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Article

Level of IgE and Eosinophils in Patients with Asthma

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Abstract: Objective: knowledge the predictive roles of eosinophil and IgE in pathophysiology of asthma patients in Tikrit city. Methods: The current research was applied in Tikrit city between February and April 2024. city during period (February-April 2024). We collect 60 blood samples from patients with asthma which is visiting advisory unit / tikrit Teaching Hospital (those patients have been diagnosis already by consultant doctor). Additionally, we collect 30 samples from people without diseases (healthy) and based on them as a control group. Absolute count of eosinophil was measured by hematology analyzer machine (complete blood count (CBC)). Levels of IgE were calculated by Sandwich Enzyme-linked immunosorbent assays (ELISA). Results: Present outcomes showed the most participants were lie within age groups; 41-50 (25%) and 51-60 years (32%) and living in urban area (65%). Additionally, our study mentioned the most cases were genetic (68%), moderate severity (52%), and have duration time >10 years (47%). Increase concentrations of IgE, eosinophil and IgE+Eosinophil indicators in isthmic patients than control individuals with significant differences ($p<0.05$). Based on ROC curve, our study showed the IgE+eosinophil indicator has highest sensitivity, specificity, PPV, and NPV (90%, 95%, 90%, and 90%), followed by IgE (84%, 90%, 88% and 81%) and then eosinophil (80%, 80%, 80%, and 80%) at cut off values (418.00, 98.50, and 291.91) respectively in diagnosis asthma patients with significant differences ($p<0.05$). Conclusions: Peoples with >40 years are more dangerous for asthma occurrences than younger. Urban area is more risk for disease than rural due to it has more pollutions. Genetic predisposition play major role in asthma occurrence. Increased levels of IgE and eosinophil in astmatic diseases due to increase inflammation. Finally, IgE+Eosinophil indicator is more better in diagnosis asthma than IgE and eosinophil due to it has highest sensitivity and specificity.

Keywords: Asthma; eosinophilic asthma; allergy; IgE; eosinophil

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1. Introduction

Sneezing tightness in the chest, coughing, and difficulty of breath are some of the symptoms of asthma, a chronic respiratory condition that is brought on by inflammation of the airways, bronchoconstriction, hyperresponsiveness, and remodeling of the airway [1]. According to [2], this remodeling results in repeated flares and decreased lung function due to the hypertrophy and hyperplasia of the cells of smooth muscles in the passageways. Through cytoskeletal proteins to inflammatory intermediaries, the pathogenesis of asthma involves a complex interaction of molecular and cellular elements [3]. About 334 million people worldwide suffer from severe asthma, a complex subtype that is difficult to treat even with strict therapies like beta-agonists, muscarinic antagonists, and high-dose glucocorticoids. Of these, 5–10% have severe asthma that does not improve with standard treatments [4].

The formation and evolution of eosinophilic asthma, a category of asthma marked by elevated eosinophil counts in the breathing passages, blood from the peripheral organs, and sputum, are influenced by a complex interaction of variables. Studies have used

peripheral blood eosinophil populations of ≥150 cells/μL, ≥300 cells/μL, or ≥400 cells/μ, plus sputum eosinophil amounts above 2 to 3%, to identify eosinophilic asthma, despite the fact that a standard definition of the condition is still elusive [5].

Contact to allergens like dust mites, pollen and dander from pets, inheritance, psychological stresses, obesity, and environmental factors such pollution and pneumonia are the primary manifestations of eosinophilic asthma. These physiologic and environmental factors set off an immunological reaction that results in long-term inflammation in the airways. Airway reorganization, which is marked by stiffness of the smooth muscle and a greater production of mucus, can be brought on by ongoing inflammatory conditions. Moreover, severe bronchoconstriction and airflow restriction are caused by bronchial hyperresponsiveness, which is an increased sensitivity of the passageways to stimulation. Another effect of ongoing inflammation is diminished lung function, which is characterized by decreased airflow rates and limited gas exchange (Hussain and Liu, 2024).

IgE is a major cause of allergic inflammation of the airways in asthma and a defining trait of type I hypersensitivity [7]. Its crucial involvement in the pathogenesis of both allergic and nonallergic asthma have been shown in earlier research [8]. There are relationships between serum levels of all IgE and breathing capacity, asthma magnitude, and asthma control. There is, however, no proof that blood total IgE levels are a useful indicator for predicting asthma exacerbations (AEs). Yuan et al. [9] found that among individuals with severe persistent asthma, higher baseline IgE concentrations were inversely correlated with subsequent adverse events (AEs); mild and moderate asthma patients did not exhibit this correlation.

1.1 Aim of the Study

Given the different opinions about the role of eosinophil and IgE in the pathophysiology of asthma, the current study aims to know the predictive roles of eosinophil and IgE in pathophysiology of asthma patients in Tikrit province.

2. Materials and Methods

2.1 Sample Collection

The current research was applied in Tikrit city during period (February-April 2024). . We collect 60 blood samples from patients with asthma which is visiting advisory unit / Tikrit Teaching Hospital (those patients have been diagnosis already by consultant doctor). Additionally, we collect 30 samples from people without diseases (healthy) and based on them as a control group. Demographic and clinical features were filled in questioner document.

2.2 Laboratory Methods

It is collected five ml of human blood and putted it in gel tube (3 mal) and EDTA tube (2 ml). EDTA tube was depended for calculated absolute count of eosinophil by hematology analyzer machine (complete blood count (CBC)) (MINDRAY BC-5130, Chena). Gel tube depended for obtain serum through separate blood by centrifuge machine (4000 rpm for 4 minutes). Serum concentrations of IgE marker in samples were calculated by Sandwich Enzyme-linked immunosorbent assays (ELISA) (CUSABIO company) based on procedure protocol presented within kit packing.

2.3 Statistical Analysis

Numerical markers were showed such as Mean and SD. Independent t test applied to discover differences of concentrations of these markers within study groups. Nominal and ordinal characters were expressed like frequencies and percentages, and in similarities among percentages calculated by Pearson-Chi-square test. Receiver operating characteristic (ROC) curve was based to measure area under the curve (AUC), cut-off, specificity and sensitivity of scale markers $P \leq 0.05$ was utilized to detect statistical differences. SPSS v. 22.0 and Prism v.10 statistical software programs were applied for analysis present results.

3. Results

3.1 Demographic Characteristics

Outcomes of current research showed the most participants were lie within age groups; 41-50 (25%) and 51-60 years (32%) and living in urban area (65%). The differences among percentages of age groups and between rural versus urban were significant ($p<0.05$). In contrast, the differences between males and females were no significant ($p>0.05$) (table 1).

Table 1. Frequency and percentages of demographic features of participants

Total number=60		N	%	P value
Gender	Males	32	53%	p>0.05
	Females	28	47%	
Age groups (years)	≤20	9	15%	p<0.01**
	21-30	5	8%	
	31-40	7	12%	
	41-50	15	25%	
	51-60	19	32%	
	>60	5	8%	
Living	Rural	21	35%	p<0.05*
	Urban	39	65%	

P>0.05 (no significant different) P<0.05* (significant different)
P<0.01** (high significant different)

3.2 Clinical Characteristics

Present outcomes mentioned the most cases of asthma were genetic (68%), moderate severity (52%), and have duration time >10 years (47%). The differences among percentages of clinical features were significant ($p<0.05$) (table 2).

Table 2. frequency and percentages of clinical features of participants

Total number=60		N	%	P value
Inheritance	Genetic	41	68%	p<0.05*
	Acquired	19	32%	
Severity	Mild	12	20%	p<0.01**
	Moderate	31	52%	
	Sever	17	28%	
Asthma duration	≤5	21	35%	p<0.01**
	6_10	11	18%	
	>10	28	47%	

P>0.05 (no significant different) P<0.05* (significant different)
P<0.01** (high significant different)

3.3 Mean Levels of IgE and Eosinophils

The current findings showed increase concentrations of IgE, eosinophil and IgE+Eosinophil indicators in isthmic patients (322.30±137.32, 519.45±216.43, and 799.15±287.90) than control individuals (75.10±31.45, 251.20±98.71, and 299.60±83.75) with significant differences ($p<0.05$) (table 3 and figure 1).

Table 3. Comparative mean levels of IgE, eosinophil and IgE+Eosinophil indicators between asthmatic patients versus controls

Groups	N	Mean	Std. Deviation	P value

IgE (mg/dl)	Patients	60	322.30	137.32	p<0.001***
	Controls	30	75.10	31.45	
Eosinophil	Patients	60	519.45	216.43	p<0.001***
	Controls	30	251.20	98.71	
IgE+Eosinophil	Patients	60	799.15	287.90	p<0.001***
	Controls	30	299.60	83.75	

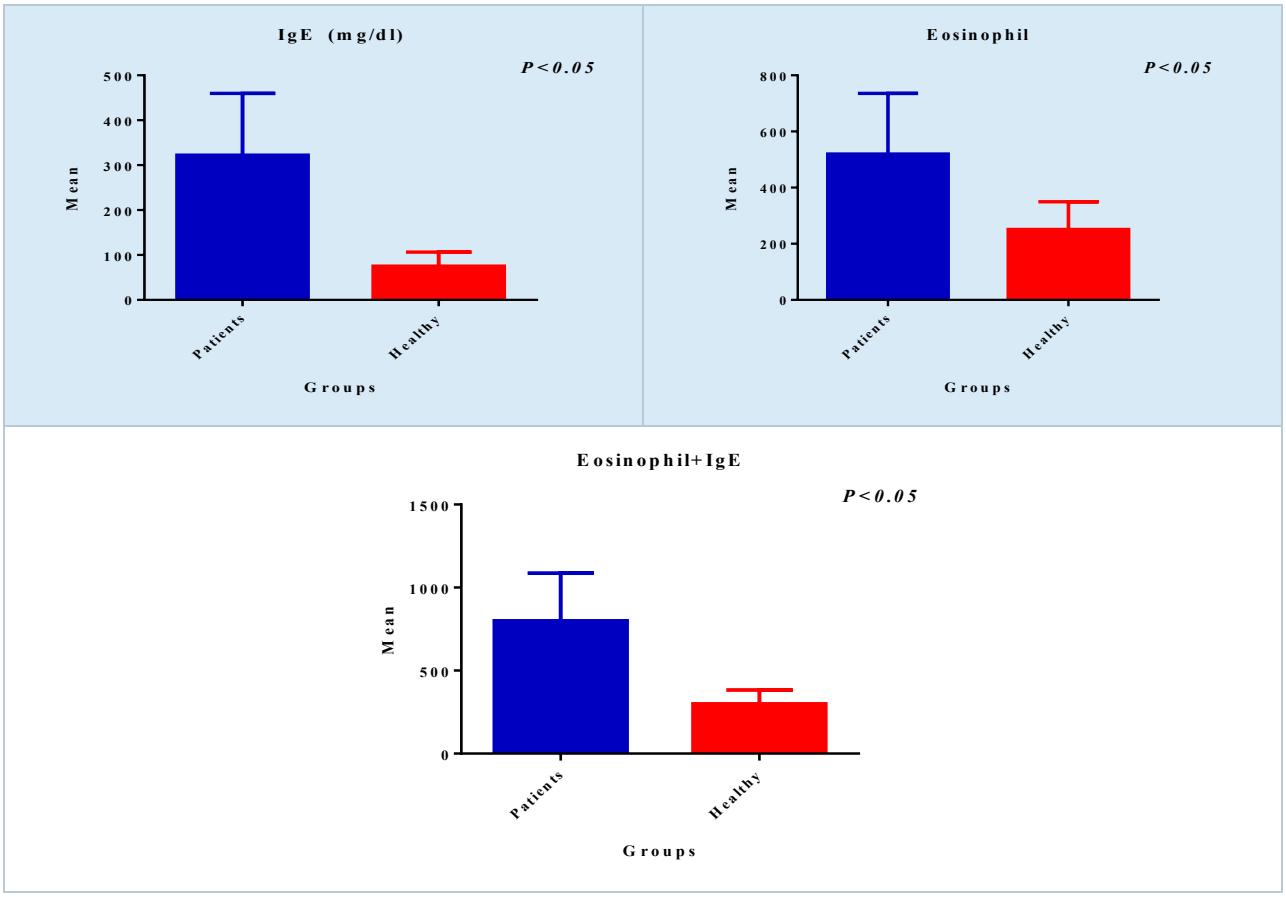


Figure 1. Comparative mean levels of IgE, eosinophil and IgE+Eosinophil indicators between asthmatic patients versus controls

3.4 Receiver Operating Characteristic Analysis

ROC curve results showed the IgE+eosinophil indicator has highest sensitivity, specificity, PPV, and NPV (90%, 95%, 90%, and 90%), followed by IgE (84%, 90%, 88% and 81%) and then eosinophil (80%, 80%, 80%, and 80%) at cut off values (418.00, 98.50, and 291.91) respectively in diagnosis asthma patients with significant differences (p<0.05) (table 4 and figure 2).

Table 4. ROC curve, sensitivity, specificity, PPV, NPV and accuracy of immunological indicators

	AUC	St. error	P value	Cut Off	Sensitivity %	Specificity %	PPV %	NPV %
IgE	0.899	0.051	p<0.05*	98.50	84	90	88	81
Eosinophil	0.839	0.62	p<0.05*	291.91	80	80	80	80
IgE+Eosinophil	0.913	0.058	p<0.05*	418.00	90	95	90	90

	AUC	St. error	P value	Cut Off	Sensitivity %	Specificity %	PPV %	NPV %
Abbreviation; AUC (Area under curve), PPV (positive predictive value), NPV (negative predictive value)								

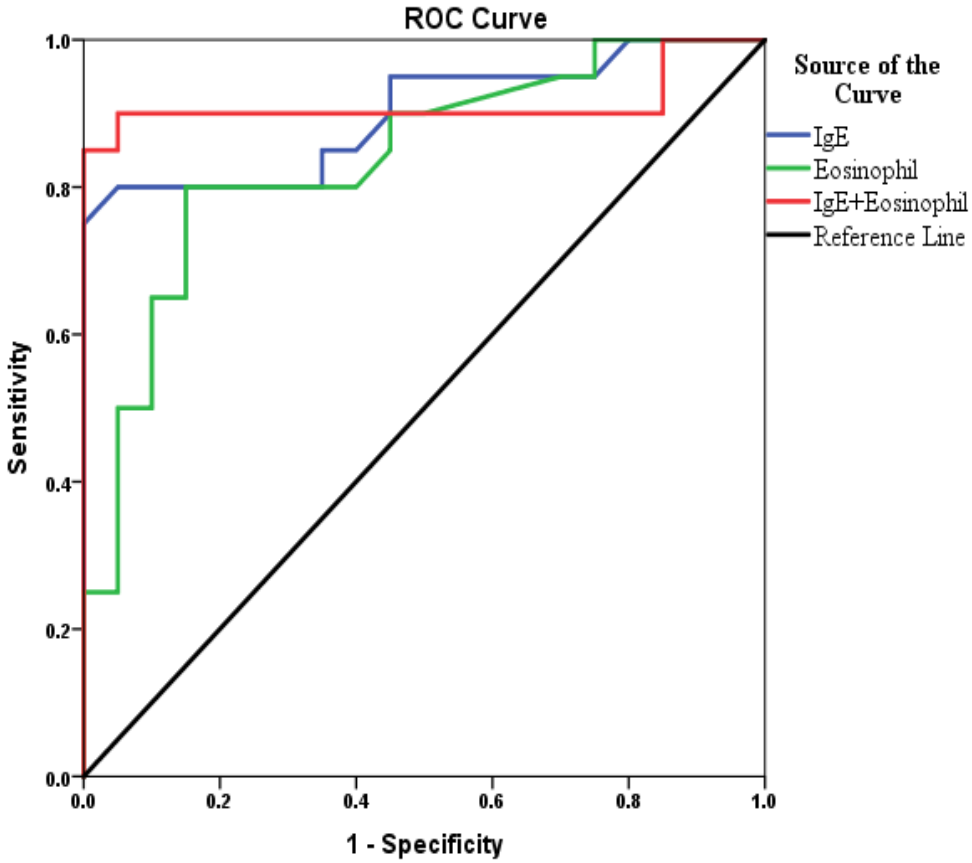


Figure 2. ROC cure of immunological indicators

4. Discussion

The goal of this study was to identify the roles that IgE and eosinophil markers play in the pathophysiology of asthma disorders. The majority of our study's patients were men over 40 who lived in cities, and the results we obtained were consistent with those of Solomon et al. [10]. After puberty, more women than males experience asthma, which may be explained by the physiological progression of the lungs and the impact of sex hormones. Female sex hormones affect people at all stages of life and are linked to inadequate asthma management [11]. According to the authors, the prevalence of asthma that is not allergic is low untill it rises in later life, whereas the prevalence of allergic asthma is greatest in early infancy and gradually declines with age. The majority of new occurrences of asthma following the age of 40 are non-allergic [12]. Asthma prevalence increases beyond age 40 for a number of reasons, including organ malfunction, reduced immunity, chronic disorders, and perhaps sample size. Urban regions had higher rates of asthma and asthma-related disorders than rural ones, and this difference was associated with exposed to environmental risk factors and availability to healthcare [13] (table 1).

According to the current study, the majority of patients had moderately severe asthma that was genetically predisposed and had lasted more than ten years. These outcomes were consistent with Solomon et al.'s [10] findings. With a variety of symptoms based on underlying genes and combinations with environmental variables, asthma is a complicated illness. Prior to the development of modern genomics technologies, research on twins and families of people with asthma revealed that the heritability of asthma

ranged from 25 to 80% [14]. The authors demonstrated how changed miRNA concentrations affect cytokine communication, which controls asthma and allergic inflammation of the airways. Therefore, the creation of treatments that target miRNA may be a potential therapeutic approach [15]. The prevalence of moderately severe asthma in individuals who have had the condition for more than ten years is influenced by the quantity of samples and geographic location (table 2).

Because of its many phenotypes, asthma is an ongoing inflammatory condition of the airways that poses serious difficulties, particularly in its severe manifestations. Recurrent flares, chronic inflammation, greater severity, and decreased response to conventional anti-inflammatory therapy are all significantly influenced by the existence of eosinophils in the passageways [6]. The current study found that asthma blood from patients had higher amounts of eosinophils than controls, which was consistent with Solomon et al.'s findings from 2023. The synthesis and stimulation of eosinophils brought on by IL-5, which is released by Th2 cells, might be the cause. Eosinophils therefore have a role in immunomodulation, inflammatory disorders, and defenses against infection. According to Li and Li [16], helminth infections and allergic responses raise eosinophil counts. According to a previous investigation, women were fewer likely than men to acquire eosinophilia; this could have been since women were more likely than men to have adult-onset asthmatic. Asthma in adults is recognized to be more frequently non-allergic than allergic. Therefore, rather than eosinophilic inflammatory processes, T2 (type 2 cytokines)-low asthma is described by neutrophilic inflammation of the airways due to the participation of non-type 2 cytokines including IL-8 and IL7 [17].

The results of this investigation demonstrated that blood IgE levels were higher among people with severe asthma than in healthy people. The outcomes were consistent with those of Qaiser et al. [18]. After adjusting for age, circulation IgE values are higher in the majority of asthmatic patients.The production of particular IgE in reaction to prominent inhalant allergens, such as those originating from molds, cockroaches, pollen particles, animal dander, and house dust insects and mites causes sensitive reactions [19]. IgE increases the number of T-cell and eosinophil development and activation by binding FcεRI on dendritic cells and improving allergen absorption and presentation to T-cells [20].

Only a few investigations have looked at the connection between the emergence of sensitization to various allergens and total IgE amounts. According to one study, the relationship between total IgE quantity and allergen-specific IgE sensitization is discussed [21]. According to a different research, those who were sensitized to both eating and inhalation allergens had considerably greater levels of total IgE than those in the non-sensitized and restaurant-sensitized groups. Furthermore, the scientists discovered that the pattern of sensitization affected the amount of total IgE [22].

Cheng et al. [23] showed increases amounts of IgE+ Eosinophil in asthma patients than controls peoples, and these outcomes were matched with our research (table 3).

The researchers observed that those with severe asthma had higher blood eosinophil counts and serum IgE concentrations. Thus, it is easy to employ these "inflammatory markers" in conjunction with other "diagnostic methods for diagnosis," "evaluating of treatment reaction," and "giving advice regarding future of severe asthma" [18]. Zhang et al. [24] shown that IgE is superior to eosinophils in determining the presence of asthma. These results aligned with the current investigation. Coumou et al. [25] demonstrated that eosinophils are a good sign for diagnosing asthma patients because of their high sensitivity and specificity (76% and 91%), which were almost identical to results that demonstrated eosinophil sensitivity and specificity were 80% and 80%. According to a another study, eosinophils' sensitivity and specificity for screening asthma patients were 74.7% and 76%, respectively [26].

An accessible and useful metric for forecasting asthma exacerbations (AEs) is variation in total serum IgE concentrations [9]. Recent investigation revealed the total IgE value is an effective indicator for screening allergic asthma in children with asthma (sensitivity 76.3% and specificity 77.8% at cut off 96.25 mg/dl) [27]. These outcomes were

lowest compared to our study that mentioned the sensitivity and specificity of IgE were (84% and 90%) at cut off 98.50 mg/dl.

Finally, present research showed IgE+Eosinophil is better indicator than IgE and eosinophil in diagnosis asthma disease because it has highest sensitivity (90%) and specificity (95%) than IgE and eosinophil. These outcomes were compatible to current investigation.

5. Conclusion

Peoples with >40 years are more dangerous for asthma occurrences than younger. Urban area is more risk for disease than rural due to it has more pollutions. Genetic predisposition play major role in asthma occurrence. Increased levels of IgE and eosinophil in astmatic diseases due to increase inflammation. Finally, IgE+Eosinophil indicator is more better in diagnosis asthma than IgE and eosinophil due to it has highest sensitivity and specificity.

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