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Aeroallergen

Sreeremya .S
Assistant Professor
Department of Biotechnology
Sree Narayana Guru College, Coimbatore, Tamil Nadu
Corresponding author's email id: *sreeremyasasi@gmail.com*

Abstract

Allergic diseases such as bronchial asthma, allergic rhinitis and atopic dermatitis are dramatically elating all over the world including developing countries like India. In the present scenario, more than 30 % of the population is known to suffer from one or other allergic ailment. There are many aeroallergens like pollen listed. There are several treatment techiques also to deal with allergic conditions.

Keywords**:** *Allergy, Aeroallergen, Pollen, Treatment, Rhinitis*

INTRODUCTION

Major causative agents are pollen grains, fungal spores, dust mites, insect debris, animal epithelia, etc. Several aerobiological research have been conducted in different parts of the country to ascertain aerial concentration and seasonality of pollen grains and fungi (Nieuwenhuijsen, et al.,1994). Recently, an "All India Coordinated Project on Aeroallergens and Human Health" was undertaken to discover the quantitative and qualitative prevalence of aerosols at 19 different centres in the country. Predominant airborne pollen are Holoptelea, Poaceae, Asteraceae, Eucalyptus, Casuarina, Putanjiva, Cassia,Gulmohar, Oleander,Quercus, Cocos, Pinus, Cedrus, Ailanthus, Cheno/Amaranth, Cyperus, Argemone, Xanthium, Parthenium and others(Houba, et al,1996).

Pollen and fungal spores are difficult to avoid, but exposure can be reduced. Grass pollen is released in dry, sunny weather, and by noon most of the grains have elated to high in the atmosphere. They descend again as the air cools towards evening, remaining suspended longer in warmer

urban areas. Cloudy, still days are often worst (Nieuwenhuijsen, et al., 1995).

- Try to avoid being outside during these times.
- As peak levels occur 6pm – 8pm in rural areas and at 10 pm to midnight in towns, schedule typically outdoor activities for the early afternoon.
- Wear wraparound sunglasses to protect your eyes.
- Rub Vaseline inside the nose.
- Close windows in the evening.
- Keep car windows closed and use air conditioning fitted with suitable filters.
- Avoid walking in open grassy spaces, particularly during the evening and at night when pollen counts are at their highest.
- Avoid walking through or cutting grass, picnics and camping.
- Use saline nasal spray to irrigate nose free of pollen (e.g. Sterimar, Neilmed, Sinus Rince)

Fungal spores are most predominant after rain/thunderstorms and in damp environments. In Japan, cedar pollen is one of major aeroallergens. The major aeroallergens are produced based on the environmental pollution (Sreeremya, 2018). Majorly air pollution is the major reason. Several studies in South India was carried out to assess the air pollution index, specifically in various parts of Palakkad (Sreeremya,2018). For instance, exposure to airborne cedar pollens comprises cedar pollinosis, similar allergic rhinitis and conjunctivitis symp- toms, in allergic individuals. At present, approximately 13.5 million people are thought to suffer from cedar pollinosis and the annual economic losses are estimated to be 287 billion yen (Quirce, et al., 1992). Meanwhile, the detailed mechanisms of cedar pollinosis are not fully understood partly because various environmental factors including air pollutants such as diesel exhaust particles, parasite infections and so on are suspected to intricately affect the disease mechanisms. The major environmental factor is the air pollution. In especially in South India, several research works regarding the air pollution tolerance index was assessed in the various region of Palakkad. Moreover, the interactions among the exposures to cedar pollens and those to the adjuvant environmental factors have to be better characterized to clarify the details of the disease mechanisms (Nieuwenhuijsen, et al., 1999). To reveal the abovementioned complex interactions, systematic analysis of personal exposures to airborne cedar pollens in conjunction with those to the adjuvant environmental factors are essential. Various types of the

pollen samplers have been developed to measure airborne pollens. For instance, the Durham sampler , the IS Rotary pollen trap, the Burkard sampler based on the Hirst method and the real-time monitor using auto fluorescence characteristics have been developed and used to measure airborne cedar pollens. Among them, the Durham sampler is the most widely used in Japan. In this sampler, the pollens are collected on a glycerinated glass slide horizontally loaded between two parallel discs. As the cedar pollens are relatively large in size, that is, approximately 30m mindia meter, they are collected on the slide by gravitational deposition. Meanwhile, the IS Rotary pollen trap is similar to the Durham sampler but the glass slide is typically inclined at an angle of 45 relative to the parallel discs to continuously face windward by means of a vertical tail fin equipped underneath the mount of the trap. The underlying structure of the IS Rotary pollen trap can aggrandize the collection efficiency approximately five times compared to that of the Durham sampler. Thus, different types of the pollen samplers have been attempted to measure airborne cedar pollens in Japan. Nevertheless, these devices cannot be availed as personal samplers as these are relatively large in size and designed as stationary samplers. To accurately measure the personal exposures to aeroallergens comprising airborne cedar pollens in the vicinity of the human subject, we have recently developed the Personal Aeroallergen Sampler (PAAS), a passive sampler for airborne coarse particles , the human subject should wear the PAAS around his or her neck to specifically collect aeroallergens adjacent to the breathing area. Briefly, the PAAS consists of two planetary rings in different sizes in which a substrate holder can rotate in all directions. The underlying structure resembling a gimbal typically enables the particle collection surface continuously directed upward regardless of inclination of the sampler. As the cedar pollens are quiet relatively large in size, their behaviors in air are dominated by gravity. The pollens are collected on the horizontally maintained collection substrate by gravitational deposition (Herxheimer, 1973). Although the active samplers are occasionally impractical for the personal air samplings owing to noise, weight, dimension, limited lifetime of battery and so on, the PAAS is convenient as it is quiet, light and easy to handle. In certain research work, the particle size distributions collected by the PAAS were compared with those by a reference active sampler, that is, the Institute of Occupational Medicine (IOM) personal

sampler for which the particle size-selective collection performance was extensively investigated (Houba, 1996) . While comparing the results obtained by these two methods, the particle size-dependent collection performance of the newly developed passive sampler, that is, the PAAS, could be featured. In the previous studies, we obtained good correlations between the two methods by measuring ambient dust particles and hence suggested the usability of the PAAS (Patel et al., 2013). There are studies to ensure the applicability of the PAAS for the purpose of personal exposure assessments of actual aeroallergens. In particular, cedar and cypress pollens were selected as target aeroallergens because of abovementioned importance. Moreover, to assure the comparability of the PAAS to the most commonly used pollen sampler in Japan, that is, the Durham sampler, the numbers of the pollens collected outdoors by the PAAS were compared with those routinely measured by the Durham sampler of the Tokyo Metropolitan Government (TMG).

Allergy is an immune-mediated hypersensitivity reaction involving specific recognition of a particular allergen and the production of specific immunoglobulins, usually of isotype E (IgE) (Worm et al., 2011). This hypersensitivity reaction is often delineated as type 1 allergic reaction. An allergic reaction of this kind can be manifested in the lungs (allergic asthma) , alllergic reactions in lungs can be detected by Plethysmography(Sreeremya,2018), in the eyes and nose (conjunctivitis and allergic rhinitis), or in the skin (atopic eczema). Among those, allergic rhinitis is considered the very common manifestation, furthermore aeroallergens are important contributing factors causing the symptoms in allergic rhinitis .Various aeroallergens from animals or plants play a keyrole in the early development of asthma and allergy. Exposure to aeroallergens increases the risk of sensitization and the development of allergic respiratory complaints (Muller et al., 1998). Many researchers have shown that the distribution and pattern of aeroallergen is significantly different in different countries and even in different parts of a country. Herbal geography, climate and temperature are responsible for the variations. Among these, climate affects many aspects of allergy and allergen exposure, comprising the type and frequency of allergens in any particular geographic location, exposure to food and insect allergens, cross-reactivity among allergens, and the prevalence of allergy-related diseases(Valenta et al.,2011).The

incidence of allergy is elating throughout the world with increasing trend of skin prick test positivity .

In the latter few decades of the twentieth century, there was a rise in the prevalence of allergy, particularly in children, not only in the Netherlands but also in other western countries. According to the National Institute of Allergy and Infectious Diseases, as many as 49 million people in the United States suffer from various types of allergies. Of these, 20.4million have asthma, a chronic lung disease often triggered by allergies. These allergic phases affect all ages in all countries, with signs and symptoms and types of allergens changing according to the ages of the sufferer. In Malaysia, one out of three people is allergic to something and it is expected to affect 50% of Malaysians by the year 2022. Around 50% of world's teenagers were already suffering from airway allergies such as allergic rhinitis. In addition, a study from the Netherlands done in year 2001 also reported the prevalence of 'nasal allergy' in adults has risen since 1991. Allergy is one of the common disorders that have major influence on the quality of life which also contributes to academic and occupational absenteeism with significant impact on health care expenditure. It is useful to identify the common allergens that provoke allergic reaction so that prevention from exposure to these allergens can be made to reduce the potential health catastrophe from occurring (Henmar et al., 2008).

PRINCIPAL COLLECTION METHODS

Airborne particles can be mainly collected passively by gravity as well as with specific instruments that actively sample the atmosphere through impaction, impingement, filtration, or other methods that provide volumetric samples. The simplest, least expensive, but least accurate and specific method of collecting airborne biological samples is through the use of gravity (Frew et al.,2006). This method often comprises of exposing a coated microscope slide or open Petri dish containing agar (often called a settle plate) to the outdoor atmosphere or indoor air for a set period of time. Gravity sampling is non quantitative for atmospheric concentrations of aeroallergens and isaffected by particle size and shape and also by air movement. Gravity samples are biased toward larger and, therefore, heavier pollen and spore types. Consequently, smallpollen, such as Morusand Urtica, and small spores, such as Penicillium and Aspergillus, will be

underrepresented in the sample, although these four tax a are important allergens. This bias is much recognized, and gravity sampling is not recommended (Cox et al., 2006). Nevertheless, a mold test kit availing a settle plate is sold commercially at home-improvement stores around the country. Similar services are offered on the Internet by dozens of vendors. The most widely used instruments for air sampling are impaction samplers. These samplers separate particles from the air stream by availing the inertia of the particles; this causes deposition of the particles onto a solid or agar surface as the air stream bends to bypass the surface. The deflection of the air stream is achieved in both suction impactors and rotating arm impactors (Bousquet et al., 1994).

A broad variety of impaction samplers are available for both outdoor and indoor sampling, including slit samplers for total spores and pollen, rotating arm impactors for total spores and pollen, and sieve samplers for culturable fungi . Several of these are discussed in detail later. Assessment of the samples is generally done by microscopy or culturing (Cox et al., 2011).

WIDELY AVAILED SAMPLING INSTRUMENTS

No single sampler is appropriate for all applications, and investigators must select the sampler type and method of assessment carefully, based on the type of data to be collected. Various samplers and methods have been reviewed, and these should be consulted in conjunction with the information herein. The major focus here is on impaction samplers (Cox et al., 2004).

A decade later, when the risk of suffering a “pollen shock” during allergen immunotherapy was typically recognized to be a considerable danger of subcutaneously administering allergen to highly sensitized patients, a similar method—called intradermal allergen specific immunotherapy—received attention. Based on the observation that hay-fever patients occasionally experienced symptom amelioration after “intradermal pollen tests”, Strikingly, such intradermal allergy immunotherapy proved to be typically both safe and highly efficacious, leading to symptom relief after administration of only three doses(Ramsay et al.,1994). At the same time, M. A. Ramirez treated patients allergic to grass pollen with a method he called “cuti-vaccination”, which consisted of

administration of pollen extract onto scarified skin. Based on these analysis, it was suggested in the 1940s that the subcutaneous route might not be optimal for administration of AIT: "knowledge of the epidermis as an immunologic organ is still meager … it may be theoretically possible that a more effective desensitization may be attained by this route than by the subcutaneous one"(Broide, et al.,1992).

Between 1950 and 1960 Frenchallergologists revisited EPIT .Pautrizel administered the allergen extract onto moderately rubbed epidermis. Even though the reported results were excellent, a large number of applications were necessary until symptom relief was observed Blamoutier, in contrast, applied the allergen drops onto heavily scarified skin: "On the proximal volar aspect of the lower arm, in a square area of 3 × 3 cm, chessboard-like horizontal and vertical scratches are made with a needle.... These scratches should be superficial and not cause bleeding". Consistently, allergic side effects were typically observed only rarely when allergen was applied via the skin, and if they occurred nevertheless, these reactions were always milder than under conventional SCIT. These promising results were supported by several studies performed in the subsequent years all over Europe, from Switzerland to Portugal. Overall, symptom relief was obtained rapidly and allowed for co-seasonal treatment. The results of treatment success rates of 80 % exceeded the success rates under conventional SCIT. Despite such successful results with the French méthode de quadrillagecutané, reports on this promising administration route disappeared into oblivion for almost half a century (Bradding, et al.,1994).

EPIT for aeroallegens

While there is strong scientific and historical evidence for EPIT in allergy treatment, no double-blind placebo-controlled clinical trials existed, a fact that our group to revisit EPIT (Konno, et al., 1996). Driven by the idea to find a patient-convenient application route of AIT in order to elate its attractiveness, and based on the good accessibility of the skin and its high density of potent immune cells, our group performed three clinical trials to test efficacy and safety of EPIT. In order to keep epithelial barrier disruption minimal, replaced skin scarification by adhesive tape stripping. Besides enhancing the penetration of allergens by removing stratum corneum, repeated tape stripping also extremely functions as a "physical" adjuvant through activation of

keratinocytes, which then secrete various pro-inflammatory cytokines (IL-1, IL-6, IL-8, TNF-α and IFN-γ) favouring maturation and emigration of DCs to the draining lymph nodes . Results of the first pilot trial revealed that patients treated with a total of 12 to 14 patches containing pollen extract experienced significant alleviation of hay fever symptoms compared to placebo-treated patients. In line with the "historical" study results described above, no severe systemic allergic reactions were reported. The only adverse states observed were very mild local eczematous reactions under the skin patch(Romani, et al.,1996).

Fig: 1 Patch test

When looking at all 12 patch applications, mild eczema was observed in 15 out of the 21 verum patients, whereas such eczema was only seen in 5 out of the 15 placebo patients. When looking at a single patch application, eczema under the patch, with a severity score between 3 and 6 on a scale ranging from 0 to 18, was observed in roughly half of the verum patients(Fig:1). In order to exclude partial unblinding of the study by the occurrence of local adverse effects, we had analysed whether or not the occurrence of eczema under the patch correlated with symptom amelioration, but one could not find such a correlation. Encouraged by these results, a second phase I/IIa trial including a total of 132 grass pollen–allergic patients was initiated to find the optimal treatment dose of EPIT (Shanley et al.,1997).

Enrolled patients were treated co-seasonally with a total of six patches. A clear relationship between the administered allergen dose and the clinical effect, with the highest allergen dose leading to the most marked symptom improvement, also, we found a dose-dependence of the local adverse effects where patches were applied, with pruritus being the most frequently reported adverse event, followed by eczema observed after patch removal (Cuzzocrea et al.,1999). With every subsequent patch application, there was a reduction of local adverse events. After the sixth patch application, only half as many local adverse events were reported. This reduction was not explicable by local depletion of immune

cells or degranulation of mast cells, as each of the six patches was applied to a different area of the arm. Therefore, the reduction of local adverse events is likely to be explained by tolerance induction. A third clinical trial assessed the immunological changes induced during EPIT and found an increase in allergen-specific IgG4. Our results have meanwhile been confirmed by an independent group that demonstrated efficacy and safety of EPIT in grass pollen–allergic children. Hay fever symptoms, as well as the use of antihistamines, were significantly reduced in the active treatment group(Virchow,1996).

So far, there is no head-to-head comparison of EPIT to other routes of administration, except in mouse models. Using the major grass pollen allergen Phl p 5, EPIT was seen in the mouse to be at least equivalent to SLIT. While EPIT and SLIT induced similar IgG2a levels and also led to a similar reduction in IgE levels in sensitized mice, it was only EPIT that led could significantly reduce eosinophil counts in the bronchoalveolar lavage (BAL) in the asthma model. Also in mice, have compared SCIT with EPIT using ovalbumin as the allergen. While EPIT without adjuvant was less immunogenic than SCIT, EPIT with an adjuvant was found to be more immunogenic, so that EPIT and SCIT appeared comparable in efficacy (Zhu et al.,2006).

EPIT for food allergens

A clinical pilot trial to test clinical efficacy and safety of EPIT using the Viaskin® EDS in children suffering from cow's milk allergy observed a tendency toward an increased cumulative tolerance dose after a three-month treatment period, but missed statistical significance. Treatment was well tolerated, with no systemic anaphylactic reactions, but a significant increase of local eczematous skin reactions was showed. Such good safety results are crucial, especially when considering the use of EPIT as treatment option for food allergies for which conventional SCIT is impractical due to an unacceptably high rate of anaphylactic reactions (Zitnik, et al.,1993).

CONCLUSION

Aeroallergen is the allergic agents present in the air, it can pollens or other assisted environmental factors. Several aeroallergens cause acute to chronic disorders like asthma. There are several detection techniques used like Plethysmography, Skin(Patch)test.

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