

Relationship between Total Serum IgE Level and Skin Prick Test in Patients with Symptoms of Respiratory Allergy

العلاقة بين مستوى الغلوبولين المناعي الكلي للنوع E واختبار وخز الجلد في المرضى الذين يعانون من أعراض الحساسية التنفسية

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الخلاصة

خلفية البحث: يعتبر اختبار وخز الجلد وقياس الغلوبولين المناعي الكلي للنوع E في مصل الدم من الاختبارات الشائعة لتشخيص الحساسية. **الهدف:** تهدف الدراسة الحالية إلى تحديد العلاقة بين مستوى الغلوبولين المناعي الكلي للنوع E وتفاعلية اختبار الجلد لدى المرضى الذين يعانون من أعراض الحساسية التنفسية. **المنهجية:** شملت الدراسة 128 مريضاً من المرضى الذين يعانون من أعراض الربو التحسسي، حساسية الأنف أو كليهما ممن راجعوا مركز الحساسية والربو في مدينة الصدر الطبية، تم إجراء اختبار وخز الجلد لمجموعة من المحسسات السائدة مثل حلم غبار المنزل، لقاح الأشجار والأعشاب والأحراش بالإضافة إلى الفطريات وكذلك تم فحص مصل الدم لقياس مستوى الغلوبولين المناعي الكلي في مصل الدم. **النتائج:** اختبار الجلد الوخزي كان موجبا لدى 87,5% من المرضى لواحد أو أكثر من المحسسات وكان 57,8% من المرضى لديهم مستويات عالية من الغلوبولين المناعي الكلي و 72(64%) ممن اظهروا ايجابية الفحص الجلدي كان لديهم مستويات العالية من الغلوبولين المناعي الكلي للنوع E. **الاستنتاج:** هناك علاقة بين أعراض الحساسية، تفاعلية الفحص الجلدي والمستويات المرتفعة من الغلوبولين المناعي الكلي للنوع E وان نتائج الفحص الجلدي تتناسب مع مستوى الغلوبولين المناعي الكلي للنوع E. **التوصيات:** يمكن استخدام قياس الغلوبولين المناعي الكلي IgE كمؤشر تشخيصي لتحديد مرض الحساسية وكذلك يمكن استخدامه كفحص واحد غير مكلف في حالات عدم توفر فحص الجلد أو هناك موانع لاستخدامه يمكن تشخيص الحساسية التنفسية بالاعتماد على التشخيص السريري بدون إجراء فحوصات الحساسية حيث ان هناك علاقة واضحة بين أعراض الحساسية وإيجابية الفحوص المستخدمة في التشخيص.

Abstract:

Background: skin prick test (SPT) and total serum IgE measurement are common tests used for allergy diagnosis.

Objective: the current study aimed to determine the association between elevated Total IgE levels and skin test reactivity in patients with symptoms of respiratory allergy.

Methodology : the study include 128 patients with symptoms of allergic asthma and or allergic rhinitis who attended to AAC In Al-Sader Medical City, skin prick test was done by using standard allergens extracts like house dust mites extracts, pollens of trees, grasses and weeds also extract for mold allergens. Also sera of patients analyzed for measurement total serum IgE.

Results: skin prick test was positive in 112 (87.5%) of patients to one allergen or more and (57.8%) of patients had high IgE levels (>190 IU/ml), 72(64%) out of 112 skin test positive patients had high IgE levels.

Conclusion: there is close association between reported allergic symptoms, skin test reactivity and elevated IgE levels, also skin test results correlate significantly with total IgE levels.

Recommendation: Total serum IgE measurement could be used as diagnostic marker to identify respiratory allergy and could be used as single cost effective test in cases when skin test not available or contraindicated, and so Respiratory allergy still could be diagnosed on the bases of clinical examination as there is significant association between symptoms and allergy tests positivity.

Key words: Respiratory allergy, skin prick test (SPT), total serum IgE

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INTRODUCTION

Respiratory allergy (allergic rhinitis and allergic asthma) is a common allergy among all populations throughout the world and by reviewing epidemiological studies obtained from different countries, one could get a clue on the importance of this health issue. The prevalence of allergic diseases is rising dramatically in both developed and developing countries ranging from 15-30% all over the world⁽¹⁾.

Although there are no official statistics on the prevalence of allergy in Iraq, the disease is widespread and both allergic rhinitis and asthma cause poor performance at work and school and diminished quality of life⁽²⁾.

Selecting the appropriate allergy test is clinically useful to determine the causative allergens and establish the correct management especially in those patients not respond to the usual anti-allergic measures like antihistamine, decongestant or steroids⁽³⁾.

The gold standard method is Skin Prick Test (SPT) which continues to be the most appropriate diagnostic in vivo test for assessment the presence of specific IgE against particular allergen, however, there are several factors affecting compliance, practicability and interpretation of the test like skin diseases, young children, experience of the examiner, inability to stop treatment and problems of hypersensitivity and anaphylaxis⁽⁴⁾.

Total Serum Immunoglobulin E or IgE was the original screening test for allergy and increased total serum IgE can be in favor of allergy diagnosis, some physicians consider it as the first laboratory test. But elevated total IgE level is nonspecific like skin reactivity and it not only strict with allergies but also with other diseases like helminthic infections, alcoholism, some malignancies, etc. However, various epidemiologic studies have shown strong association among total serum IgE levels, skin test reactivity to different allergens, and allergy prevalence, but the details of these associations is still not well determined⁽⁵⁾.

The evidence for the role of IgE in asthma and or rhinitis is supported by the new treatment strategy that reducing IgE levels in allergic patients which lead to clinical improvement⁽⁶⁾.

OBJECTIVES

This study aims determine the association between elevated total IgE levels and skin test positivity in patients with symptoms of respiratory allergy.

METHODOLOGY

Study Design

This cross sectional study was carried out from March 2013 to February 2015 including, 128 patients with bronchial asthma and or allergic rhinitis who attend Asthma and Allergy Centre in Al-Sadder Medical City in AL-Najaf province, their age range from 15-63 years with mean of 35.48 ± 10.521 . All patients carefully examined by respiratory specialists and they were without treatment by antihistamines and systemic oral steroids for at least one week before testing.

All participants have been instructed and informed about the aim of the study and investigation procedure and their acceptances are taken.

Skin Prick Test (SPT) positivity

Skin test was performed, using standardized allergenic extracts (Stallergen, Paris, France), and a sterile lancet. allergens were used for the patients with respiratory symptoms including: Pollens[five grasses , Bermuda, plantain, tree I(fagacea), tree II(oleacea), tree III (butulacea),

chenopodium, mugwort], Moulds as; [mould I (alternaria), mould II (cladosporium), mould III (penicillium), mould IV (aspergillus), candida], Mites as; [Dermatophagoides pteronyssinus (DP) and Dermatophagoides farina (DF)], other inhalants such as HDM, date pollen supplied by Allergy vaccine lab. /Iraq for intradermal skin tests. Reactions were measured 20 minutes after the pricks. Positivity was defined as a mean wheal diameter of at least 3 mm to at least one of the allergens and greater than the negative control⁽⁴⁾

Immunological Test

Samples of three milliliters (ml) of venous blood were collected from each patient. Blood samples were drawn aseptically using disposable needle and syringe, Blood allowed to clot at room temperature then centrifuged at 1500 rpm for 5 minutes then serum kept at deep freeze (-20 C°) to be used for total IgE measurements.

Determination of the level of total serum Ig performed by Chemiluminescence immunoassay (CLIA) kit and according to manufacturer's instructions reference value of normal IgE range 1-190 IU/ml. (Biomedical Engineering Co-UK)

Statistical analysis:

Data of the studied group analyzed by using the statistical package for social sciences (SPSS) version 22, 2014. Chi square test was used to compare frequencies. Level of significance, P. value, was tailed in all comparison and set at ≤ 0.05 to be considered as significant difference or correlation (Daniel, 2010).

RESULTS:

Table (1): Descriptive statistic of study population

variables	Patients (N=128)
Age (yrs)	35.48 ±10.521
Gender: male	67(52.3%)
female	61(47.7%)
Allergic condition:	
Asthma	47(36.6%)
Allergic rhinitis	43(33.5%)
Asthma & rhinitis	38(29.6%)
Skin prick test	
Negative	16(12.5)
Positive	112(87.5%)
Total serum IgE	
≤190 I.U/ml	54(42.2%)
>190 I.U/ml	74(57.8%)

Descriptive statistics for study population are shown in table (1) there were 112 (87.5%) of patients show positivity to skin prick test while 74(57.8%) of them had elevated levels of IgE.

Table (2): The pattern of sensitization according to sensitized allergens number by skin prick test

Prick test response	No. of patients (%)
Positive to one allergen	29(25.8%)

2+	38(33.9%)
3+	37(33%)
4+ and above	8(7%)
Total	112(100%)

Table (2) reveals that only 25.8% of patients showed sensitization to one allergens while the majority of patients exhibited poly sensitization pattern.

Table (3): The distribution of different IgE levels among study groups

Total IgE I.U/ml	No. of patients (%)	Patients subgroups		
		Asthma	Rhinitis	Both
≥190	54(42.2%)	21(44.7%)	19(44.2%)	14(36.8%)
191-489	46(35.9%)	14(29.8%)	15(34.9%)	17(44.7%)
490-789	12(9.4%)	6(12.8%)	4(9.3%)	2(5.3%)
790-1089	1(0.8%)	0(0%)	0(0%)	1(2.6%)
Above 1090	16(12.5%)	6(12.8%)	6(14%)	4(10.5%)
Total	128(100%)	47(100%)	43(100%)	38(100%)

Table (3) Shows the result of measuring total serum IgE among the 128 patients with respiratory allergy which revealed a very wide spread of values, which ranged from 53- 3200 I.U/ml & mean of 482 I.U/ml.

Table (4): The association between total serum IgE level and skin test reactivity in patients with respiratory allergy symptoms.

Serum total IgE(I.U/ml)	SPT		Total
	positive	negative	
≥190	40(35.7%)	14(87.5%)	54
<190	72(64.3%)	2(12.5%)	74
Total	112(100%)	16(100%)	128

P=0.0001, likelihood ratio (LH)=16.

Table (4) shows that from 112 patient had positive skin reactivity 72(64%) appear to had raised IgE level, while only 2(12.5%) of negative skin test patients had raised level, the association between elevated serum total IgE and the positive skin prick tests of all allergens used in this study were statistically significant.

Table (5): Association between total serum IgE level and pattern of skin test positivity in patients with respiratory allergy symptoms

Total IgE (I.U/ml)	Skin prick test reactivity				
	negative	Positive 1	Positive 2	Positive 3	Positive 4 &above
≥190	14(87.5%)	19(65.5%)	8(21.1%)	11(29.7%)	2(25.0%)

<190	2(12.5%)	10(34.5%)	30(78.9%)	26(70.3%)	6(75.0%)
Total	16	29	38	37	8

P=0.0001

Table(5): Show that 78.9%, 70.3% & 75% of patients sensitized to two, three, & 4 allergen respectively had high IgE level (in comparison to those not sensitized 12.5% or sensitized to one allergens 34.5% and the difference was highly significant.

DISCUSSION

Skin prick test(SPT) was positive in 87.5% of case that were clinically suspected to have respiratory allergy, this percent of positivity completely agree with other studies conducted by Saleh,(88%) in Tikrit⁽⁸⁾ and Iranian study by Assarehzadegan *et al*(90%)⁽⁹⁾. The study demonstrate (25.5%) of the sensitized patients were mono sensitized against one allergen and others were poly sensitized to more than one allergen, where (33.9%) sensitized to 2 allergen and (33%) sensitized against 3 allergens, this agree with study in Tikrit province that show 13% mono sensitized , 30% sensitized to 2 allergen & 45% sensitized to 3 allergens⁽¹⁰⁾. A study from Saudi Arabia reported that (17%) of patients were mono sensitized, (39%) sensitized against 2 allergens and (40%) had sensitization against 3 allergens⁽¹¹⁾, also in Jordan, researchers reported a 17.6% of allergic patients were monosensitized & (81.4%) were reactive to 2 or more allergens ⁽¹²⁾ while study in Iran reports that (88%) of patients were mono sensitized , (3%) sensitized against 2 allergens and (2%) sensitized against 3 allergens ⁽¹³⁾. An overall assessment of the epidemiological and clinical trial data suggests that between 50% and 80% of patients consulting allergists are poly-sensitized. The exact prevalence depends on the population and the region, Poly-sensitization might be the result of genetic factors or environmental factors which favor growth and vegetation of specific plant species such as grass and weeds with similar survival conditions ⁽¹³⁾. It might also be due to cross-reactivity which reflects the presence of common allergenic epitopes in different but botanically close plant species ⁽¹⁴⁾.

The results revealed that 74(57.8%) of allergic patient show high level of total and allergic patients show much higher levels of IgE reach to above 1090 and a proximately all patients subgroups weather suffered from asthma, rhinitis or both show the same percent with no significance difference between them. Our findings are similar to those of some other studies which showed increased total IgE from among patients with different respiratory allergies.^(15,16)

Skin test reactivity and elevated IgE were found together in 64.3 % of the patients and there is a highly significant association between skin reactivity and elevated level of IgE as p=0.0001 and the likelihood ratio(LH)=16.

Droste *et al* found such a relationship in a group of allergic rhinitis patients with 2167 population sample and suggested that total IgE and SPT may be considered complementary to one another in diagnosing the disease and Total IgE may be regarded an indicator of greater dysregulation of the immune system in atopic allergy.⁽¹⁷⁾

In Kuwait a study of 101 asthmatic patients has revealed concomitant skin reactivity and elevated IgE in 62% of the cases ⁽¹⁷⁾ which close to our finding. Moreover, Dutch general population study on patients with respiratory allergy reported a meaningful positive likelihood ratio of skin test positivity and high levels of total IgE⁽¹⁹⁾.

Inconsistent result reported in Adult Bronchial Asthmatic Patients by Parveen *et al*⁽²⁰⁾ in Pakistan , and children with respiratory allergy in Iran ⁽²¹⁾ , as both studies find the association

between the positive skin prick test and elevated serum total IgE were not statistically significant ($P > 0.05$).

High level not only associated with skin positivity but also associated with number of sensitized allergen, Most of our patients with poly-sensitisation seem to have raised IgE levels in comparison to those sensitize to one allergen and this agree with⁽¹⁹⁾. As the IgE regarded the key molecule in development of atopy this strong relationship between skin positivity and elevated total serum IgE may be due to increase IgE-mediated allergic reaction in our population due to increase exposure to different types of allergen with high concentrations and prolong periods because of changes in environment and may belong to our dusty climate.

CONCLUSION

There is significant statistical association between respiratory allergic symptoms, skin test positivity and high level of total IgE. Also skin test results correlate significantly with elevated total IgE levels and total serum IgE could be a predictor of positive SPT.

RECOMMENDATION:

1. Total serum IgE measurement could be used as diagnostic marker to identify respiratory allergy and could be used as single cost effective test in cases when skin test not available or contraindicated.
2. Respiratory allergy still could be diagnosed on the bases of clinical examination as there is significant association between symptoms and allergy tests positivity.

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