REVOLUTIONIZING ALLERGY MANAGEMENT; EXPLORING CUTTING EDGE DEVELOPMENTS AND NOVEL THERAPIES

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***Abstract*- This article delves into the transformative landscape of allergy management, focusing on cutting-edge developments and novel therapies that are reshaping the field. Allergies have long been a global health concern, affecting millions worldwide, and demanding innovative solutions. We explore groundbreaking approaches, including biotechnological advancements, personalized treatments, and precision medicine, which hold the potential to revolutionize how we diagnose, understand, and treat allergies. With these emerging strategies, we glimpse a future where allergy management becomes more effective, patient-centric, and adaptable. This review underscores the vital role of ongoing research and interdisciplinary collaboration in advancing allergy care, promising a brighter outlook for individuals grappling with allergic conditions.**

***Keywords*; allergy,immune system,novel therapy,emergency management.**

INTRODUCTION

Allergies are chronic inflammatory diseases characterized by abnormal immune responses to so-called allergens, which are substances found in the environment. Numerous proteins with different ancestries can operate as allergens in charge of allergic reactions in various settings [1]. The severity of allergy symptoms can range from unpleasant to potentially fatal. According to famous allergy experts [2].The allergic reaction occurs when the immune system is exposed to an antigen that is moderately damaging. Numerous different reactions might result from allergies. Contrarily, immunoglobulin (IgE) antibodies are created in response to even minimal exposure to environmental triggers that do not disturb the majority of people in atopy, a genetic predisposition to illnesses. Every atopic reaction is an allergy as a result [3]. Several chemical allergies, such as those found in dyes, lotions, and scents etc.

A doctor from Vienna named Clemens von Pirquet first used the word "allergy" in 1906 after noticing how sensitive some of his patients were to things like certain meals, pollen, or dust [4]. In the past, a variety of inappropriate inflammatory hyper-immune sensitive reactions were referred to as allergies. The majority of cases were believed to be caused by an overactivation of particular immune system cells that cause inflammation. Later, it was found that the release of inflammatory mediators from particular immune system cells was caused by an allergic IgE-mediated mechanism [5]. In order to distinguish reactions of type I to IV hypersensitivity, Philip Gell and Robin Coombs created a new classification system in 1963 [6,7] that includes immunological elements and the immune process.

MECHANISM OF ALLERGY REACTIONS

The role of the immune system is to protect the body against invading pathogens causing different diseases. When the immune system misidentifies a harmless foreign antigen as a pathogen, an allergic reaction occurs .To protect the organism against exaggerated stimulation signals from harmless antigens, such as environmental and self-antigens, the immune system must be closely monitored. In genetically predisposed individuals, an imbalance in the immune system's regulatory mechanisms may lead to allergic diseases or autoimmune disorders, depending on the nature of the antigen [8].

During an allergic reaction, the immune system must detect pathogenic stimuli and generate a robust immune response. Specific antigen sensitization is required: naive T and B cells identify specific sections of antigens, which are termed epitopes. First, specific MHC (major histocompatibility complex) class II antigens synthesized on the antigen-presenting cells (APC) surface detect allergens and deliver them to naive T lymphocytes. T cell activation causes T helper type 2 (TH2) cells to proliferate and differentiate. Interleukin IL-5, IL-4, and IL-13 and innate (ILC-2) lymphoid cells that can maintain and enhance local TH2 inflammation caused by the secretion of TH2 cytokines (IL-13 and IL-5) are the primary cytokines responsible for the allergic response[9] . These ILs act on B cells, causing them to switch to the Ig class E (IgE). Allergen-specific IgE antibodies bind to high-affinity IgE receptors (FcRI) on basophils and mast cells. Repeated exposure to the allergen causes FcRI-bound IgE to crosslink, boosting the release of other mediators and histamine that generate allergic disease symptoms. Allergen-specific cells are enlarged and reactivated locally after 6–12 h of allergen exposure, culminating in the late phase of an allergic reaction. Effector cells (basophils, mast cells, and eosinophils in particular) release cytokines and inflammatory mediators, prolonging the proinflammatory response[10] . The symptoms of allergic disorders are caused by this phase, and persistent allergen exposure causes the disease to become chronic.

NOVEL THERAPIES FOR ALLERGY TREATMENT

1. Biologics: Proteins that have been designed to target certain molecules implicated in allergic reactions are known as biologic drugs. For instance, the biologic medication Omalizumab binds to and inhibits immunoglobulin E (IgE), a crucial component of allergic reactions[11]. Omalizumab relieves allergic symptoms, especially in severe cases like allergic asthma, by lowering IgE levels, which helps limit the production of histamine and other inflammatory molecules.
2. Gene Therapy: Gene therapy is a cutting-edge method for altering the genes that cause allergic reactions. This could entail employing CRISPR-Cas9 technologies to edit existing genes or adding new genes to alter immune cells. The objective is to alter the immune system's response to allergens permanently, maybe resulting in an allergy cure.[12].
.3.Allergen Immunotherapy: Allergen immunotherapy aims to desensitize the immune system to specific allergens by gradually exposing the patient to increasing amounts of the allergen. While traditional subcutaneous immunotherapy (SCIT) involves injecting allergens under the skin, newer methods like sublingual immunotherapy (SLIT) administer allergens under the tongue, and epicutaneous immunotherapy (EPIT) uses patches to deliver the allergens through the skin. These approaches help the immune system build tolerance over time and reduce the severity of allergic reactions.
4. Treatments based on nanoparticles: Nanoparticles can be designed to carry allergens and transport them to particular immune system cells. The nanoparticles can reduce the allergic reaction by selectively targeting these cells[13]. Additionally, anti-inflammatory medications can be packaged into nanoparticles to provide targeted distribution to injured regions and minimize systemic side effects.
5.microbiota Modulation: Researchers are examining the relationship between allergic diseases and the gut microbiota. Prebiotics, probiotics, or fecal microbial transplants can alter the gut microbiota, which in turn can alter how the immune system reacts to allergens[14]. This line of inquiry has potential for producing ground-breaking allergy medicines.
6.Peptide Immunotherapy: In peptide-based therapies, immunological tolerance is induced by employing particular allergen fragments. The immune system is trained not to overreact to the entire allergen by being exposed to these benign pieces. This technique may significantly minimize allergic responses[15].

7.Blocking Allergen Recognition: Scientists are looking at creating chemicals or antibodies that can stop allergens from tying up with IgE antibodies. Allergic responses brought on by the allergen can be reduced or completely avoided by preventing this interaction.

TRADITIONAL THERAPIES

Different strategies are used in traditional allergy treatments to control symptoms and lessen allergic responses. The following are a few of the most popular conventional allergy treatments:
1.Antihistamines ;These drugs work by inhibiting histamine, a substance that is released during an allergic reaction. They aid in easing symptoms like itching, sneezing, and watery eyes. Cetirizine, loratadine, and diphenhydramine are a few examples.
2.Decongestants ; By constricting blood vessels in the nasal passageways, decongestant medicines can reduce nasal congestion[16]. Oral or nasal sprays are both acceptable. Use nasal spray decongestants sparingly because prolonged use can result in rebound congestion
3. Corticosteroids: These medications reduce inflammation and suppress the immune response. They are available as nasal sprays, inhalers, creams, and oral tablets. Nasal corticosteroids are commonly used for allergic rhinitis, while inhaled or oral corticosteroids are used for more severe allergies.[17].
4. Leukotriene Modifiers: These drugs block the action of leukotrienes, which are chemicals that contribute to allergic reactions. They are often used in asthma treatment but can also help manage allergies.
5. Allergen Immunotherapy (Allergy Shots): This treatment involves exposing the person to gradually increasing doses of the allergen over time. It can help desensitize the immune system and reduce allergic reactions. Allergy shots are typically recommended for severe allergies that don't respond well to other treatments.
6. Saline Nasal Irrigation: This involves rinsing the nasal passages with a saltwater solution to help clear out allergens and reduce congestion.
7. Eye Drops: Antihistamine or decongestant eye drops can help relieve itching and redness caused by allergic conjunctivitis.
8. Steam Inhalation: Inhaling steam can provide temporary relief from nasal congestion and soothe irritated nasal passages.
9. Avoidance: One of the most fundamental approaches is to avoid exposure to allergens that trigger your symptoms. This might involve staying indoors during high pollen seasons, using air purifiers, and taking steps to minimize exposure to dust mites, pet dander, and other allergens.

EMERGENCY MANAGEMENT

Emergency management of allergies, particularly in cases of severe allergic reactions (anaphylaxis), requires prompt and decisive action. Here's a detailed breakdown of the steps to take:
1. Recognize the Symptoms: Be familiar with the symptoms of anaphylaxis, which can include difficulty breathing, swelling of the face and throat, rapid heartbeat, hives, nausea, vomiting, and confusion.
2. Administer Epinephrine: If the person has been prescribed an epinephrine auto-injector (like an EpiPen), use it immediately at the first sign of anaphylaxis[18]. Inject it into the outer thigh muscle and hold it in place for several seconds. Epinephrine helps reverse severe allergic reactions by constricting blood vessels and opening airways.
3. Call 911: Even if the epinephrine seems to be working, call for emergency medical help. Anaphylaxis can quickly worsen, and medical professionals should assess and monitor the person's condition.

4. Lay the Person Down: If they are having trouble breathing, help them lie down on their back. Elevate their legs if possible, as this can improve blood flow.
5. Loosen Clothing: Loosen tight clothing, especially around the neck, to help with breathing.
6. Stay Calm: Keep the person as calm as possible. Anxiety and stress can worsen symptoms.
7. If Conscious, Use Additional Medication: If the person is conscious and can swallow, help them take an oral antihistamine if available, as it can further help control symptoms.
8. Monitor Breathing and Consciousness: Keep a close eye on the person's breathing and level of consciousness. Be prepared to perform CPR if needed.
9. Keep Them Warm: Cover the person with a blanket to keep them warm. Anaphylaxis can lead to a drop in blood pressure, which can make them feel cold[19].
10. Stay with Them: Do not leave the person alone. Offer reassurance and support until medical help arrives.
11. Follow Up: After receiving emergency medical treatment, it's essential for the person to follow up with their healthcare provider to discuss the allergic reaction, determine the cause, and develop an action plan for future episodes[20].

CONCLUSION

In summary, this review article showcases the exciting developments in allergy management, offering hope for improved treatment and quality of life for allergy sufferers. These advances signal a promising future for the field, emphasizing the need for ongoing research and collaboration. We are on the verge of a revolution in how we understand and treat allergies, promising a more precise and patient-centered approach.

REFERENCES:

1. Woodfolk J.A., Commins S.P.Schuyler A.J,Erwin E.A., Platts-Mills T.A. Allergens ,sources,particles, and molecules ; why do we make IgE responses . Allergol.int .2015;64;295-303.doi; 10.1016/j.alit.2015.06.001.
2 . Raychaudhuri, S.P., & Raychaudhuri, S.K. (2009). Biologics: Target-specific treatment of systemic and cutaneous autoimmune diseases. Indian Journal of Dermatology, 54(2), 100–109. doi: 10.4103/0019-5154.53175. PMCID: PMC2807147. PMID: 20101303.
3.Tanno, L.K., Calderon, M.A., Papadopoulos, N.G., Sanchez-Borges, M., Rosenwasser, L.J., Bousquet, J., Pawankar, R., Sisul, J.C., Cepeda, A.M., Li, J., Muraro, A., Fineman, S., Sublett, J.L., Katelaris, C.H., Chang, Y.S., Moon, H.B., Casale, T., & Demoly, P. (2016). Revisiting Desensitization and Allergen Immunotherapy Concepts for the International Classification of Diseases (ICD)-11. Journal of Allergy and Clinical Immunology: In Practice, 4(4), 643-649.
4.Di Felice, G., & Colombo, P. (2017). Nanoparticle–allergen complexes for allergen immunotherapy. International Journal of Nanomedicine, 12, 4493–4504. doi: 10.2147/IJN.S134630. PMCID: PMC5484593. PMID: 28684909. Published online 2017 Jun 19.
5.Paddon, D. (Year not provided). Intranasal corticosteroids in allergic rhinitis. Publisher or Journal Name, Volume(Issue), Page numbers. PMCID: PMC1115725. PMID: 10323829.
6.Clark, S., & Camargo, C.A. Jr. (2005). Emergency management of food allergy: systems perspective. Current Opinion in Allergy and Clinical Immunology, 5(3), 293-298. doi: 10.1097/01.all.0000168797.14487.73.
7.Aldakheel, F.M., & Tchounwou, P.B. (2021). Allergic Diseases: A Comprehensive Review on Risk Factors, Immunological Mechanisms, Link with COVID-19, Potential Treatments, and Role of Allergen Bioinformatics. International Journal of Environmental Research and Public Health, 18(22), 12105. doi: 10.3390/ijerph182212105. PMCID: PMC8622387. PMID: 34831860. Published online 2021 Nov 18.
8.Genuneit, J., Seibold, A.M., Apfelbacher, C.J., Konstantinou, G.N., Koplin, J.J., La Grutta, S., Logan, K., Perkin, M.R., Flohr, C., & The Task Force 'Overview of Systematic Reviews in Allergy Epidemiology (OSRAE)' of the EAACI Interest Group on Epidemiology. (2017). Overview of systematic reviews in allergy epidemiology. Allergy, 72, 849–856. doi: 10.1111/all.13123.
9.Turnbull, J., Adams, H., & Gorard, D. (2015). The diagnosis and management of food allergy and food intolerances. Alimentary Pharmacology & Therapeutics, 41, 3–25. doi: 10.1111/apt.12984.
10.Galli, S.J., Tsai, M., & Piliponsky, A.M. (Year not provided). The development of allergic inflammation. Publisher or Journal Name, Volume(Issue), Page numbers. PMCID: PMC3573758. NIHMSID: NIHMS371252. PMID: 18650915
11.Kay, A. B. (2001). Allergy and allergic diseases. New England Journal of Medicine, 344(1), 30-37.
12.Calzada, D., Baos, S., Cremades, L., & Cardaba, B. (2018). New treatments for allergy: Advances in peptide immunotherapy. Current Medicinal Chemistry, 25, 2215–2232. doi: 10.2174/0929867325666171201114353. .
13.Soyer, O., Akdis, M., Ring, J., Behrendt, H., Crameri, R., Lauener, R., & Akdis, C. (2013). Mechanisms of peripheral tolerance to allergens. Allergy, 68, 161–170. doi: 10.1111/all.12085.
14.Akdis, C.A., & Akdis, M. (2014). Mechanisms of immune tolerance to allergens: Role of IL-10 and Tregs. Journal of Clinical Investigation, 124, 4678–4680. doi: 10.1172/JCI78891.
15.Shamji, M.H., & Durham, S.R. (2017). Mechanisms of allergen immunotherapy for inhaled allergens and predictive biomarkers. Journal of Allergy and Clinical Immunology, 140, 1485–1498. doi: 10.1016/j.jaci.2017.10.010.
16.Sokol CL, Barton GM, Farr AG, Medzhitov R. A mechanism for the initiation of allergen-induced T helper type 2 responses. Nature Immunol. 2008;9:310–318. This paper identifies a key role for basophils in the initiation of TH2-cell responses to exogenous proteases.
17. Edwards A. Allergy Frontiers: Diagnosis and Health Economics. Springer; Berlin/Heidelberg, Germany: 2009. History of Allergy; pp. 3–19.

18. Mir M.A., Mehraj U., Nisar S., Sheikh B.A., Suhail S., Qayoom H. The Fundamentals of Hypersensitivities and Allergies. Nova Science Publishers Inc.; New York, NY, USA: 2020. Hypersensitivity reaction; pp. 1–34.
19.Platts-Mills T.A. The continuing effect of the discovery of IgE by Kimishige Ishizaka. J. Allergy Clin. Immunol. 2018;142:788–789. doi: 10.1016/j.jaci.2018.07.017.
20.. Lei D.K., Grammer L.C. An overview of allergens. Allergy Asthma Proc. 2019;40:362–365. doi: 10.2500/aap.2019.40.4247.