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Original Article

Impact of infection with Toxoplasmosis on Serum albumin level and effect of blood transfusion in dissemination of infection in hemodialysis patients in Kirkuk city

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ABSTRACT

Background: *Toxoplasma gondii* is a worldwide parasitic disease, with a wide range of complications in immunocompromised patients such as hemodialysis patients. This study aimed to determine the associated factors for the transmission of *T. gondii* among hemodialysis patients in Kirkuk city. Materials and Methods: This study was carried out on 180 individuals (130 were hemodialysis patients and 50 were healthy controls). All serum samples were tested for *Toxoplasma gondii* immunoglobulin (IgG and IgM) antibodies by ELISA. Results: The results of hemodialysis patients showed that the seroprevalence of anti-*T. gondii* IgG and IgM antibodies was higher in the age group between 30 and 60 years and there were 66.66% for both IgG and IgM antibodies, respectively, while the seroprevalence of anti-*T. gondii* IgG and IgM antibodies in the age group > 60 years was 26.66% and 33.33% for both IgG and IgM antibodies, respectively. Yet, the lowest percentage was observed in the age group between 15 and 30 years and it was 6.66% for anti-*T.gondii* IgG without IgM (0%) in the same age group. Furthermore, a significant correlation was found between *Toxoplasma gondii* seropositivity and risk factors such as age and blood transfusion with P-values < 0.05. On the other hand, the level of serum albumin was reduced significantly in hemodialysis patients infected with toxoplasmosis compared to the healthy group in this study. Conclusions: Screening for *Toxoplasma gondii* parasites among blood donors and dialysis patients mainly by serological tests plays an essential role in preventing the transmission infection to others during blood receiving and dialysis. Additionally, the infection with *T. gondii* affected the level of serum albumin in hemodialysis patients positive for Toxoplasmosis.

Keywords: *Toxoplasma gondii*, Hemodialysis, ELISA, Risk factors, Serum albumin.

Introduction

Toxoplasma gondii is an obligate intracellular protozoan parasite that can infect humans and various mammalian species and cause a disease called toxoplasmosis [1]. *T. gondii* undergoes three infectious stages: tachyzoite (associated with acute infections), bradyzoite (indicative of chronic infections), and oocysts, generated exclusively in the final host [2]. *T. gondii* can be transmitted through various routes, including ingestion of oocysts from contaminated food or water, consumption of undercooked meat containing tissue cysts, vertical transmission from mother to fetus, organ transplantation, or blood transfusion [3]. The majority of people infected with *T. gondii* are immunocompromised individuals such as patients with AIDS, transplant recipients, and individuals undergoing hemodialysis, which can lead to significant complications and potentially life-threatening infections [4]. The exposure of blood donors to *T. gondii* is 33 % around the world [5]. Over the last two decades, the number of patients with end-stage kidney disease who need hemodialysis has grown. Such patients have immune system dysfunction, including innate and adaptive immunity. Alterations of the adaptive immunity have been demonstrated in different aspects, such as in CD4+ T cell function, CD4+/CD8+ ratio, and T cell responses to stimuli and their activation profiles leading to an increased risk of infection [6]. Albumin is a vital serum protein that plays a crucial function in human health, and it is one of the several proteins that are manufactured by the liver [3]. The diagnosis of *T. gondii* infection can be confirmed by using the serological test. Developed types of ELISA have been created to detect *T. gondii* antibodies or antigens [5]. One of the most effective methods to detect *T.gondii* antibodies is the ELISA assay. This method has the ability to detect both IgG and IgM antibodies and identify acute and chronic infection that result from this parasite in highly specificity and accuracy [6].

Materials & Methods

This study was conducted in Al-Amal Dialysis Center, Kirkuk, Iraq on 130 hemodialysis patients (55 female and 75 male patients aged 16-88 years) and 50 healthy groups (25 females and 25 males, aged 21-60 years) from September 2024 to December 2024.

Sample Collection

Approximately 3 mL of venous blood was collected from hemodialysis patients and the healthy group using a sterile syringe and placed into sterile gel tubes. The test tubes were left at room temperature for 20-30 minutes to allow the blood to clot, then centrifuged at 3000 rpm for 5-10 minutes. The sera were then put in Eppendorf tubes and stored in the freezer (-20°C) until use.

Enzyme-Linked Immunosorbent Assay (ELISA)

This test was used to detect anti- Toxoplasmosis IgM and IgG antibodies using (Sunlong Biotech Co., Ltd, China) according to the protocols provided by the manufacturer of the kits.

NeoChem 20

It is a fully automated biochemistry analyzer with an extremely accurate optical system that is comprised fiber optic. In addition, high resolution filters were designed to estimate the serum albumin by using albumin Kit (bt products, Turkii) according to the protocols provided by the manufacturer company of the kits.

Ethical Approval

At the beginning of the study, an official ethical approval to conduct the study was obtained from the Kirkuk Directorate of Health / Ministry of Health/ Iraq. The participants were informed about the purpose and procedure of collecting information from them attending Al-Amal dialysis center according to document number 703 dated September 2024.

Statistical Analysis

Data were analyzed using the Chi-square test by PRISM 7. P-values < 0.05 were considered statistically significant.

Results

The results obtained from 130 hemodialysis patients are shown in Table (1), the results of hemodialysis patients showed that the seroprevalence of anti-*T. gondii* IgG and IgM antibodies was higher in the age group between 30 and 60 years and there were 66.66%

for both IgG and IgM antibodies, respectively, while the seroprevalence of anti-*T. gondii* IgG and IgM antibodies in the age group > 60 years was 26.66% and 33.33% for both IgG and IgM antibodies, respectively. However, the lowest percentage was observed in the age group between 15-30 years, and it was 6.66% for anti-*T.gondii* IgG without IgM (0%) in the same age group.

Table 1. Relationship Between Seroprevalence of Anti-toxoplasmosis IgG and IgM Antibodies with Age Groups in Hemodialysis Patients Using ELISA Assay.

Group	IgG			Group	IgM		
	Age	Positive	%		Age	Positive	%
Hemodialysis patients	> 15 (n = 5)	3	6.66	Hemodialysis Patients	> 15 (n = 5)	0	0
	> 30 (n = 77)	30 ***	66.66		> 30 (n = 77)	4 ***	66.66
	> 60 (n = 48)	12	26.66		> 60 (n = 48)	2	33.33
	Total (n = 130)	45	100		Total (n = 130)	6	100
Healthy group	> 15 (n = 24)	9	64.28	Healthy group	> 15 (n = 24)	0	0
	> 30 (n = 26)	5***	35,71		> 30 (n = 26)	0	0
	Total (n = 50)	14	100		Total (n = 50)	0	0

***: *Indicate significance.*

From a total of 180 hemodialysis patients and the health controls, 55 received blood transfusions and all of them were hemodialysis patients. From a total of 55 hemodialysis patients who received blood transfusion, 19 of them were positive for anti-Toxoplasma antibodies IgG and IgM (17 of them were IgG and 2 were IgM), with no antibodies seen in the healthy group, as shown in tables (2 and 3).

Table 2. The seroprevalence of *Toxoplasma gondii* after to blood transfusion.

Groups	Total bloodtransfusion	Positivity	Negativity
Haemodialysis patients	55	19 (34.54 %)	36 (65.45 %)
Healthy group	0	0	0

Table 3. The seropositivity of anti-Toxoplasma antibodies IgG and IgM in hemodialysis patients and healthy group according to blood transfusion by ELISA test.

Anti-Toxoplasmosis antibodies	Haemodialysis patients	Healthy group
IgG	17 (89.48 %)	0
IgM	2 (10.52 %)	0
Total	19 (100 %)	0

There was a significant correlation found between *T. gondii* seropositivity and hemodialysis patients who received blood transfusion with P-values of < 0.05. As can be seen from the table (4), the mean of serum albumin level in hemodialysis patients +ve toxoplasmosis was 3.610±0.3684 g/dl, while the means of serum albumin level in both hemodialysis patients -ve toxoplasmosis and healthy group were 3.560±0.3605 g/dl and 4.190±0.4072 g/dl, respectively. It is apparent from this study that the infection with toxoplasmosis lead to a significant decrease in the mean level of serum albumin (P < 0.05).

Table 4. The mean level of Serum albumin in hemodialysis patients and healthy groups according to presence of Toxoplasmosis antibodies.

Parameters	Hemodialysis with Toxoplasmosis +ve Mean±SD	Hemodialysis with Toxoplasmosis –ve Mean±SD	Healthy group Mean±SD
Serum albumin	3.610±0.3684***	3.560±0.3605	4.190±0.4072

*** *Indicate significant, Normal range serum albumin: 3.5 – 5.5 g/dl.*

Discussion

One of the zoonotic diseases affecting one-third of the world's population is toxoplasmosis, caused by *T.gondii* which affects immunocompromised patients, especially hemodialysis patients, sometimes leading to death [6,7].

In the present study, it was found that the seroprevalence of anti-*T.gondii* IgG and IgM antibodies was higher in the hemodialysis patients in the age group between 30- 60 years. This may be due to the infection with these parasites that stimulate immunological sensors, that recognize structural components of *T. gondii*. This can generate pro-inflammatory cytokines and chemokines that result in activation of immunological sensors for targeting and elimination of the parasite. Therefore, previous infection with toxoplasmosis is responsible for decreased seroprevalence with age as a result of memory immunity to infection [8,9]. These results confirmed Fallahi Zadeh *et al*. and Nafal *et al*. who reported a higher seroprevalence of anti-*T. gondii* in the age group above 30 years [9,10]. In contrast, the result of this study did not confirm a previous study conducted in Dyiala and Kirkuk by Maysalon *et al*. and Hamad *et al.* [11,12]. Another important result of this study was the impact of blood transfusion as a risk factor for transmission of *T. gondii.* It was found that from the total 130 hemodialysis patients, 55 of them received blood transfusion and from these patients, 19 were positive for anti- Toxoplasma antibodies IgG and IgM (17 of them were IgG and 2 were IgM).

Several routes have been implicated in the transmission of *T. gondii,* including blood transfusion. A transfusion-transmissible infection is defined as the transmission of an infection from one person to another through blood transfusion including neonates, pregnant women, and immunocompromised patients [13,14]. One reason for the dissemination of Toxoplasma among Iraqi patients, especially hemodialysis patients, is the lack of a mandatory screening test for detection of this parasite. In addition, blood donors infected with *T. gondii* are asymptomatic, with no clinical symptoms, that are considered major health concerns [13]. These findings support the idea that *T. gondii is* transmitted through blood donors [5,13,15]. However, these results disagree with Moawad *et al*. who reported no significant correlation found between *T. gondii* seropositivity and blood transfusion [16].

Moreover, Toxoplasmosis infection may result in kidney and liver tissue damage which leads to change of the values of some physiological parameters, such as enzymes and some blood elements, which are present in most cells and tissues of the body, especially the liver, kidney, and muscles [17,3]. One of the main functions of the albumin in the body is reduced fluid accumulation that lead to edema and prevents body swelling and maintaining organ functions [18]. In order to assess the association between serum albumin with toxoplasmosis infection, serum albumin was measured in both hemodialysis patients and healthy groups. It was observed that there was a significant decrease in serum albumin level in hemodialysis patients infected with *T. gondii*, although their levels were still within normal range borderline compared to the healthy group. This might be explained by mild effects of toxoplasmosis on serum albumin in hemodialysis patients. This result match to previous observation of study carried out in Baghdad city by Mohammed *et a.l* which found that the serum albumin level decreased in patients infected with *T.gondii* [19].

Conclusion

Screening for *T. gondii* infection in hemodialysis patients and blood donors is mainly done through serological tests that are required by law. We recommend that dialysis patients be regularly screened for *T. gondii* infection as part of their routine care. This will prevent the transmission of the infection to others during hemodialysis and reduce mortality. Also, infection with *T. gondii* affected the level of serum albumin in haemodialysis patients positive for Toxoplasmosis.

Conflict of Interest

The authors declare that there is no competing of interests.

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