



Letter to the Editor

POLLEN ALLERGY AND THE CNS

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INTRODUCTION

The immune system defends the body from foreign substances (antigens). In atopic individuals, the immune system can overreact to exposure to certain substances such as allergens present in the environment (especially in spring) or in foods or in drugs, which are normally harmless to most people. In atopic subjects, antigens bind to their receptors and cause an allergic reaction. Allergens are molecules that can be identified by the immune system and stimulate an immune response. Some people are allergic to only one substance, while others are allergic to many. Today, about a third of the US population suffers from allergy. Pollen can cause an allergic reaction once in contact with the eyes or if inhaled. Allergies cause the production of inflammatory cytokines and chemokines in the nose and sinuses, which enter the bloodstream and can affect many organs, including the central nervous system (CNS) (1). The allergic phenomenon causes the release of inflammatory mediators that play a role in the activation of sensory nerves that produces psychological effects (2).

DISCUSSION

Inflammatory mediators act on endothelial cells causing vasodilation and increased vascular permeability with exudation of plasma exudate. These reactions can cause headaches, mood changes, fever, and tiredness. Antihistamine medications are a standard treatment to relieve seasonal allergies. If therapy with antihistamines does not produce any effect, an alternative may be the use of specific immunotherapy with a vaccine. However, the new antihistamine drugs, called second generation, do not cause effects on the mechanism of action of acetylcholine, which is released on parasympathetic nerve fibers. Some of these fibers are sympathetic and innervate the sweat glands, adrenal glands, and vasodilatory fibers (3). Interestingly, it appears that individuals who suffer from severe allergies also appear to have higher rates of anxiety and depression.

The myriad of pollen that is produced in the spring season can be excruciating for atopic individuals, i.e., those who are predisposed to the allergic phenomenon (Table I). Allergy is essentially an exaggerated reaction of the immune system and is due to specific activators called allergens, including pollen. In the case of the common spring allergy, pollen is the classic allergen. Pollen includes a set of male genetic information that is released into the air by plants, to be delivered to the female organs of other plants.

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Table I. *Primary symptoms presenting in allergy.*

• Itchy eyes	• Runny nose
• Watery or red eyes	• Sneezing
• Stuffy and irritated nose	• Sore or swollen throat
• Cough	• Chest tightness
• Wheezing	

Thankfully, a new drug is due to be released on the market which is capable of combating allergy that afflicts approximately 8% of men and 12% of women. Researchers have found markers close to a gene located on chromosome 5 which is closely involved with allergy. The gene almost encodes a protein belonging to the cytokine family called interleukin-4 (IL-4), which is responsible for the production of IgE-type antibodies produced by immune cells, B lymphocytes, and plasma cells. Since this gene is fundamental for allergic induction, blocking it and inhibiting IL-4 could provide great benefits by utilizing a mechanism that is different from all other drugs that are currently available to treat allergy (4). However, blocking IL-4 can inhibit the production of all antibodies, which are important for B cell reactions.

Recently at the congress of the American Academy of Allergy and Immunology, some scientists described a new type of engineered vaccine against allergies in animal experiments, which, with some modifications, could also be valid for humans (5). Unlike antiviral vaccines or those against bacterial infection that stimulate the body's immune response, this vaccine works by helping only the immune organs to be more tolerant and less reactive.

In recent research, some scholars have used genetically modified mice lacking the receptor for the IgE antibodies that trigger allergy. The receptor is nothing more than a specific protein capable of binding, in this case, the IgE antibody. By blocking or eliminating the receptor, for example with a drug, the allergic phenomenon does not occur, even after stimulation of the cell.

In recent biotechnological research, molecules are being tested that do not allow the formation of IgE antibodies and this would also help against allergies. Other researchers have highlighted that mast cells (MCs), which release the molecules responsible for allergic symptoms, can be induced to commit suicide or apoptosis. If these cells lack growth factors such as interleukin-3 (which are responsible for the maturation of MCs) the allergic phenomenon is inhibited. This suggests that proteins responsible for MC growth are fundamental for the development of allergy. Studies on these issues are currently underway and the scientific community will certainly take advantage of this research for the treatment of allergies. Most of the drugs available today include the ABC theory: Avoiding allergens, blocking histamine, and correcting immune abnormalities.

Antihistamine drugs can have a moderate antiallergic effect, but they do not solve the problem because histamine mediates the allergic reaction for only approximately 30% of cases. The intake of antihistamines, which can also be sold without a medical prescription, causes drowsiness, difficulty urinating, dryness of the oral system, and dizziness, phenomena which are accentuated with the intake of alcohol and decongestants. Some medications that are not histamine blockers can be helpful in relieving nasal congestion and sneezing, but their side effects may also include insomnia. Many anti-allergic drugs that are available with medical prescription, can also block histamine without drowsiness, but they can cause cardiac arrhythmia in some people.

Doctors recommend using over-the-counter medications such as eyewashes and antihistamines, but some people often need prescription medications such as topical antihistamines that prevent the degranulation of MCs that contain allergic molecules that help mucus form (6). When the allergy is very strong and particularly tedious, steroid drugs such as cortisone are often used, which are administered in the form of nasal sprays, but also by other routes in order to reduce the inflammatory phenomenon.

Recently, some scholars in the USA have recommended that subjects suffering from chronic allergies take steroids and antihistamines also in preventive form, because allergy can often activate or accentuate asthmatic phenomena with narrowing and inflammation of the airways. Historically, long-term treatments have involved a series of graduated injections of allergens to induce tolerance to them, but this method has not given the desired results. Therefore, the use of allergens in graduated doses is falling into disuse and antihistamine and steroid drugs appear to be more effective and better tolerated to combat allergies which reach their peak incidence in spring.

Inflammatory substances that cause allergic reactions may also affect the CNS and are implicated in the development of anxiety and depression, as well as the exacerbation of these conditions that are already present in atopic individuals. For example, allergies and the symptoms that accompany them may lead to elevated levels of the stress hormone cortisol.

Allergy symptoms cause distress for sufferers, interfering with social interactions and the sleep cycle, which can worsen already existing mental health conditions or cause anxiety.

CONCLUSIONS

During allergic reactions, the immune system overreacts to exposure to allergens present in the environment or in foods or in drugs. Allergy affects approximately one third of the US population, and new therapeutic drugs are eagerly awaited to assist in the treatment of this often-seasonal affliction that can also produce negative psychological effects and lead to mood disorders.

Conflict of interest

The author declares that they have no conflict of interest.

REFERENCES

1. Daines SM, Orlandi RR. Inflammatory cytokines in allergy and rhinosinusitis. *Current Opinion in Otolaryngology & Head & Neck Surgery*. 2010;18(3):187-190. doi:<https://doi.org/10.1097/moo.0b013e328338206a>
2. Castellani ML, Galzio RJ, Felaco P, et al. VEGF, substance P and stress, new aspects: a revisited study. *Journal of Biological Regulators & Homeostatic Agents*. 2010;24(3):229-237.
3. González MA, Estes KS. Pharmacokinetic overview of oral second-generation H1 antihistamines. *International journal of clinical pharmacology and therapeutics*. 1998;36(5):292-300.
4. Massey O, Suphioglu C. Recent Advances in the Inhibition of the IL-4 Cytokine Pathway for the Treatment of Allergen-Induced Asthma. *International Journal of Molecular Sciences*. 2021;22(24):13655. doi:<https://doi.org/10.3390/ijms222413655>
5. De Groot AS, Moise L, Terry F, et al. Better Epitope Discovery, Precision Immune Engineering, and Accelerated Vaccine Design Using Immunoinformatics Tools. *Frontiers in Immunology*. 2020;11. doi:<https://doi.org/10.3389/fimmu.2020.00442>
6. Church MK. Allergy, Histamine and Antihistamines. *Handbook of experimental pharmacology*. 2017;241:321-331. doi:10.1007/164_2016_85