

A Review on Pollen Allergic Rhinitis

¹ Bhargavi. S, ¹Ednil Picardo, ²Dharani. V, ³Shobha Rani R.H,

¹Pharm D student, Aditya Bangalore Institute of Pharmacy Education and Research, Bangalore, India.

²Assistant Professor, Aditya Bangalore Institute of Pharmacy Education and Research, Bangalore, India.

³Professor and Director, Aditya Bangalore Institute of Pharmacy Education and Research, Bangalore, India.

Abstract: Seasonal hypersensitivity of many people is commonly caused by pollen, which is released by 100 different kinds of plants for fertilization. In India, between 10% to 40% of the population suffers from pollen allergies, one of the most common outdoor allergens. Pollen must produce allergens for humans to become sensitised and experience allergy symptoms. The complex pathophysiology of pollen allergic rhinitis includes both early- and late-phase allergic reactions. Genetic, environmental, lifestyle, occupational, and other concomitant variables are risk factors. Pollen allergy rhinitis has been categorised on its own by ARIA (Allergic Rhinitis and its Impact on Asthma) as intermittent, moderate, or severe, and mild or persistent. The physical examination, skin prick test, and serum IgE are used to make the diagnosis. Both pharmacological therapy and non-pharmacological therapy (patient education) are provided. Pharmacological therapy includes antihistamines, decongestants, corticosteroids, leukotriene inhibitors, immunotherapy—allergic shots and sublingual tablets. Pharmacological therapy is administered by a treatment strategy based on the severity of the symptoms.

Index Terms : ARIA, Pollen allergic rhinitis, immunotherapy, patient education.

The word pollen is derived from Greek word meaning “fine flour”, pollen grain's helps in plant reproduction to fertilise the female flower. The wind, birds, insects, and other animals carry pollen (a fine yellowish powder) from plant to plant but can be miserable for those who suffer from seasonal allergies.[1]

Between 20% and 30% of India's population is affected by allergic illnesses, which have been steadily rising over the past few decades. One of the most prevalent outdoor allergens in India is pollen allergy, which affects 10% to 40% of the population [2] [3], *Parthenium*, *Amaranthus Spinousus*, *Prosopis Juliform*, *Ricinus Communis*, and *castor oil* plant are the pollens responsible for 20% of the allergies in Bangalore. These could result in respiratory issues.

- The most prevalent pollen allergy, grass pollen is most active in the summer and results in some of the most severe and challenging-to-treat symptoms. (June/July)
- Ragweed plants are infamous for being the most prevalent weed pollen allergies, and they are most active from late spring to early autumn. Other typical weed pollen allergies include tumbleweed and sagebrush.
- Birch pollen allergy: During the spring, birch pollen is one of the main triggers of pollen allergies. Up to 5 million pollen grains can be released into the atmosphere by a single birch tree.
- Allergies to tree pollen can also be brought on by oak and cedar trees. (April/March) [9]

How its spreads??

For sensitization and the elicitation of allergy symptoms in humans, allergen release from pollen is a requirement. It has been proposed that pollen grains enter an organism through two different routes: first, when they are outside the body and travelling through the atmosphere, and second, when they come into

contact with the upper respiratory tract's mucosal surface. [5, 10] Pollen and plant/pollen-derived paucimicronic (less than 1 micron) and submicronic (less than 10 micron) aero allergenic particles are examples. Starch granules and polysaccharide [4] particles, which may not be present in mature pollen, are the principal components of these particles, which can reach the lower airways and cause allergic symptoms in those who are vulnerable.

The pollen grains of anemophilous plants, such as trees, grasses, and weeds, are the most significant outdoor sources of allergies. Wind-pollinated [6,9] plants have developed distinctive traits, such as little dehydrated pollen with strong aerodynamic qualities that allow distribution over hundreds of km, to improve the likelihood of fertilisation.

Depending on plant species, changing climatic conditions, maturity stage, and environmental influences [4,7] (pollution), allergens in pollen may or may not be present, and their expression levels may also vary.[5] Since of climatic variations, it is crucial to make observations on diurnal and seasonal prevalence since the knowledge gained from doing so can be used to treat individuals with hay fever.

According to numerous experimental and epidemiologic investigations, aeroallergens, particularly plant allergens, are affected by climate change. Climate Change and Allergic Diseases: Climate change interacts with rising atmospheric CO2 concentrations [4] to promote plant growth, which in turn results in increased pollen production, affecting anther dehiscence and pollen dispersal and transport, accelerating the start and duration of the pollen season, and promoting the emergence of new pollen species in new areas that are not endemic to the specific area. Under changing climatic conditions, the onset, duration, and intensity of pollination, the fruiting patterns and sporulation of fungi, the allergen content and allergenicity of pollen grains, fungal spores [8], and other bio particulates change.22,36,93 It has been reported that global warming has boosted atmospheric CO2. [33]

Pathophysiology:

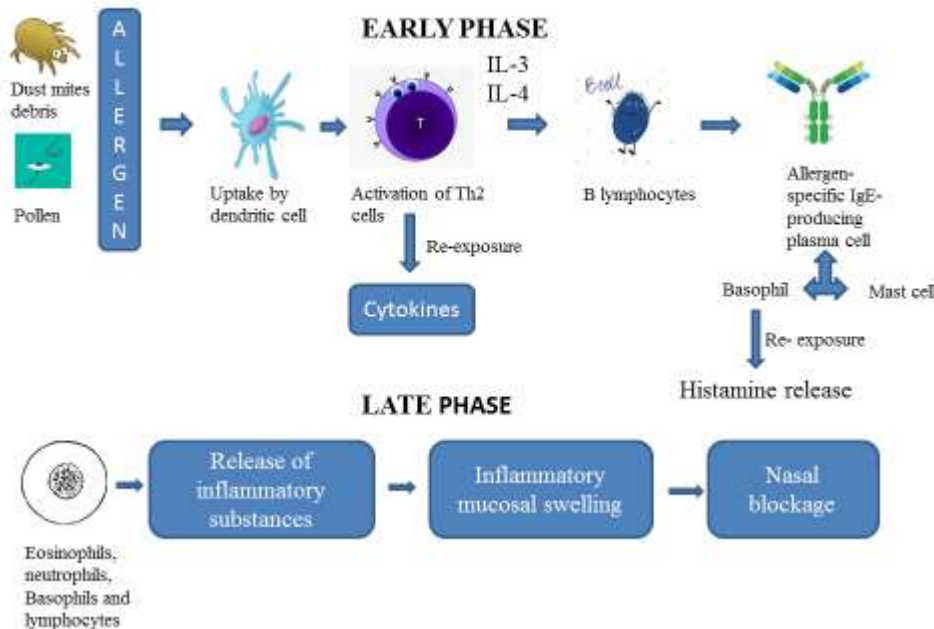


Fig1.1- Showing the pathogenesis of pollen Allergic Rhinitis.

Early- and late-phase allergy responses are both a part of the complicated pathophysiology of AR [11]. Exposure to allergens, such as pollen, mites, and/or animal dander that are identified by antigen-specific mast cells and basophil immunoglobulin E (IgE) receptors in predisposed individuals sets off the process. Mast cell degranulation is a hallmark of the early-phase reaction (Fig. 1). The quick start (over a few minutes) of acute nasal symptoms, such as sneezing and rhinorrhea, [20]as well as the appearance of ocular symptoms, such as itching, redness, and watering, are all characteristics of this phase. Histamine release, mainly from mast cells in the nasal mucosa, is mainly cause these symptoms.

Along with the actions of other potent pro-inflammatory cytokines (like leukotrienes) and eicosanoids (including prostaglandins and kinins) [12], this early-phase histamine release also increases vascular permeability, which results in the formation of oedema. After exposure to an allergen, the late-phase reaction takes many hours to manifest. Cellular recruitment of basophils, neutrophils, T-lymphocytes, monocytes, and eosinophils [19] as well as the production of many mediators, such as cytokines, prostaglandins, and leukotrienes, which support the inflammatory response, are its defining characteristics.

Nasal congestion, which patients regard to be one of the most bothersome symptoms of AR, develops and persists as a result of this late-phase inflammatory reaction, together with additional tissue oedema and tissue remodelling [12, 13]. Mucosal inflammation causes tissues to become primed and respond to allergen exposure more forcefully. Bronchial hyper responsiveness is a result of these late-phase responses and changes in tissue responsiveness. Impact of pathophysiology on AR symptoms and disease burden in humans Patients' QoL and daily functioning may be negatively impacted by nasal and ocular AR symptoms, which are linked to both early and late responses [14]. Patients with AR may experience fatigue, misery, and irritability at least occasionally when allergy symptoms are at their worst, which occurs on a nearly daily basis [17].

Even more so than nasal obstruction and pruritus, the duration and intensity of ocular symptoms such itchy and watery eyes, oedema of the eyelids, and asthenia have a significant negative influence on quality of life. The characteristic of an allergic reaction is nasal congestion. Sleep-disordered breathing is linked to this symptom, which can have a significant impact on productivity and lead to more daytime sleepiness [15]. In more than 80% of AR and NAR patients, nasal obstruction is connected to poor sleep quality. Up to 45% of children with nasal allergies experience sleep disruption, poor academic and work performance [18] due to symptoms, whilst one in four adult patients report being unable to fall asleep or being disturbed during the night [16]. Additionally, a number of the important pathophysiological agents that trigger AR responses, such as histamine, leukotrienes, cytokines, and prostaglandins, are involved in the regulation of sleep and may be directly responsible for this aspect of the illness, separate from nasal obstruction. [17]

RISK FACTORS:

The risk of getting hay fever can rise if any of the following occur:

- Having asthma or additional allergies [32]
- Having an inflammatory and itchy skin condition called atopic dermatitis or eczema. [35]
- Having a blood relative who suffers from allergies or asthma, such as parents or siblings. [21,19]
- Working or living in an environment where allergens are present all the time. [21,23 ,19]
- Being around smoke and other smells that aggravate the nose's lining [19, 28]

SYMPTOMS:

- Pollen can make asthma symptoms worse, such as
- Worsening coughing and wheezing.
- Runny nose, sneezing, and nasal stuffiness (congestion).[48]
- Eyes, throat, and nose itch.
- Migraines, nasal pain, and bags under the eyes
- Increase in mucus in the throat and nose
- Malaise and fatigue (a general uneasy sensation).
- Post-nasal drip-related sore throat caused by mucus in the throat. [37]

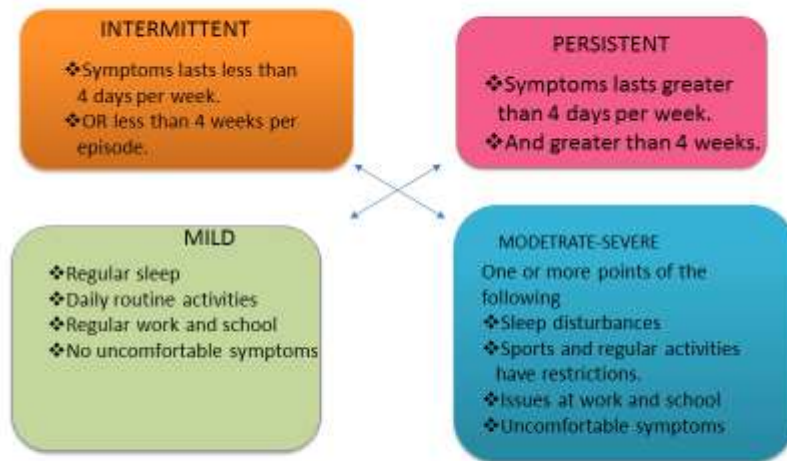


Fig1.2- Showing the classification regarding the severity symptoms of Allergic Rhinitis based on ARIA

Complication:

Reduced quality of life, Sleep apnea, worsening asthma, sinusitis, ear infection, hearing impairment, anaphylaxis. [24,25,35]

Comorbidities of pollen allergy are bronchial asthma, atopic dermatitis, allergic conjunctivitis, sinusitis, and urticaria. [26,36,49]

Diagnosis:

- Skin prick test:

The most crucial method for identifying trigger allergens is skin testing [27]. There are several testing techniques, including patch, prick, and intradermal tests. Skin testing also have certain drawbacks. Some medications, notably antihistamines, patients’ ages, and test locations can affect this test. Skin tests are challenging to perform on patients who have dermatological conditions. [29] The wheal-and-flare reaction on the skin test location after 20 minutes of allergen contact is considered a positive result for skin tests. A wheal is a red, painful raised lump with surrounding inflammation that shows the presence of allergic antibodies.[28]

- Serum IgE

Despite being the first technique to identify serum-specific IgE,[28] the radioallergosorbent test (RAST) has not been extensively adopted due to the need for a radioactive isotope, expensive equipment, and the inability to identify numerous antibodies at once. The multiple allergen simultaneous test (MAST) is the following technique. The MAST has been utilised widely because it offers several advantages over the RAST. The MAST does not need expensive equipment, can concurrently identify many allergens, and does not involve radioactive isotopes. This test is less intrusive, can be used on people with demographics, and is unaffected by medications like antihistamines. Low sensitivity of the MAST in comparison to the skin prick test is one issue.[29]

TREATMENT

1) **Antihistamines:** Prescription and over-the-counter antihistamine medicines are both available. They function by preventing the histamine from being released during an allergic reaction. Pills, liquids, eye drops, nasal sprays, and inhalers are all forms of antihistamines. They consist of cetirizine (Zyrtec®), loratadine (Claritin®), Levocetirizine (Xyzal®) and fexofenadine (Allegra®). Antihistamines may make you feel sleepy. [28]

2) **Decongestants:** These drugs help to clear sinus and nasal congestion. They can be ingested orally (as pills or liquids) or topically (as a nasal spray). Among them is Afrin® nasal spray. Examples; Neo-Synephrine®, a phenylephrine nasal spray, Sudafed (pseudoephedrine).

Decongestants can raise blood pressure, bring on headaches, make it difficult to fall asleep, and make you irritable. Using nasal decongestants for more than five days may make you dependent on them. [28]

3) **Corticosteroid nasal sprays and inhalers:** [31] These products lessen swelling and treat hay fever symptoms. The three most popular nasal sprays are Rhinocort®, Nasacort®, and Flonase®. Headaches, nasal irritability, nosebleeds, and cough are a few of the side effects.

4) **Leukotriene inhibitors:** When the body has an allergic reaction, leukotriene, histamines, and other chemicals are released, which lead to inflammation and hay fever symptoms. Montelukast (Singulair®), the most popular leukotriene inhibitor, is used. They go through mood swings, strange nightmares, uncontrollable muscle movements, and skin rashes. [48]

5) **Immunotherapy:** This therapy helps the body develop a tolerance to allergens. [30] Every time, an allergen-containing shot is administered in a series of injections. The level of the allergen will increase after receiving an injection. Immune system eventually becomes immune to the allergen and ceases reacting to it. [32]

- ❖ **Allergy shots:** A treatment plan that lasts for three to five years often entails repeated injections of diluted allergy extract at escalating concentrations until a maintenance dose is established. The injection schedule is then adjusted so that the same dose is administered with longer gaps between doses. Immunotherapy reduces the severity of symptoms brought on by allergen exposure, helps the body develop tolerance to its effects, and occasionally even stops skin test reactions. Symptoms should become better over the course of many months as tolerance builds. [39]
- ❖ **Sublingual tablets:** In 2014, the Food and Drug Administration approved this kind of immunotherapy. Patients dissolving a tablet under the tongue every day beginning many months before the start of allergy season. Year-round care is beneficial for some people. Up to three years may pass between treatments. Only a small number of allergens, including some grass and ragweed pollens as well as home dust mites, can be addressed. [39]

Patient education

Outdoor environment

- Remain indoors as much as you can while pollen counts are at their highest, typically in the middle of the day and early evening (this can change depending on the type of plant pollen), and when the wind is moving pollen around.
- Refrain from using window fans, which can bring mould and pollen into the home.
- When outdoors, put on eyewear or sunglasses to reduce the quantity of pollen that gets into your eyes.
- Pollen may stick to towels and sheets if you hang clothes outside to dry.
- Try to avoid rubbing your eyes, since this can aggravate them and might exacerbate your symptoms.

Indoor Environment

- Use air conditioning in your home and automobile and keep the windows closed. Maintain the cleanliness of your air conditioning system.
- Limit your contact with dust mites, especially in your bedroom. Use "mite-proof" covers for mattresses, box springs, comforters, and duvets. Use hot water that is at least 130 degrees Fahrenheit to frequently wash your bedding.
- Keep your home's humidity low (between 30 and 50 percent) and routinely clean the kitchen, basement, and bathrooms to reduce your exposure to mould. Use a dehumidifier, especially in moist, humid areas like the basement, and make sure to empty and clean it frequently. If mould is present, clean it as advised by an allergist using mild detergent and a 5 percent bleach solution.
- Instead of sweeping or dry-dusting, clean the floors with a moist rag or mop.

Pet exposure

- After stroking any animal, wash your hands right away and wash your clothes.
- If you have an allergy to a household pet, try to limit the time the animal spends inside your home. If you must have the pet indoors, keep it out of your bedroom to protect yourself from pet allergens while you sleep.
- If you have forced air or central heating or cooling, close the air ducts to your bedroom. Replace carpets with linoleum, hardwood, or tile, all of which are simpler to keep dander-free.[39]

STUDY OF POLLEN ALLERGY IN DIFFERENT STATES OF INDIA

- According to a study by Shyna K. P. Et al. (2018), a total of 60 children under 15 years old with allergic rhinitis and pollen allergies were examined; 36 boys (60%) and 24 girls (40%) revealed 10% parthenium were impacted.[40]
- C.D.S. Katoch et al (2022) conducted a study among 327 cases 149(45.56%) were Males, and 178(54.44%) were women. 17 cases (5.2%) had antipathetic rhinitis, 129 cases (39.45%) had bronchial asthma & 181 cases (55.35%) had both antipathetic rhinitis and bronchial asthma. 26.30% cynodon dactylon showed high prevalence of pollen mislike.[41]
- Bharati Chogtu et al (2017) reported a study that Out of 2219 cases, 1193(53.8%) were males and 1026(46.2%) ladies and 20.57 % showed lawn and tree pollen mislike. The perceptivity of *prosapis* 29.80% was seen in maximum number.[42]
- In research by Roohi Rasool et al. (2013), they found that out of 38 cases, 20 (or 54%) tested positive for pollens, with *Parthenium hysterophorus* accounting for 36% of those results, *Amaranthus spinosus* for 32%, and *Cyanodon dactylon* for 24%. 37 (4.48%) of the 108 Antipathetic rhinitis cases tested positive for pollens, while 74 (68.5%) of the cases did so for a common allergen panel. Additionally, only 4 (1.6%) of 248 cases of urticaria had a good response. Two (or 50%) of the four instances that tested positive for SPT were to the pollens of *Parthenium hysterophorus*.[43]
- Prasad, et al (2009) reported study that Out of 48 cases, 28 were males and 20 were ladies. Among them 7.8% pollen allergen shows lesser prevalence of *Amaranthus spinosus*, *Argemone Mexicana*, *Adhatoda vasica*, *Ailanthus excelsa*, *Cannabis sativa*.[44]

- Anand Patel et al (2012) conducted a study that aggregate of 24 cases were included, amongst pollen group of allergen, utmost predominant allergens were *Cassia Siamea* %29.17 followed by *Morus Alba* %25 and *Ricinus Communis* % 25. [45]
- In a study by Dabarati Dey et al. (2019), 605 cases—319 men and 286 women—were combined. Among the pollen, *Cocos*%73.28 and *Azardidacta*%57.25 displayed the highest levels of sensitization in terms of positive skin responses. [46]
- In a study by Anuradha B et al (2006), they found that out of 500 instances, 46.5 percent were atopic asthma cases, 10.5 percent were non-atopic asthma cases, 31.8 percent of atopic urticaria cases, and 13 percent of non-atopic urticaria cases had positive family histories, but none of the cases with rhinitis/urticaria did. *Sorghum vulgare* (%54.9 &%64.7), *Pennisetum typhoides* (%53.1 &%56.7), and *Artemisia scoparia* (%48.1 &%51.9) were the three most common pollen allergens in cases of asthma and urticaria. [47]

CONCLUSION

The characteristic of pollen induced allergic rhinitis is an invasion of many cell types with an inflammatory response. These events occur in people who have a history of allergy sensitivity because IgE antibodies that are specific for the allergen have grown and are linked to mast cells and other cell membranes. *Parthenium hysterophorus*, *Cynodon dactylon prosapis*, *Amaranthus spinosus*, *Argemone Mexicana*, *Adhatoda vasica*, *Ailanthus excelsa*, *Cannabis sativa*, *Cassia Siamea*, *Morus Alba*, *Ricinus Communis*, *Cocos*, *Azardidacta*, *Sorghum vulgare*, *Pennisetum typhoides* and *Artemisia scoparia* are the major pollen allergens which are seen in India. Due to significant seasonal pollen exposure, which will be affected by regional environmental and climatic factors, pollen –induced AR (PiAR) prevalence in the analysed region is extraordinarily high. Patients exhibit nasal symptoms associated with both perennial and seasonal allergies, but are only allergic to seasonal allergies. The quality of life and academic performance of children who have pollen allergic rhinitis and other allergic co-morbidities are significantly impacted. Correct diagnosis techniques and precise treatment are important [49]. The primary treatments for the condition are inhaled corticosteroids and second-generation oral antihistamines. To prevent rhinitis medicamentosa, prolonged use of nasal decongestants should be avoided. Avoiding allergens is still the cornerstone of the treatment [48]. Further research may lead to well-targeted medicines, which in turn will provide superior symptom alleviation, regulate associated comorbidities and reduce economic burden due to this widely prevalent ailment. [50]

The role of clinical pharmacist is to educate the patient on pollen allergic rhinitis.

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