

AeroAllergen – Allergy: Diagnosis and Immunotherapy

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Abstract. Atmosphere is an important and unavoidable part of our ecosystem. We are continuously exposed to it and autonomously inhale and exhale oxygen and carbon dioxide from and into it. Atmosphere, apart from other contents, contains various types of microbioparticles such as pollen grains, fungal spores, viruses, bacteria, mites, detached plant parts etc. Many of these aeromicrobioparticles are responsible for causing various allergic ailments like Rhinitis, Nasobronchial allergies, conjunctivitis, Dermatitis, Urticaria etc. Hence these particles are referred as Aero-allergens because an allergen is a substance which causes allergy. Allergy is hypersensitive reaction in a person due to sensitivity towards a particular substance or substances. Allergy can be diagnosed by counting the number of IgE antibodies in blood serum and by skin testing with allergen extracts. Once diagnosed, the ailment can be controlled by avoidance of allergens, palliation with drugs and by Hyposensitization/Immunotherapy.

Key words: Aeromicrobioparticles, Allergens, Allergy, Diagnosis, Hyposensitization.

1 Introduction

The atmosphere contains and carries a number of animate and inanimate microparticles. Animate particles which are commonly present in air are pollen grains, fungal spores, viruses, bacteria, mites, detached plant parts, algal materials etc. All these microbioparticles are collectively termed as 'aerosol'. Of these pollen grains, fungal spores and mites are potent allergens. An allergen is a substance that causes allergy. Since these are air-borne, they are known as aero-allergens. Pollen grains are microscopic grains produced by flowering plants. Those pollen grains which are light in weight and are produced in large quantities, are carried away (disseminated) by wind current. Fungal spores are microscopic spores produced by various fungi and mites are microscopic organisms. They enter into the body via inhalation and cause allergic ailments in sensitive human population.

A fair percentage of human population suffers from allergies. As per previous data, in USA 10-20% of the total population suffers from allergic disorders. (Pipes, 1937 & Urbach and Gottlieb, 1946). The incidence of allergic disorders in India is reported to be quite high. In a survey of 5,00,000 Government employees and their families in New Delhi, the incidence of bronchial asthma was found to be 0.98% (ICMR, 1961), Another

survey of small population of 1000 urban people in Patna and 920 rural individuals forming a population near Patna showed 1.6% and 2.7% incidence of bronchial asthma respectively (Viswanathan et. al. 1965). With regard to the prevalence of all the major diseases in India (nasal, bronchial, dermal, gastro-intestinal etc), the total incidence estimated in the neighbourhood of 10% of the population (Viswanathan, 1964). But recent studies show that increased amount of pollutants in air water, food etc. have lowered down the immunity of human population leading to increase in hypersensitivity. According to recent data of World Allergy Organization (WAO) almost 30-40% of the world population suffers from some or the other kind of allergy. "The number of people reporting allergies keeps increasing every year" according to Ruby Pawankar, President of World Allergy Organization and the President of the Indian Academy of Allergy.

2. What is Allergy?

It is very difficult to define allergy accurately, but in broad terms, a patient may be considered allergic, if he exhibits a specific sensitivity towards, a particular substance or substances. Von Pirquet, in 1906, introduced the term allergy and defined it as an altered and accelerated reaction in a person to a second or subsequent exposure to an allergen to which his body has already become sensitized due to prior exposure. This happens because the human body possesses a very sophisticated immune system. The immune response of humans is exercised by an apparently limitless repertoire of antibodies (which are proteins) each synthesized in response to provocation by a different foreign protein termed antigen. In some individuals due to some blemish in the immune system, the body starts producing certain harmful antisubstances known as sensitizing antibodies (Reagins or IgE antibodies) on exposure to harmless substances. Such individuals with sensitizing antibodies in their bodies suffer from various allergic disorders, whenever they are re-exposed to the same substance (the specific allergen). Hypersensitive persons (The allergic individuals) readily produce IgE antibodies upon exposure to allergens to which they are allergic. Therefore in allergic patients, IgE levels are increased by 3-10 times the normal level. This happens due to the allergen-antibody interaction. Due to this allergen-antibody interaction certain mediators of allergy such as histamines, 5 – hydroxytryptamine, SRS – A (Slow reacting substance of anaphylaxis), some Kinins etc. are released. These mediators act on the tissues, and are responsible for the precipitation of symptoms of allergic disorders, such as breathlessness in the patients of asthma, sneezing and running nose in the patients suffering from rhinitis (allergic colds) and itching and rashes in patients of Urticaria etc. Out of the context very abrupt introduction of IgE (reagins) have a strong tendency to attach to mast cells and basophilic granulocytes. This tendency of IgE is known as cytophilicity. In humans, mast cells are found specially in the lungs, in the membranes of the upper respiratory tract, in the skin and in the intestinal tract. The allergic symptoms appear when the IgE antibodies react with its corresponding allergen on the surface of the mast cells and the basophilic granulocytes. This results in

degranulation of the cells, whereby the different biologically active substances are released into the tissues eliciting the symptoms.

3. Common Allergies And Their Symptoms

- i. **Hay fever:** Hay fever is defined as seasonal affliction of the eyes, nose, throat and lungs. The irritation, sneezing and running of nose are the main symptoms. Eyes get irritated, starts watering and become red by itching. Hay fever is mainly caused by pollen grains. Hay fever is also known as Allergic rhinitis. It is of two types seasonal and perennial.
- ii. **Conjunctivitis :** It is an ophthalmic reaction to an allergen in which eyes feel itching and rubbed frequently. Allergic conjunctivitis is generally associated with allergic rhinitis.
- iii. **Allergic Bronchial Asthma :** In Asthma widespread narrowing of peripheral airways to lungs takes place. This causes obstruction of flow of air to lungs. This reduces the breathing capacity of the person resulting in asthmatic attack. But it improves and returns to normal after the attack is over. However in chronic bronchitis, the reduction of breathing capacity is constant and does not vary significantly.
- iv. **Eczema:** Eczema is defined as a tissue reaction involving the epidermis and upper portion of the dermis, brought about by the action on these areas of substances to which the skin is allergic. In this disease, skin becomes irritated and develops rashes often accompanied by severe itching. Skin may be wet or dry and sometimes chapped.
- v. **Urticaria:** (Hives, Nettle Rash) : Urticaria is defined as multiple raised, markedly irritant (itching) skin lesions each displaying the classical tripple response of red line, flare and weal. Skin becomes warm, reddish with itching.
- vi. **Angio-oedema:** Angio-Oedema is defined as an acute local Oedema of the skin. It is usually present in the region of the mouth, eyelids and cheeks, but may extend to the neck, pharynx, tongue and glottis.

4. Diagnosis of allergy

To diagnose a patient of allergy, the case history of the patient is an important factor. Carefully taken history helps not only in successful diagnosis but it also saves lot of time and money. History helps to decide the probable substance or substances, to which the patient is allergic and how much severity patient shows to a particular allergen or allergens. The questions, to be asked are ones that are related to the seasonal or non seasonal occurrence of symptoms, and emphasis is laid on the time of day or year when symptoms occur. The main objective of the history is to find out whether or not the patient is allergic; and if allergic, whether the problem is perennial or seasonal. It also involves suspected allergens involved in the case. Thus first step of

diagnosis, is the history of patients. The second step is examination and third is final confirmatory tests. Test of blood serum showing IgE levels increased by 3-10 times, the normal level, provides the information of Hypersensitivity in a patient (person). However this determination does not confirm allergic ailments and also does not identify the offending allergen or allergens responsible for clinical manifestations. Because increased IgE level can also be due to other pathological conditions. However, increased IgE level indicate for further & final investigation for the identification of the offending allergen. The final and confirmatory test involves skin testing of the patients. This is done by three methods : Prick Testing, Intradermal testing and Patch testing. For this purpose, extracts of allergens are prepared by removing fats from them. These extracts are sterilized and diluted in Coca's /buffer solution. The experienced allergist will know from the patients' history, which allergens to be selected for testing. The skin test helps in assessment of the amount of allergen specific IgE antibodies attached to mast cells by measuring the size of the local weal and flare reactions caused by release of vasoactive substances.

5. The treatment of Allergy

Three major ways have been suggested to control such diseases :

- a) Avoidance of the allergens / Removal of the source of allergen.
- b) Palliation with drugs.
- c) Hyposensitization / Immunotherapy

Avoidance of the allergens / Removal of the source of allergens.

If the allergens, to which a person is sensitive are known, exposure of the patient to the allergens can be avoided by changing the place. However this is not very practical and satisfactory way because the distribution of aero-allergens differ from region to region. Further the casual allergens may be more frequent or new types of allergens may be present to which the individual is sensitive. As far as pollen grains are concerned, they can not be removed from the atmosphere because it needs total destruction of vegetation which will result into the danger of human existence.

Palliation with drugs

A number of therapeutic substances are used to suppress the allergic symptoms. These substances are antihistamines, steroids and decongestants.

Hyposensitization

In hyposensitization, allergen is either injected into the body or it is given orally. As a result, a minimal amount of free allergen reaches the mucosal cells controlling the release of the IgE antibodies.

Instead large molecular weight antibodies probably IgG4, are created. Because of their large molecular size, they inactivate further doses of invading allergen before the IgE reaction on the mast cell can take place. In order to produce sufficient amounts of circulating IgG (blocking antibody) a sufficient dose of allergen by injection or orally must be given. Therefore, it is always desirable to continue hyposensitization till the stage, at which the patient is symptom free. Thus hyposensitization is the only way of fundamental treatment of allergy.

6. Conclusion

Qualitative and quantitative knowledge of prevalence of aero-allergens in the atmosphere is the prerequisite in diagnosis and treatment of allergic diseases.

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