

The role of interleukin 33 in patients with allergic diseases who has a positive result of total and specific IgE

Ghanyia Jasim Shanyoor*,
Ekhlash N. Ali, and Rawaa
Abdul-ameer Abdul-jabbar

Abstract

Introduction: Allergic diseases affect a large group of population and the common types were asthma, rhinitis, and urticaria and newly found that IL-33 playing an important role in the pathogenicity of allergic diseases.

Objectives: The main goal of this research to evaluate the levels of IL-33 in adult patients has real allergic diseases (asthma, rhinitis, and urticaria) through the detection of both positive assays of total and specific IgE of allergic diseases.

Methods: The total and specific immunoglobulin E (IgE) and IL-33 were determined in the serum of three types of allergic patients and healthy controls.

Results: There was a highly significantly higher concentration of IgE and IL-33 in the serum of patients with allergic diseases. Serum IL-33 and total IgE concentration are clearly statistically highly significant increases in three groups of patients (Rhinitis, Asthma, Urticaria) compared with healthy control ($p < 0.001$). No significant correlation between IL-33 levels and total IgE in four groups.

Conclusion: Our results show a significantly higher concentration in serum level IL-33 of patients with three types of allergic diseases (asthma, rhinitis, and urticaria).

Keywords: interleukin 33, allergic diseases, specific IgE.

Biology Department, College of Science,
Mustansiriyah University, Baghdad, Iraq.

***Corresponding author:** Dr. Ghanyia Jasim Shanyoor

E-mail: Isamhussain59@gmail.com,
stkn@uomustansiriyah.edu.iq

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Introduction

The common types of allergic diseases are asthma, rhinitis, and urticaria and these diseases consider as hypersensitivity disorders and newly found that IL-33 playing an important role in the pathogenicity of allergic diseases (1, 2).

Interleukin (IL33) is a regulatory cytokine from IL-1 cytokine family and it consider as an alarmin that alerts the immune system, its produce by many types of cells like epithelial cells of (skin, lungs, and gastrointestinal tract that exposure to the environmental allergens), endothelial cells, osteoblast, fibroblasts, adipocytes, smooth muscle cells, macrophages and dendritic cells (DCs) (3-5) and after exposure to the exogenous antigen or allergen, IL33 released to stimulate the first line cells of the immune system such as epithelial cells (6), which activate allergic reactions through type-2 innate immunity cells(5), and promotes circulating CD34+ stem cells to proliferate and produce IL-5 and IL-13 which known as pro-allergic cytokines and stimulates mast cells, eosinophils, Th2 cells, and basophils(7), and recent study by Cayrol et al 2018 showed when human exposure to environmental allergens (6).

The IL33 has a protease sensor property which reveals proteolytic activities, that leads the generation of group 2 innate

lymphoid cells and reduces allergic inflammation, while Chan and his colleagues 2019 (5) indicate that IL33 has various immune regulatory occurrences in addition to its role in the pathogenicity of allergic diseases through a combination of its blocking agents and may be interference by the synergistic characteristic in allergic and inflammatory diseases and they added that need further essential extensive clinical trials studies on allergic diseases.

The main goal of this research to evaluate the levels of IL-33 in adult patients has real allergic diseases (asthma, rhinitis and urticaria) through both positive assays of total and specific IgE of allergic diseases.

Material and Methods

Study group

Real-time object detection is crucial for many space-related applications. Although higher accurate object detection is becoming important, there are many loopholes in current object detection methods. Therefore, robust object detection systems are needed to precisely understand the environment. Recently, convolutional neural net-works (CNNs) have been

used as a powerful tool for recognizing image content and are widely considered in the computer vision community [4]. One disadvantage of CNNs is that it is computationally demanding, which requires a GPU that requires higher power consumption. With the development of the software industry, there are many advances that have been done in the fields of computer vision and machine learning. One major contribution is the Faster R-CNN [4] which shows promising results. This context motivated the researcher to participate in this research and to develop robust faster R-CNN based object detection models that will perform a key role in the computer vision community. This research was focused on generating new CubeSats databases and development of CubeSats detection models using the Faster R-CNN [4]. In this research, CubeSats with various dimensions are referred as "1U CubeSat," "2U CubeSat," "3U CubeSat," and so on [5]. Latest development the Faster R-CNN achieves near real-time performances using deep networks [4]. Faster R-CNN models described in this research for CubeSat detection were trained and tested on both Web-searched images and synthetic images rendered using CAD models. A series of sensitivity analyses were performed to measure the accuracy of the developed CubeSats detection models. Results showed the potential to be a general CubeSat detection tool.

Serological test

Measuring the Total IgE (which estimated by Immunoenzymatic Assay using the total IgE ELISA kit, (Euroimmun/German), and specific IgE (done by the western Immunoblotting method by using a kit has a specific IgE for 20 Inhalation allergens from Polycheck-Allergy Diagnostic/Germany).

The serum IL-33 concentrations were determined according to the manufacturer's instruction of commercial enzyme-linked immunosorbent assay (ELISA) kits (Shanghai Yehua Biological Technology /China).

Statistical analysis

The statistical was done by MINITAB Statistics version 13 software, analysis of variance (ANOVA) was achieved for comparison of variables between groups and a P-value less than 0.05 was considered statistically significant. And specific IgE results were expressed as a percentage. The experimental procedure for using human blood was obtained by informed written agreement from all subjects.

Result and Discussion

The large particles are removed by the nasal mucosa and upper tracheobronchial passages, but particles $<5 \mu\text{m}$ can reach the alveoli of the lungs; asthma and rhinitis are triggered by a variety of allergens. Some patients will have a lot of triggers, while others may only react to one or two items, some triggers are easier to avoid than others while grass and tree are common causes of spring allergy.

The results of specific IgE indicated a presence for one or more

inhalant allergens in sera of asthma, rhinitis and urticaria patients to 20 inhalant allergens, these results indicated that the highest percentage in rhinitis patients were for Tree (t2, t3, t4, t7), Grasses (g6, g12) and Weeds (w6, w9) and higher in males than females, while the results of asthma patients were similar to rhinitis patients, but the proportion was higher in female than male, while the results of urticaria patients showed that the highest percentage were against mite (d1,d2) and animal (e1, e2, e3, e5, e6, e82, e84)and the proportion was higher in female than male table 1, these results indicate that there is a variance in terms of the most common allergens in allergic patients. This difference may be due to several factors, including the size of the sample under study, type of allergic disease, season, age, geographical location, and housing environment (rural or city centers).

This study has shown an association of mite and animal sensitivity with urticaria due to high percentage of these two allergens, as many studies (8-10), and Henszel and their colleagues(10) indicate that mites effuse plenty of allergenic proteins especially mite faces and the extracts of allergenic proteins from their purified bodies which may inflict atopic allergies (respiratory and dermal), such as bronchial asthma, rhinitis, or atopic eczema, and they added that 5% of the population is sensitive to mites allergens.

Serum IL-33 and total IgE concentration are clearly statistically highly significant increase in three groups of patients (Rhinitis, Asthma, Urticaria) in compared with healthy control ($p < 0.001$). No significant correlation between IL-33 levels and total IgE in four groups, and no significant differences were found in the age and weight among the groups table 2, figure 1. The prevalence of allergic diseases as a chronic inflammatory disease has been rapidly increasing in last decades in the worldwide, and despite rhinitis and asthma are diseases effect on respiratory system but there were differences between two these diseases and urticaria also , in normally state there were dynamic balance between Th1 and Th2 while when an allergic disease occur due to environmental allergens cause breaking of dynamic balance between Th1 and Th2, and Th2 play a triggering role in the induction of IgE antibody-producing B cells, mast cells, and eosinophils (11, 12), and these cells are found in all the tissues, especially in areas that are typical sites of allergic reactions, those sites include mouth, nose, throat, lungs, skin, and gastrointestinal (GI) tract that becomes inflamed due to an allergic reaction.

Cayrol and Girard 2014 (13) indicate that IL-33 production depends on cellular stress or cellular damage, and Oboki et al., 2010 (14), Mjosberg et al., 2011 (15), Khaitov et al 2018(11) in vivo experiments found IL-33 play crucial roles in allergic inflammation, type-2 immunity, and eosinophil homeostasis, and Chan and their colleagues 2019(5) added that IL33 liberated during cell damage and necrosis and activation of allergic inflammation through promoting production of inflammatory factors and chemotactic factors (11)like IL-4, IL-5, and IL-13 that progress allergic inflammation.

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Conflict

No conflict of interest

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