


Original Article

Evaluation of total serum Immunoglobulin E level in leukemia patients infected with parasite infection in Kirkuk City

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Abstract

Naturally occurring human immunity to parasitic infection has been associated with Immunoglobulin E (IgE) responses against parasite allergen-like proteins. However, parasites are known to exert strong immunomodulatory effects, including regulatory cells and cytokines. Elevated IgE levels often lead to the elimination of parasites and the removal of poisons from the body. This study aimed to measure the total serum IgE levels in 100 leukemia patients with and without parasitic infection. (100) blood samples from leukemia patients after chemotherapy were used in this study. This study was carried out between September 2023 and May 2024, at Kirkuk Oncology and Hematology Center and Kirkuk General Hospital to determine the total IgE level in serum. We have noticed the presence of different types of parasites in 52 samples with leukaemia disease, the most prominent was (protozoa)Entamoeba histolytica, Blastocyst hominis, and others, (helminths) Ascaris lumbricoides, Entrobium vermicularis and seropositive toxoplasma gondii immunoglobulin G (IgG) and (48) samples that do not contain parasites. However, the mean IgE concentration in leukemia patients infected with parasites was higher (199.59ng/ml) compared to non-infected leukemia and controls at 146.56ng/ml, and 49.9ng/ml respectively. The study proved that IgE levels increased in parasitic infection in leukemia patients after chemotherapy.

Keywords: Leukemia, Immunoglobulin E, Helminth, Protozoa

Introduction

Leukaemia is a cancerous tumour that affects the haematological system and is often associated with a poor prognosis [1] Leukaemia is a condition characterized by abnormal growth of leukemic cells in the bone marrow, leading to an increased number of cells in the affected lineage in the bloodstream. In certain cases of lymphoid malignancies, abnormal cell growth in lymphatic tissue is also observed [2]. Leukaemia's are generally classified into subtypes defined by cell lineage (lymphocytic or myeloid) and stage of maturation arrest (acute or chronic) [3]. Chemotherapy and bone marrow transplantation (BMT) are the standard treatment options for these individuals.

However, the illness itself and the immunosuppressive treatments increase the risk of acquiring infections [4]. Various parasite species are associated with diarrhoea, vomiting, nausea, and depletion in humans. Patients with compromised immune systems and those undergoing immunosuppressive therapy are at higher risk of experiencing severe parasitic infections [5]. Leukemic individuals with weakened immune systems may develop opportunistic infections characterized by severe symptoms when affected by parasitosis [6, 7]. Intestinal parasite infections are significant worldwide health problems, affecting almost 25% of the global population. These infections result in a high level of sickness and mortality in poor countries [8]. The prevalence of parasites is affected by various factors, such as environmental, demographic, socio-economic, political, physiological, and immunological factors. Transmission can occur through direct contact between individuals, between animals and humans, between animals themselves, or indirectly through water, food, and possibly through air [9]. During an infection, parasite organisms produce a variety of compounds to support their metabolism and survival as parasites. Some of these molecules induce the production of specific IgE antibodies, while a small number of them cause allergy symptoms and/or increase the occurrence and severity of allergic illnesses [10].

IgE is one of the body's 5 classes (isotypes) of immunoglobulins (antibodies). IgE, like other immunoglobulins, is synthesized by B cells and plasma cells in response to an antigenic stimulus. Unlike other immunoglobulins, the concentration of IgE in the bloodstream is minimal because mast cells have a very high affinity for IgE [11]. IgE is an antibody that protects against several parasitic infections. It is widely believed that IgE and its receptors originated as a defence mechanism against metazoan parasites [12]. When IgE interacts with its high-affinity receptors FcεRI on mast cells and basophils, it activates these cells, causing the production and release of biologically active substances such as histamine and other active amines. These substances play a crucial role in facilitating the removal of parasites. Another method that assists in parasite removal is antibody-dependent cell-mediated cytotoxicity, which can be induced by IgE receptors. This process is known as antibody-dependent cell-mediated cytotoxicity (ADCC) [13].

Material & Methods

The current study was conducted at Kirkuk Oncology and Haematology Centre of Kirkuk City and Kirkuk General Hospital. Among (125) Iraqi participants p (1-79 years old) of both genders, (100) patients with leukaemia disease after chemotherapy infection were diagnosed by a consultant haematologist according to clinical signs. In addition, several laboratory tests were performed on the blood sample, including complete blood count (CBC), bone marrow biopsy to determine the type of leukaemia and flow cytometry. Then, (25) individuals appeared to be in good health (control group) during the period between September 2023 to May 2024. Each patient included in this trial had their blood, stool oral swab samples taken.

Collection of samples

Collection of blood samples

A plastic disposable syringe was used to draw intravenously blood from each participant (3ml) of venous blood collected from both genders of different ages and from the control group in a gel tube and centrifuged at 3000 rpm for 5 min. Serum was kept in Eppendorf tubes stored at 0 C until a concentration of total serum IgE was measured by the VIDAS technique.

Collection of Oral Swabs and Examination

The swap was taken by a sterile cotton swap (Transport cotton swap) containing 2ml of 0.085% of normal saline to preserve the samples until they were delivered to the laboratory for microscopic examination.

Collection of stool samples

One stool sample (2g) was taken from each study participant using a sterile, dry, and clean stool cup and examined macroscopically by naked eyes for physical characteristics such as color, consistency, volume, shape, smell, and mucus and microscopically under 400x and 1000x objective lenses. The study used a direct wet mount and concentration method for examination of protozoan cyst and trophozoite and helminth ova, larva, and adult worms.

VIDAS®Total IgE

This test was used for the detection of Total IgE level in serum using (VIDAS®Total IgE kit) with the instruments of VIDAS family (VITEK Immuno Diagnostic Assay System) as an automated quantitative enzyme-linked fluorescent immunoassay (ELFA) according to the protocols designed by the manufacture of the diagnostic kits.

Ethical approval

After obtaining official approval from the Directorate of Health in Kirkuk to conduct the study, the participants were provided with a description of the study's objectives and the procedures for gathering information from leukemic patients who visited the hospital at the beginning of the study.

Statistical analysis

Data were gathered, calculated, tabulated, and statistically analysed by using SPSS a statistical computer program with ANOVA test and T-test. Duncan's multiple range test was used to compare the differences between means under the probability level 0.05 ($P < 0.05$).

Results & Discussion

IgE is produced by plasma cells. The primary physiological function in the human body is to protect against parasites (e.g. helminths and protozoa) [14]. An alternative or complementary hypothesis suggests that the IgE's role protects against toxins, known as the 'toxin hypothesis' [15].

The results presented in Figure (1) showed significant differences ($p < 0.05$) in the mean IgE concentration in study groups in which the mean IgE concentration in leukaemia patients infected with parasites was higher (199.59ng/ml) compared to non-infected leukaemia and the control (146.56ng/ml, 49.9ng/ml respectively). The high concentration of IgE in leukaemia patients infected with parasites compared to non-parasite-infected leukaemia patients was due to a weak immune response because of the leukaemia disease, the host defence mechanism against parasites and toxins produced by parasites. It can differ depending on the type of parasite that causes infection. The activation of Th2-cells protects against parasitic infections by producing cytokine (IL-4) inducing IgE antibody production and eosinophil activation [16].

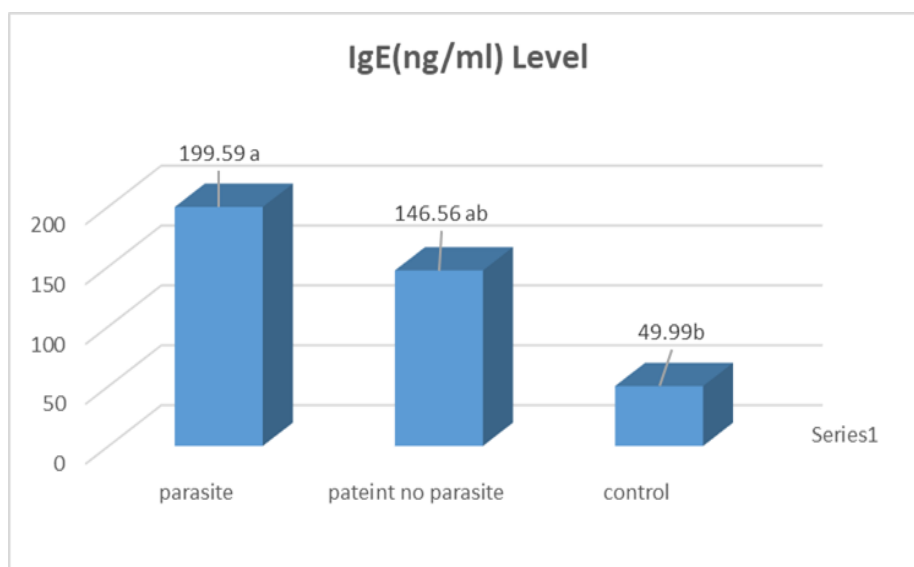


Figure 1. Mean IgE concentration in studied groups

Table 1. Level of total serum IgE among the study group

Type of parasite	Number	Mean of IgE ng/ml
E.histolytica	14	139.66 ab ±29.35
E.gingivalis	9	77.42 ab ±27.9
B.hominis	6	89.04 ab ±63.39
G.lambella	2	140.69 ab ±61.8
A.lumbricoides	2	386.31 a ±280.76
E.vermicularis	4	346.98 ab

			±332.29
Toxoplasma gondii	IgG	15	264.94 ab ±89.34
	IgM	0	0
No parasite (leukemia)		48	146.56 ab ±22.88
Control		25	49.99 b ±4.7
P-Value(<0.05)= 0.024			

* Similar letters mean that there are no significant differences between groups, at a potential level $P < 0.05$

In the current study, the results of nearly all parasites were higher than the controls (E.histolytica 139.66: 49.99 control, E.gingivali 77.42: 49.99 control, B.hominis 89.04: 49.99 control, G.lambliia 140.69: 49.99 control, A.lumbricoides 386.31: 49.99 control, E.vermicularis 346.98: 49.99 control) and seropositive toxoplasma antibody IgG 264.94: 49.99 control). So the results came in agreement with a study [17]. The concentration of IgE is caused by intestinal helminth (A.lumbricoides then E.vermicularis) higher than intestinal protozoa because of poor sanitation and poor personal personnel, helminth infections continue to be a major health challenge in developing countries, affecting especially immunocompromised patients. Helminthic parasites are too large to be ingested by phagocytosis. The cytotoxic substances released by the eosinophil granules can kill, damage, or remove the parasite as a host defense mechanism. Therefore, it is common to observe both elevated IgE levels and eosinophilia in many helminthic parasitic infections [12]. The result may agree with both studies [18, 19].

The current study revealed that the mean value of IgE in leukaemia patients without parasitic infection was also higher than the control. This may be due to chemotherapeutic drugs, such as asparaginase and monoclonal antibodies that are often administered intravenously as part of combination chemotherapy for individuals leukaemia leading to hypersensitivity reaction result after chemotherapy treatment. Yet, some drugs have the potential to induce an immune response elevating serum IgE level [20, 21]. Excessive sensitivity to medications can cause serious reactions, including anaphylaxis. Typically, this is an immune response mediated by IgE. It occurs when mast cells are activated by IgE, leading to the production and release of several chemical mediators, including histamine and certain metabolites of arachidonic acid [22]. Our result agreed with the study connected to patients with acute lymphocytic leukaemia administered chemotherapy [21].

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