

Seroprevalence of *Toxoplasma Gondii* among Cancer patient in Qena Governate

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Abstract

Background: Toxoplasmosis is one of the most important cosmopolitan life-threatening diseases in immune-compromised patients. It is caused by an intracellular protozoon: *Toxoplasma gondii* (*T. gondii*), this parasite can cause pneumonia, encephalitis or disseminated disease in immune-deficient patients.

Objectives: This study aimed to evaluate the prevalence of toxoplasmosis in Egyptian cancer patients and to correlate the prevalence with type of malignancy and the different cancer treatment modalities.

Patients and Methods: This study conducted on 100 cancer patients (21 male and 79 female) who attended the Oncology Outpatient Clinic of Qena University Hospital and diagnosed by cancer, receiving chemotherapy or both chemotherapy and radiotherapy, and their ages ranging from 20 year to 76 years from January 2019 until December 2020.

Results: The high incidence of Toxoplasmosis was among cancer breast patient. The mean of Ig M titre is 0.849 with minimum level is 0.15 and maximum level is 10.43. There were 70 cancer patients undergoing chemotherapy, 6 of them were positive for toxoplasma Ig M (8.7%), but 30 of whom received chemotherapy and radiotherapy, 11 of whom were infected (36.7%) according to the IgM level.

Conclusion: Patients with a positive result are at risk of reactivation of the infection, while patients with a negative result should be informed to prevent primary infection.

Keywords: Seroprevalence; *Toxoplasma gondii*; Cancer; Qena Governate

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DOI: 10.21608/SVUIJM.2021.64617.1096

Received: 1 January, 2021.

Revised: 7 February, 2021.

Accepted: 23 February, 2021.

Published: 29 January, 2024

Cite this article as: Osama Hussein Abd Ellah, Asmaa Hamdy Mobarak, Mohamed Mostafa Ali Wahman, Eman Abd El Azeem, Asmaa M Elkady (2024). Seroprevalence of *Toxoplasma Gondii* among Cancer patient in Qena Governate. *SVU-International Journal of Medical Sciences*. Vol.7, Issue 1, pp: 245-250.

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Introduction

Toxoplasma gondii is the most frequent protozoan causing opportunistic infections in immunocompromised individuals which is an obligate intracellular that infects up to one-third of the world's population (Hosseinejad et al., 2018).

Humans acquire *T. gondii* infection by ingesting the undercooked meat of intermediate hosts containing tissue cysts, especially pork and lamb, or by the ingestion of water or food contaminated by oocysts from the definitive hosts (Hill et al., 2018) . Toxoplasmosis can present with different signs and symptoms. In immunocompetent individuals, infection is mostly self-limiting because a competent immune system limits the dissemination of the rapidly multiplying tachyzoite stage (Cong et al., 2015) .

Immunocompromised individuals, especially those with deficiency in cellular immunity as Patients with cancer, most susceptible to be infected (Wang et al., 2015). Cancer is a leading cause of death worldwide, accounting for approximately 7.6 million deaths (13% of all deaths) in 2008(Cannon et al., 2012) . Deaths from cancer worldwide are found to continued rising, with an estimated 11 million deaths in 2030 according to(WHO)criteria (WHO,2011) .

Low gamma globulin levels and impaired cellular immunity have been noticed in cancer patients, which may be pathogenetic mechanisms for development of *T. gondii* infection in those patients (Imam et al., 2017) . Serologic evidence (IgG + IgM) of *T. gondii* infection was found to correlate with many cancer diseases such as leukemias and cancer of lung and larynx. Serologic evidence of *T. gondii* infection among cancer patients followed by confirmatory tests and specific treatment, commonly, results in changes of life quality for the patient group with active

toxoplasmosis. Cancer patients who are seronegative for *T. gondii* infection could get benefit from advice on preventive measures, to bypass seroconversion that may lead to active severe toxoplasmosis(Imam et al., 2017).

Patients and methods

In the present study, after approval from the scientific ethics committee and obtaining an informed written consent,100 blood samples taken from patients who diagnosed with cancer at Oncology Outpatient Clinic of Qena University Hospital from January 2019 until December2020.

Each sample was examined using Enzyme-linked immunosorbent assay (ELISA) kits(KEWEI DIAGNOSTIC- REF NUM 600780) for detection of *toxoplasma gondii* IgG and IgM antibodies. Briefly 3ml of venous blood was withdrawn from each patient using sterile syringes and was evacuated in a plain tube which is labeled with patient name, age and cancer type. Then blood samples was centrifuged to collect serum which was examined using Enzyme-linked immunosorbent assay (ELISA) kits.

Statistical analysis

Data were analyzed using IBM SPSS Statistics for Windows version 25.0 and Medcalc version 15.8.0. Quantitative data were expressed as mean \pm standard deviation. Qualitative data were expressed as number and percentage. Chi-square (χ^2) test and Fisher's Exact Test were used for comparison regarding qualitative variables as appropriate.

Results

This study conducted on 100 patients (21 male and 79 female) who diagnosed with cancer at Oncology Outpatient Clinic of Qena University Hospital and their ages ranging from 20 year to 76 years from January 2019 until December2020.

Table .1. Gender distribution According to Ig G

Sex	Number of tested patients	Number of infected patients & %	
		Number	%
Male	21	10	47.6%
Female	79	30	38.5%

The Numbers of male patients were 21 cases (21%) with 10 cases were infected (47.6%) ,female patients were 79 cases (79%) with 30 cases were infected (38.5%) according to IgG level.

Table 2. Gender distribution According to Ig M

Sex	Number of tested patients	Number of infected patients & %	
		Number	%
Male	21	4	19%
Female	79	13	16.7%

(Table .2) Showing, numbers of male patients were 21 cases (21%) with 4 cases were infected (19%) ,female patients were 79 cases(79%) with 13 cases were infected (16.7%) according to IgM level.

Table 3. Relation between patient factor and Ig M

Variables		IgM		P value
		Positive	Negative	
age		57.8±12.8	55.1±12.3	0.411
Sex	Male	4(23.5%9)	17(20.7%)	0.001*
	Female	13(67.5%)	65(79.3%)	
Treatment	Chemotherapy	6(35.3%)	63(76.8%)	0.957
	Chemotherapy and radiotherapy	11(64.7%)	19(23.2%)	

The outcome of IgM titre is positive with patients 57.8+12.8 years of age, males percentage is (23.5 %) and females percentage (67.5%) and in those patients undergoing chemotherapy (35.3 %) and that receiving chemotherapy and radiotherapy 11(64.7%) according to (Table .3).

It is negative for patients aged 55+12.3, (20.7) of them were male and females (79.3)

and percentage of patients that receiving chemotherapy was(76.8) and in those receiving chemotherapy and radiotherapy (23.2). p value = 0.001, which is significant value for gender, but are (p value =0.411 , 0.957 which are non-significant values) for age and treatment line .

Table.4. Relation between type of cancer and IgG titre

Variables	Ig G		P value
	Positive	Negative	
brain glioma and ovarian cyst	0	1(1.7%)	0.505
breast cancer	21(52.5%)	30(50.8%)	
cancer prostate	0	1(1.7%)	
celenic carcinoma	0	1(1.7)	
chronic myeloid leukaemia	4(10%)	3(5.1%)	
colon cancer	1(2.5%0	5(8.5%)	
gall bladder cancer	1(2.5%)	0	
gastric cancer	2(5%0	3(5.1%)	
glioblastoma multiforme	0	1(1.7%)	
hepatic cell carcinoma	5(12.5%)	2(3.4%)	
Hodgkin lymphoma	1(2.5%)	4(6.8%)	
lung cancer	2(5%)	4(6.8%)	
Lymphoma	0	2(3.4%)	
ovarian cancer	1(2.5%)	1(1.7%)	
renal cancer	0	1(1.7)	
urinary bladder cancer	1(2.5%)	0	
uterine cancer	1(2.5%)	0	

(p value=0.505 which is not a significant)

Table 5. Relation between type of cancer and Ig M

Variables	Ig M		P value
	Positive	Negative	
brain glioma and ovarian cyst	0	1(1.2%)	0.007*
breast cancer	3(17.6%)	48(58.5%)	
cancer prostate	0	1(1.2%)	
celenic carcinoma	1(5.9%)	0	
chronic myeloid leukemia	5(29.4%)	2(2.4%)	
colon cancer	1(5.9%)	5(6.1%)	
gall bladder cancer	0	1(1.2%)	
gastric cancer	1(5.9%)	4(4.9%)	
glioblastoma multiforme	0	1(1.2%)	
hepatic cell carcinoma	1(5.9%)	6(7.3%)	
Hodgkin lymphoma	1(5.9%)	4(4.9%)	
lung cancer	1(5.9%)	5(6.1%)	
Lymphoma	1(5.9%)	1(1.2%)	
ovarian cancer	1(5.9%)	1(1.2%)	
renal cancer	1(5.9%)	0	
urinary bladder cancer	0	1(1.2%)	
uterine cancer	0	1(1.2%)	

(Table .5) Shows the relation between the type of cancer and IgM titers

(p value = 0.007, which is a significant value).

Discussion

Toxoplasma gondii is an obligatory intracellular protozoal parasite, which infects almost all mammalian include humans.

Although most infections are clinically asymptomatic, in immunocompromised patients, it can cause severe clinical manifestations and even death (Schlüter et al., 2014).

It is a big disaster that the cancer patients were seropositive for *T. gondii* test. The cancer may induce severe opportunistic parasitic disease in anticancer treatment process.

The immune system plays an important role in controlling and clearing parasitic infections (Sanad et al., 2014). Some of these parasitic infections in the immunodeficient hosts could be more hostile and life threatening (Mohammedi et al., 2014).

The present study focused on evaluating the current status of toxoplasmosis in Egyptian cancer patients, in correlation with the type of malignancy and the type of treatment they receive.

This study conducted on 100 patients (21 male and 79 female) who diagnosed by cancer at Oncology Outpatient Clinic of Qena University Hospital and their ages ranging from 20 year to 76 years from January 2019 until December 2020.

This study shows that, the prevalence of *T. gondii* was higher in females (75%) than males (25%) with no significant relation between sex and IgG level, but for IgM level and sex the prevalence of *T. gondii* was higher in females (67.5%) than males (23.5%) with significant statistical difference (p value 0.001), this difference due to high numbers of female patients (79 cases) who mostly diagnosed with breast cancer (51 cases) which may be attribute to direct contact of females (mostly house wives) sources of infection as domestic cats, meat, knifed chicken or rabbits. In accordance with (Mostafa et al., 2018) who recorded 90.9% and 30% anti-*Toxoplasma* IgG antibodies in females and males, respectively.

This result may be attributed to more susceptibility of females to indoor activities

dealing with raw or undercooked meat, raw unwashed fruits or vegetables and/or farming and their greater proximity to cats as well as other animals during daily cleaning activities. Also this agree with (Walle et al., 2013) Who reported that females were more affected than males infected patients. In contrast, some studies reported statistically significant higher infection rate of *T. gondii* in males than in females (Shimelis et al., 2009) (Jones et al., 2014). Also in a study done by (Abdel Malek et al., 2018), the prevalence of *T. gondii* was higher in males (18%) than females (16%) with no significant difference. This may be due to the increased risk of exposure of males due to more outdoor activities and the habit of eating fast foods. This goes in agreement with the work of (Wang et al., 2015) who also found a higher prevalence of toxoplasmosis in males with no significant statistical differences in gender (male, 8.96%; female, 7.45%, P = 0.4).

In our study, there was significant relation between type of cancer and IgM level but with no significant relation between type of cancer and IgG level. The high incidence of Toxoplasmosis is among breast cancer patient about 52% then hepatocellular carcinoma and chronic myeloid leukemia (CML) about 7% of all cancer patients included in this study. This agrees with (Mostafa et al., 2018) who found the highest positivity of IgG was in breast cancer and bone carcinoma (80%).

In the study of (Yuan et al., 2007) revealed higher positivity rates of toxoplasmosis in Chinese cancer patients. He also found that patients having rectal and nasopharyngeal tumors had significantly higher rates of positive anti-*Toxoplasma* IgG than the other cancer groups, the prevalence of *T. gondii* in these study was higher in patients having solid organ tumors (24%) than in patients with hematological malignancies (12%) but this difference was not statistically significant (p=0.06). Leukemic patients contribute the highest percentage of positive IgG results (22%), followed by lymphoma (14.4%), breast cancer (7.3%), lung carcinoma (3.5%) in the study of (Nimir et al., 2010). Moreover, the type of treatment doesn't seem to affect the prevalence of *T. gondii*.

Limitation of this study: One of the limitations of this study is that all the patients

were recruited from only one hospital, further studies including centers from different parts of the country are needed. Also, the small number of study population was another limitation.

Conclusion

Cancer patients showed a significantly higher rate of infection with *T. gondii*. For that reason, we recommend the inclusion of a screening test for toxoplasmosis in their routine workup.

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