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ORIGINAL ARTICLE

Relation between Toxoplasmosis and Suicidal attempts among Patients attending to Mansoura University Toxicology Unit

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ABSTRACT

Toxoplasma gondii is an intracellular neurotropic protozoa. Previous studies showed a relation between toxoplasmosis sero-positivity and psychiatric illnesses. In this study, toxoplasmosis was screened in 130self poisoned persons attended to Mansoura Emergency Hospital and other 91 volunteers to study toxoplasmosis as a risk factor for suicidal attempts. Prevalence of toxoplasmosis in the studied population was 41.2%. A statistically significant higher prevalence was found in self poisoned persons in comparison to controls (p-value <0.0001). For the precipitating suicidal factors, Family, financial and work troubles were representing (46 %, 30 % and 5% respectively). Only 23 cases (19%) of cases gave history of psychiatric illnesses (5 Schizophrenics, 9 with depression, 8 were substance abusers, while 2 showed other mental illnesses). Cases with history of psychiatric illnesses showed statistically significant higher anti-toxoplasma IGg antibody titer (p-value=0.0008). There was no statistically significant difference in IGg titers among patients with single and repeated suicidal attempts (p-value=0.358). Also according to the toxicity severity score, patients with psychiatric illnesses were graded as 3 and4 with more serious intentions to die. These results suggest toxoplasmosis as a risk factor for suicidal attempts in both psychiatric and healthy persons.

Key words; *Toxoplasmosis, Suicide, deliberate self poisoning and toxoplamosis IGg.*

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INTRODUCTION

Toxoplasma gondii (T. gondii) is a highly successful global pathogen that is remarkable in its ability to infect nearly any nucleated cell in any warm-blooded animal. Infection with T. gondii typically occurs through the ingestion of contaminated food or water, but the parasite then breaches the intestinal epithelial barrier and spreads from the lamina propria to a large variety of other organs in the body (Harker *et al*.,2014). Also Infection occurs when tissue cysts in raw or undercooked meat from an infected eaten animals. Infection can also occur by ingestion of food or water contaminated with Toxoplasma eggs from feces of infected animals (Remington *et al*., 2004).

While the aetiology for most psychiatric disorders remains unknown, the possible role of some infectious agents in inducing behavioural changes in animal and human models has gained increasing research interest in recent times, especially *T gondii* parasites as they are neurotrophic intracellular pathogens (Flegr, 2013).

Previous studies showed a relation between the toxoplasmosis sero-positivity and psychiatric disorders (Torrey *et al*., 2007, Pearce *et al*., 2012 and Flegr, 2013). The effects of toxoplasmosis on the human culture and self violence were also shown in further studies (Laffetry, 2006and Pedersen *et al*., 2012).

In this study we have investigated toxoplasmosis in suicidal cases attending to Mansoura University Emergency Hospital (toxicology unit) to study the role of toxoplasmosis in association with the other suicidal factor in generation of suicidal attempts among healthy and psychotic patients with suicidal trials attending to the toxicology unit.

PATIENTS AND METHODS

Methods

The study was conducted in the toxicology unit of Mansoura University Emergency Hospitals, Dakahlia, Egypt. The study was undertaken between January 2013 and November 2013. The facility is draining a large area of the Egyptian Delta and is a referral center for toxicology cases in 4 different governates of about eight millions habitants.

Study population

The study was designed and conducted after approval from Mansoura Faculty of Medicine research ethical committee. Signed informed consents were taken from all persons involved in the study as controls or self poisoned patients.

121 self poisoned patients attending to the emergency hospitals toxicology units were included in the study. In Parallel toxoplasmosis IGg titer was assayed in other health 100 volunteers of matching age, sex and residency with the poisoned patients. To be included in the study, controls must not have had a current or past history of a psychotic disorder or previous trials of self harm. No stipend was provided, however controls were informed about their own toxoplasmosis titer results.

For self poisoned patients, history was taken from the patients themselves or their relatives or friends. History included the taken toxic agent and the predisposing suicidal factor. Active toxicological first aid measures were done, followed by supportive treatment and antidotal therapy when indicated. Admissions were done when indicated. A standardized scale for grading the severity of poisoning were used to assess the severity of toxic ingestions (Perrson *et al*., 1998)

Adequate history was taken considering risk factors for exposure to toxoplasmosis in both patients and controls including; history of blood transfusion, contact with domestic cats and eating outside fast meals.

All studied cases were evaluated for psychiatric disorders using The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (American Psychiatric Association, 1994)

From each individual who satisfied the study inclusion criteria, Two milliliters of blood samples were collected into potassium EDTA sample containers, mixed and allowed to stand for 2–5 minutes, after which samples were spun and plasma separated into plain sample containers. The tests were run immediately and in cases where the assay could not be performed immediately, the samples were kept frozen till assay.

Data analysis

The statistical procedures were performed using Prism (GraphPad Software Inc., San Diego, CA). Continuous and categorical comparisons performed using the student t-test and chi-squared tests. Fisher exact tests were used where necessary. Level of significance was set at $P<0.05$.

RESULTS

Demographic and clinical characteristics of cases and controls:

Our study included 121self-poisoned patients, who attended or refereed to Mansoura Toxicology unit patients as cases and other 100 volunteers who satisfied the inclusion criteria of our study. Socio-demographic data of all participants are shown in table (1). Almost the socio-demographic data is matched between both groups.

For analysis of toxic agents taken by the cases; organophosphates were the commonest (14.5% of cases) followed by drugs overdoes. Among drugs overdose poisoned patients; multiple drugs co-ingestion and oral hypoglycemic alone were the commonest (7.4% of cases for each). Other drugs as paracetamol (6%), antipsychotics (5.4%), antidepressants (5.2%) digitalis (4.9%), beta-blockers (4.5%) and calcium channel blockers (4.5%) were also involved.

According to the poisoning severity scaling for the poisoned patients (121 cases); 35 cases (29%) were zero graded with no symptoms. 37 cases (30.5%) were graded as grade minor cases with Mild, transient and spontaneously resolving symptoms (mostly presented with vomiting). 40 cases (33%) were represented by pronounced and prolonged symptoms and were scored as garde 2 (moderate cases) of toxicity and they were in need for urgent medical interventions and appropriate antidotal therapies were given in some cases with admissions, when indicated, in the inpatient wards. The remaining 9 cases (7.5%) were represented with life threatening conditions (mostly respiratory) and admitted, urgently, in intensive care unit (ICU) to receive the appropriate therapies and care.

Prevalence of toxoplasmosis among the studied population:

Our results regarding toxoplasmosis titer among the studied groups revealed that only 91 cases (41.2%) were sero-positive and the remaining 130 (58.8%) cases were sero-negatives. Regarding the risk factor of toxoplasmosis, our data showed statistically significant difference between sero-positive and sero-negative cases according to history of blood transfusion (P-value=0.0017). Also history of contact with domestic cats

showed statistically significant difference between the 2 fore-mentioned groups (P-value=0.0034). Furthermore Toxoplasmosis was more prevalent in individuals with low educational level (P-value=0.002) (table 2).

Table (1): Demographic data of persons involved in the study

Parameter	Controls	Cases
Total number	100 (100%)	121 (100%)
Age Mean (SD) Range	 29.4(7.9) Yrs 17-50 Yrs	 28.6(7.2) yrs 15-45 yrs
Gender Female Male	 58 (58%) 42 (42%)	 81 (66.9%) 40 (33.1%)
Residency Rural Urban	 56 (56%) 44 (44%)	 68 (56.2%) 53 (43.8%)
Employment Employed Nonemployed	 42 (42%) 58 (58%)	 50 (41.3%) 71 (57.7%)
Education Non educated High school graduate and students University graduate and students	 19 (19%) 53 (53%) 28 (28%)	 21 (17.3%) 57 (47.1%) 43 (35.5%)
History of blood transfusion Yes No	 9 (9%) 91 (91%)	 11 (9%) 110 (91%)
History of eating out doors Yes No	 24 (24%) 76 (76%)	 32 (26.4%) 88 (73.6%)
Contact with cats at home Yes NO	 59 (59%) 41 (41%)	 72 (59.5%) 48 (39.5%)

Table (2): Association between the history data and risk of toxoplasmosis infection

Parameter	Infected 91 cases (100%)	No infected 130 (100%)	Fisher exact p-value
Gender Female Male	 61 (67%) 30 (33%)	 78 (60%) 52 (40%)	0.395
Residency Rural Urban	 50 (54.9%) 41 (45.1%)	 74 (57%) 56 (43%)	0.784
History of blood transfusion Yes No	 15 (16.5%) 76 (83.5%)	 5 (4%) 125 (96%)	0.0017**
History of eating out doors Yes No	 23 (25.3%) 68 (74.7%)	 33 (25.4%) 97 (74.6%)	1
Contact with cats at home Yes NO	 45 (49.4%) 46 (50.6%)	 90 (69.2%) 40 (30.8%)	0.0034**

Relation between toxoplasmosis and suicidal attempts:

Our results reported a statistically significant difference between both groups in IGg toxoplasmosis titer as shown in table (3) with higher prevalence of sero-positivity and high titers among the self-poisoned patients. Interestingly, 77% of cases involved in our screen with high titer (>1/64 and >1/128) have attended to the unit with suicidal attempt.

Only 24 cases (19.8%) of cases gave history of psychiatric disorders; (5 Schizophrenics, 9 with depression, 8 were substance abusers, while 2 showed other mental illnesses). Interestingly, there was high statistically significant difference in toxoplasmosis IGg titer between patients who gave history of psychiatric disordersand patients with negative history of psychiatric disorders (P-value =0.0026) (table 4). Moreover,

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according to the toxicity severity score, patients with psychiatric disorders were scored as grade 3 (14 cases) or grade 4 (10 cases).

For Patient with suicidal attempts without any psychiatric disorders, the precipitating suicidal factors were mainly family, financial, educational troubles and others (55.1 %, 12% 7.1% and 6 % respectively).

In the present study, 67 (55.4%) cases reported history of previous suicidal attempts. There was no statistically significant difference in toxoplasmosis titer among patients with single suicidal attempts and other presented to us with the first suicidal trial (P-value=0.358). Apart from five cases, all cases (78.3%) with psychiatric disorders have reported previous suicidal attempts. It is also of interest to mention that toxoplasmosis titers were significantly correlated with the severity of grading scored by poisoning severity score (PSS) (P-value=0.002 and r=0.76; Spearman rank correlation).

Table (3): Toxoplasma titer of persons involved in the study

Titer	Controls (100)	Cases (121)	Chi-square p-vlue
<1/16	76 (76%)	54 (44.6%)	0.0002***
>1/16	6(6%)	14 (11.5%)	
>1/32	8 (7%)	20 (16.5%)	
>1/64	7 (7%)	23 (37.4%)	
>1/128	3 (3%)	10 (8.3%)	

Table (4): Precipitating factors of suicidal attempts in relation to toxoplasma IGg titer:

Type	Cases number (121)	Toxoplasmosis IGg titer					P-value
		<16	>1/16	>1/32	>1/64	>1/128	
Suicidal attempts Patients without Psychiatric disorders	97 (80.2%)	50	12	15	15	5	
Suicidal attempts Patients with Psychiatric disorders	24 (19.8%)	4	3	4	8	5	0.0026**
Depression	9 (7.4%)	1	1	1	3	3	
Schizophrenia	5 (4.1%)	0	2	1	0	2	
Substance abuse	8 (6.6%)	2	0	1	5	0	
Others	2 (1.5%)	1	0	1	0	0	

DISCUSSION

This work was conducted to investigate the relation between toxoplasmosis IGg sero-positivity and the suicidal attempts among self-poisoned cases attended to Mansoura University Emergency Hospital. In our study, self inflicted poisoning was more common in females (66.9% of cases) with more incidence of organophosphates as used toxic agents. This finding is in agreement with Gad ElHak *et al. (2009)* who showed that toxic ingestion of organophosphates rodenticide is more common in females representing about 46% of females suicidal deaths. Mostly toxic ingestion is preferred by female as a suicidal method as it is less painful than other methods as hanging, cut radials, firearms injuries or chest stabs.

In this work, suicidal attempts were more prevalent in middle age group ranging between 20–30 years old. This is in agreement with data of other studies as Gad ElHak *et al*. (2009), Séguin *et al*. (2006) and Parente *et al*. (2006). This may be attributed to lake of life experience and age specific problems related to this age group.

We have found that 41 % of the whole studied participants sero-positive toxoplasmosis IGg. Internationally, a wide range of sero-prevalence of toxopasmosiswas reported in humans and animals among countries depending on their geographic location and patterns of lifestyle. Shin *et al*., (2009) had reported only 6.7 % of toxoplasmosis seroprevalence in Korea while seroprevalence up to 68.6% was found in Brazil (Sroka *et al*., 2010).

According to our study we have found that incidences blood transfusion and contact with domestic cats were significantly higher in sero-positive groups of participants of the present study. Moreover, lower educational level was associated with higher incidence of toxoplasmosis. These finding are in accordance with previous studies (Mostasavi *et al*., 2011 and Baquero-Artigao *et al*., 2013).

In contrast to Andiappan *et al*. (2014), our study did not show significant difference in ages among sero-positive and negative toxoplasmosis groups as we were targeting matched age group with the self poisoned patients which were mainly belonging to the middle age group. We did not find difference

between both groups regarding eating outdoors as restaurant fast meals become commonly used by this middle age group.

Our study showed significant association between anti-TG ICg seropositivity and suicidal attempts regardless presence or absence of psychiatric illnesses. Our findings are in accordance with previous studies. Pederssen *et al*. (2012) reported that females with toxoplasmosis are 54% more likely to attempt suicide than sero-negative women. Moreover,Ling *et al*. (2011) have reported higher incidence of suicidal attempts among sero-positive women specially in older age groups (postmenopausal) even in immune-competent women.

Moreover, anti-TG IGg titer in the studied cases was correlated to suicidal attempts as 77 % of self poisoned cases involved in the study with high toxoplamaI Gg titer (≥1/64). This is also in accordance with Pedressen *et al*. (2012) as they stated that persons with high titer for toxoplasmosis are 91% more common to attempt suicide in comparison to the non-infected women.

According to our results anti-TG IGg sero-positivity was significantly higher in self poisoned cases with psychiatric illnesses in comparison to the others committed suicidal trials with no psychiatric illnesses. This is similar to the previous data showing a correlation between schizophrenia and toxoplasmosis titer (Torrey and Yolken, 2003 and Mortensen *et al*., 2007), even other studies showed that antipsychotics lower the toxoplasmosis titer in relation to control of psychosis among psychic patients (Jones-Brando *et al*. 2003). Also latent toxoplasmosis was reported to cause personality changes (Flegr *et al*. 1996), psychomotor performance(Havlıcek *et al*. 2001) and also decreased intelligence was reported by Flegr *et al*. (2003). Neuropathological studies have showed that astrocytes were affected in both toxoplasmosis and schizophrenia (Halonen *et al*. 1996; Cotter *et al*. 2001), regarding their levels of dopamine, serotonin, norepinephrine and other neurotransmitters. Torry and Yolken (2003) meta-analysis revealed that 18 of the 19 studies showed higher TG prevalence within schizophrenia patients than controls.

According to the toxicity severity score, the present study showed that patients with psychiatric illnesses were grade 3 (13 cases) or grade 4 (10 cases), which means that death was the intention (not only self harm or attraction of others sympathy)with more marked significant toxic ingestion of organophosphates and drugs over-doses. Also more significant toxic ingestions were observed in sero-positive cases as they were representing majority of the cases scored as moderate and severe according to PSS. This also means that there were more intention to die or they tried to be kept away from their family or friends by locking doors and their attempts were mainly late at night or early morning, so they were brought to the toxicology unit after longer periods from ingestion. This delay has decrease the role of decontamination to remove as much as possible of the toxic ingestion and so more amount of toxic agents were absorbed with more severity in the toxic manifestations.

To conclude our results, our data showed significant association between toxoplasmosis titer of IGg and suicidal attempts among self poisoned patient attended to Mansoura Emergency Hospital Toxicology Unit. Our data showed also significant association between toxoplasmosis and mental illnesses (schizophrenia and depression). Also we found association between toxoplasmosis titer and severity of toxic ingestion. Main limitation of this study was the fact that we did not screen for the presence of other viral infections as the Human Immunodeficiency Virus (HIV) which increases susceptibility to infection or re-infection with the protozoanT. Gondii but we have very low prevalence of HIV in Egypt. So it is not expected that HIV will affect robustness of the present data. We recommend other larger studies for association between toxoplasmosis and other methods of suicidal, which are expected to support our results and hypothesis.

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