the patient's quality of life^[11]. These medications are started gradually based on the frequency and severity of asthma symptoms. Low, moderate, and high doses of inhaled corticosteroids are available for the treatment of mild, moderate, and severe and persistent asthma^{[12][13]}.

It takes more weeks to observe the results from the inhaled steroids. It cannot be used to treat asthma attacks when they occur, but it can prevent future attacks^[14]. In most cases, the longer steroids are used, the more likely it is to rely on a rescue inhaler. Inhaled steroids are corticosteroids. It is mostly similar to cortisol, a hormone that is naturally produced in the body. Every morning, the adrenal glands in the body release cortisol into the bloodstream, which provides energy for daily tasks^[15].

Epidemiology of Asthma in Indian Scenario

In the Indian Study on the Epidemiology of Asthma, Respiratory Symptoms and conditions of Chronic Bronchitis in Adults estimated the national burden of asthma at 17.23 million with an overall prevalence of 2.05%. A recent Global Burden of Disease (GBD, 1990–2019) study estimated the total burden of asthma in India at 34.3 million, representing 13.09% of the global burden. It also attributes that there were 13.2 per thousand deaths due to asthma in India. Asthma accounted for 27.9% of disability-adjusted life years (DALYs) in the Indian population. Overall, India has three times the mortality and more than twice the DALYs compared to the global share of asthma burden^{[16][17]}. Disproportionate mortality and morbidity can be explained by global studies with uniform methodology^{[18][19]}.

Over the past two decades, India has seen changes in its economy, industrialization, air pollution levels, and environmental and socio-cultural factors. Apart from the ISAAC studies, no other global multicenter studies have been conducted to analyze the impact of these changes on asthma prevalence and severity. The ISAAC study group was resurrected in 2012 as the Global Asthma Network (GAN) to estimate the current prevalence of asthma and allergy symptoms.^{[20][21]}

Inhaler Therapy used in Asthma

Inhalation therapy is the cornerstone of asthma treatment, and direct delivery of medication to the lungs allows for optimal efficacy and safety. However, up to 94% of patients with asthma and COPD do not use their inhalers correctly and require several educations to maintain their technique^{[22][23]}.

Pressurized metered-dose inhalers (pMDIs) are the most commonly prescribed devices, but their proper use requires simultaneous activation of the device and inhalation, which is a challenge for many patients. In addition to the coordination, geriatric patients and those with osteoarthritis or weak hands will not have the grip strength or ability needed to trigger the inhaler. Although dry powder inhalers (DPIs) are breath-activated and do not require the same coordination as MDIs, more than 90% of patients fail to demonstrate proper DPI inhalation technique^{[24][25][26]}. Activating the DPI device is problematic for children, the elderly, and extremely dyspnoeic patients, who may not be able to inhale quickly and forcefully enough to activate the device. Breathing patients may also not be able to maintain the 10 second breath hold recommended immediately after inhalation^{[27][28]}. Poor inhalation technique can also cause confusion if patients use more than one type of inhaler. Considering all these factors, patients with slow inspiratory flow (ie, flow limitation) may be very suitable for pMDI if they can coordinate manual and respiratory maneuvers; whereas patients who can achieve adequate inspiratory flow but have coordination problems may be better suited for DPI^[29].

In addition to patient concerns, other factors that contribute to poor inhalation technique include a lack of proper inhaler technique for healthcare workers and patient demand for inhalers. There is considerable misunderstanding by primary health care providers about the appropriate use of MDIs. Pharmacists, who are the "last port of call" before patients attempt self-administration, may have poor theoretical and practical knowledge of inhaler devices. Consequently, a shared decision-making model based on patient preferences would be an ideal strategy to promote appropriate inhaler use, with healthcare professional education and physician prescribing decisions^[30].

There are a variety of medications and inhaler combinations available to manage asthma and COPD, increasing the chances of finding the right option for each patient. Inhaler devices vary depending on how the inhaler delivers the drug, whether the treatment is passive or active (eg, using

a nebulizer, mechanical or compressed air), and the form of drug formulation (eg, liquid, dry powder, or ok. mist), whether the inhaler contains single or multi-dose medication, and whether the device is disposable or refillable. Each inhaler device has unique design features, which means it can be selected to meet the specific needs of the patient^[31]^[32]^[33].

However, these factors also depend on whether the patient knows how to use the device and has sufficient education and support to continue using it. This is often exacerbated by patients being given multiple devices that work in different ways^[34]^[35]. The use of multiple inhalers requiring different breathing patterns has been shown to adversely affect clinical outcomes in patients with COPD and asthma. Patients who believe that inhaler use is an important part of asthma management report higher rates of inhaler use. However, it is known that in addition to understanding the patient's need to use an inhaler to control the disease, the patient must be educated about the need for proper use^[36]^[37].

The Role of Corticosteroid Inhalers in Asthma

Inhaled corticosteroids (ICS) is an FDA-approved treatment for asthma prevention in chronic asthma patients. Persistent asthma is categorized by symptoms occurring more than two days per week, waking up more than three nights per month, using short-acting beta-2 agonists to control symptoms, or restricting normal activity due to asthma more than twice a week. Regular use of this medication reduces the frequency of asthma symptoms, bronchial sensitivity, reduces the risk of serious complications, and improves the quality of life. This treatment is started gradually, depending on the frequency and severity of asthma symptoms. Low-, moderate-, and high-dose inhaled corticosteroids are available for the treatment of mild, moderate, and severe chronic asthma, respectively^[38]^[39]^[40].

If inhaled corticosteroids alone are not enough to control the patient's asthma symptoms, other control medications such as long-acting beta-agonists or leukotriene receptor antagonists can be started. Asthma control medications are used in combination with short-acting beta-agonists such as albuterol as part of an asthma regimen to manage both acute and chronic symptoms^[41]^[42].

Inhaled corticosteroids have potent glucocorticoid activity and work at the cellular level to restore capillary permeability and stabilize lysosomes to reduce inflammation. The onset of action is gradual and may take days to weeks to

achieve maximum benefits with consistent use. Metabolism occurs through the liver with an elimination half-life of up to 24 hours^[43].

These drugs are administered directly to the site of action through the inhalation route. This method of administration bypasses the first-pass metabolism of oral drugs, reducing the dose required for the desired effect. Reduced systemic bioavailability also reduces side effects. Inhaled corticosteroids come in liquid capsule formulations delivered through nebulizer machines, metered dose inhalers, and dry powder inhalers (DPIs)^[44]^[45].

Most of the Inhaled steroids comes in three forms: the hydrofluoroalkane inhaler or HFA (mostly called as the metered dose inhaler or MDI), dry powder inhaler (DPI), and soft mist inhalers.

Nebulizer

Advantages: Coordination with the patient is not essentially required, high doses can be given without any issues

Disadvantages: More expensive, time consuming (10 to 15 minutes per dose), can cause contamination of the nebulization apparatus.^[46]

Metered Dose Inhalers (MDI)

Advantages: Less costly when compared to nebulizers, more convenient, faster to use, has a dose counter with it.

Disadvantages: Coordination is required if not using a mask, pharyngeal deposition may occur, more difficult to deliver high doses

Dry Powder Inhaler (DPI)

Advantages: Portable, have a dose counter, less coordination is required when compared to MDI

Disadvantages: Requires higher inspiratory flow to use it effectively, pharyngeal deposition of medication can occur, cannot use in mechanically vented patients^[47]^[48]

Some of the Corticosteroids used in Inhaler therapy include;

- Beclomethasone dipropionate
- Budesonide
- Budesonide/formoterol, it's a combination drug which includes a steroid and a long-acting bronchodilator drug
- Fluticasone
- Fluticasone as an inhalation powder
- Fluticasone/Salmeterol, which is a combination drug that include a steroid based drug and a long-acting bronchodilator.

- Fluticasone/umeclidinium/vilanterol, it's a combination drug that usually includes a steroid and two long-acting bronchodilators
- Mometasone
- Mometasone/formoterol, its a combination drug that includes a long-acting bronchodilator drug

Advantages of using corticosteroid inhaler;

- Reduce the frequency of symptoms
- Slow lung damage
- Improve the quality of life
- Result in fewer hospital admissions
- Reduce the risk of dying from asthma

Disadvantages of using a corticosteroid inhaler;

- Hoarseness: Some individuals who are using the corticosteroid inhalers may develop a hoarse voice.
- Using continuously the corticosteroid inhalers may have a Potential Impact on the growth in Children
- Some individuals who are on corticosteroid inhaler therapy may experience weight gain due to an increase in appetite while taking inhaled corticosteroids.
- Long term risk may occur such as osteoporosis, Pneumonia, Suppression of HPA Axis[49][50]

The most widely seen adverse effects of the inhaled corticosteroids are dysphonia, oral candidiasis, and bronchospasm. The above mentioned adverse effects are less common in case of using low-dose inhaled corticosteroids but seen most commonly when using along with high-dose inhaled corticosteroids. When using high dose of Inhaled Corticosteroids it can be associated with an increased risk of bone fracture. Most of the adult patients on chronic Inhaled corticosteroid therapy should mostly undergo bone density measurement once every six months if possible^{[51][52]}.

SIGNIFICANCE:

Corticosteroid Inhalers are selected as one of the most effective standard treatment regimen for asthma in majority of hospitals. This review is conducted so as to point out the effectiveness and benefits of including Corticosteroid Inhalers as treatment option for asthma with all the available evidence of various studies.

II. CONCLUSION:

Steroid Inhalers has an enormous role in the treatment of Asthmatic conditions. Our body has

the inbuilt ability to assemble its own required steroids but steroid medications contain chemicals that have the potential to bind more effectively to the cell receptors. It is a safe, economic and clinically proven drug. Corticosteroids, mostly the Inhaled Corticosteroids the most studied and used drug group and it has proved its efficacy in treating mild to severe Asthmatic Conditions.

Corticosteroids play an important role in the treatment of acute asthma exacerbations. Further research is greatly needed to shed more light on the use of ICS in the patients, their optimal dose and duration, as well as their concomitant use with systemic corticosteroids. In addition, more research is needed on the safety of dispensing oral corticosteroids for home use in case of asthma exacerbation.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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