PERIÓDICO TCHÊ QUÍMICA
ARTIGO ORIGINAL

TOXOPLASMOSE E PERTURBAÇÃO CONGENITA

TOXOPLASMOSIS AND CONGENITAL DISTURBANCE

داء المقوسات والاضطرابات الخلقية

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RESUMO

A infecção da toxoplasmose é causada por parasitas protozoários intracelulares chamados *Toxoplasma gondii*. O animal e o humano podem sofrer as infecções por diferentes vias. Algumas pessoas com status imunocomprometido estão em alto risco de infecção; exemplos desses grupos são gestantes, fetos e recém-nascidos. Este estudo teve como objetivo avaliar o papel da infecção por toxoplasma na manifestação de abortos e outros distúrbios congênitos entre mulheres casadas com idades entre 18 e 45 anos na cidade de Maysan (no sul do Iraque). Os critérios de inclusão incluem o grupo de estudo com histórico de infecção por *Toxoplasma gondii* (100 mulheres) e, para controles, aqueles que estavam livres de toxoplasmose (100 mulheres). Os critérios de exclusão foram gestantes, solteiras e portadoras de doenças imunossupressoras. As amostras de soro foram testadas quanto a IgG e IgM contra antígenos de *Toxoplasma gondii* usando o sistema de imunoensaio automático Biomerieux Mini VIDAS, que dependia do princípio da tecnologia *Enzyme Linked Fluorescent Assay* (ELFA). O estudo revelou que as mulheres não abortadas infectadas eram 14 (14%), enquanto as mulheres não abortadas não infectadas eram 24 (24%). As mulheres infectadas com um caso de aborto foram sessenta (60,0%), enquanto as mulheres não infectadas com um caso de aborto foram 40 (40,0%). As mulheres infectadas que tiveram dois casos de aborto e aquelas infectadas que tiveram mais de dois casos de aborto foram 26 (26%) e 14 (14%), respectivamente. Houve diferença estatisticamente significante entre mulheres infectadas e não infectadas em relação ao aborto ($p < 0,01$). Verificou-se que houve diferenças altamente significativas entre mulheres infectadas e não infectadas em relação a anomalias e partos por cesariana (valor de $p = 0,001$). Houve diferença estatisticamente significante (valor de $p = 0,01$) entre mulheres infectadas e não infectadas em relação ao parto com ou sem bebês prematuros.

Palavras-chave: *Toxoplasma gondii, abortos, anomalias, cesarianas, bebês prematuros*

ABSTRACT

Toxoplasmosis is a disease caused by intracellular protozoan parasites called *Toxoplasma gondii.* The animal and human could suffer from infections through different routes involving diets, non-hygienic habit, contacts to soil, as well as blood transfusions and organs grafting. Some people with immune-compromised status are at a high risk of infection; examples of these groups are pregnant women, fetuses, and newborns. This study aimed to evaluate the role of Toxoplasma infection in the manifestation of abortions and other congenital disturbances among married women aged 18 to 45 years in Maysan city (in the south of Iraq). Inclusion criteria include the study group with a history of infection with *Toxoplasma gondii* (100 females) and for controls, those who were free from toxoplasmosis (100 females). Exclusion criteria were pregnant women, unmarried women, and those suffering from immunosuppressive diseases. The serum samples were tested for IgG and IgM against *Toxoplasma gondii* antigens by using the Biomerieux Mini VIDAS automated immunoassay system, which depended on the principle of Enzyme-Linked Fluorescent Assay (ELFA) technology. The study revealed that infected non-aborted women were 14 (14%), while non-infected non-aborted women were 24 (24%). Infected women with one case of abortion were sixty (60.0%), while non-infected women with one case of abortion were 40 (40.0%). The infected women who had two abortion cases and those infected ones who had more than two cases of abortions were 26 (26%) and 14 (14%), respectively. There was a statistically significant difference between infected and uninfected women regarding abortion ($p < 0.01$). It has been found that there were highly significant differences between infected and non-infected women concerning anomalies and deliveries by cesarean sections (p-value = 0.001). There was a statically significant difference (p-value =0.01) between infected and non-infected women concerning their deliveries with or without premature babies.

Keywords: *Toxoplasma gondii, abortions, anomalies, cesarean sections, premature babies.*

الملخص:

داء المقوسات هو مرض تسببه طفيليات البروتوزا الداخلية الخلوية والتي تدعى المقوسات الكوندية. تصيب هذه الطفيليات كل من الانسان والحيوان من خلال العديد من الطرق وتشمل الغذاء ، العادات غير الصحية ، التماس مع التربة بالإضافة الى نقل الدم وزراعة الاعضاء . اكثر الاشخاص عرضة للإصابة هم الذين تكون مناعتهم ضعيفة ومن الأمثلة على ذلك النساء الحوامل ، الأجنة ، وكذلك حديثي الولادة. تهدف هذه الدراسة الى تقييم دور الاصابة بداء المقوسات في حصول الاجهاض وبقية الاضطرابات الخلقية لدى النساء المتزوجات للأعمار من 18 الى 45 في مدينة ميسان (في جنوب العراق). المعايير المتضمنة شملت مجموعة الدراسة والتي كانت مكونة من الاناث المصابات بالمقوسات الكوندية وعددهن 100 امرأة ، وشملت ايضاً مجموعة السيطرة والتي هي الاخرى مكونة من 100 امرأة ولكنهن غير مصابات بهذه الطفيليات. المعايير المستثناة من الدراسة هي النساء الحوامل ، غير المتزوجات ، وكذلك النساء الاتي يعانين من الأمراض المثبطة للمناعة. عينات مصل الدم فحصت للتحري عن وجود الاجسام المناعية المضادة للمقوسات الكوندية من نوع (IgM) و(IgG) وذلك باستخدام جهاز (Biomerieux Mini VIDAS) بنظام الطرق المناعية الآلية والتي تعتمد على تقنية الفحص المتألق المرتبط مناعيا (ELFA). اظهرت الدراسة ان النساء المصابات غير المجهضات كانت اعدادهن 14 (14%) بينما غير المصابات من اللواتي لم يحدث عندهن اجهاض كانت اعدادهن 24 (24%). النساء المصابات مع حالة اجهاض واحدة كانت اعدادهن 60 (60%) بينما غير المصابات مع حالة اجهاض واحدة كانت اعدادهن 40 (40%). المصابات مع حالتي اجهاض والمصابات مع اكثر من حالتي اجهاض كانت اعدادهن 26 (26%) و 14 (14%) على التوالي ، مع فرق معنوي احصائي بين أعداد المصابات وغير المصابات حيث كانت p- value اصغر من 0.01 ($p < 0.01$). كما قد وجد ان هناك فرق معنوي عالي بين أعداد النساء المصابات وغير المصابات فيما يخص التشوهات وحالات الوضع بواسطة العمليات القيصرية (p- value = 0.001). كما ان هناك فرق معنوي احصائيا (p- value =0.01) بين أعداد المصابات وغير المصابات فيما يتعلق بولادة النساء لحديثي الولادة غير المكتملين (الخدج)

الكلمات المفتاحية: *مقوسة كوندي ، الاجهاضات ، التشوهات ، العمليات القيصرية ، أطفال الخدج*

1. INTRODUCTION:

Toxoplasmosis is a disease caused by *Toxoplasma gondii* that can infect animal and human (Lu *et al.*, 2015; Robert-Gangneux and Darde, 2012).

T. gondii divided into three stages: tachyzoites, bradyzoites (tissue cysts), and sporozoites (in cats' feces). It can be transmitted by ingestion of contaminated fruit, vegetable, under-cooked meats, unpasteurized milk as well as low hygiene around food and cook-wares. Another route of transmission is through contact with contaminated soil or by changing the cat litter box (Kaakour *et al.*,2019 ; Soares and Caldeira, 2019). Around 30% of the world's population is assumed to be infected with *T. gondii* (Montoya and Liesenfeld, 2004).

In immune-competent humans, the toxoplasmosis is commonly asymptomatic. Still, it can be fatal in immune-compromised persons, such as patients with HIV and cancer in addition to organ transplant recipients and pregnant women (Lu *et al.*, 2015; Agrawal *et al.*, 2014).

T. gondii causes encephalitis and neurologic defects, and it can affect the heart, inner ears, eyes (chorioretinitis), and liver. Although rare, congenital toxoplasmosis (infection of the infant) leads to ocular (retinochoroiditis) or severe permanent neurological disease, as well as brain and cardiac anomalies (Montoya, 2002). The clinical effects of toxoplasmosis among pregnant women are various. Such women may suffer from spontaneous abortions, stillbirth, intrauterine growth retardation, deliveries of premature babies and anomalies in fetus. Furthermore, it has been suggested that *Toxoplasma* infections have some undesired implications on the capacity of the reproductive organ in both males and females (Flegr, 2013).

The infection of pregnant women with the *Toxoplasma* parasite is linked to exposure to cats and the age. This infection can lead to delivery with cesarean section and to *Toxoplasma* infected newborn (Kaakour *et al.*, 2019).

The study aimed to investigate the possible association between toxoplasmosis and some congenital disturbances among women who attended at Al. Sadr Teaching Hospital in Maysan city.

2. MATERIALS AND METHODS:

After finding the female eligible for the present study, she was explained the nature of the study and consent was sought. Those willing to give the consent and able to cooperate brief history were taken from them in the college of Nursing.

2.1. Study design

A case-control research was conducted in Al. Sadr Teaching Hospital, from July 2019 to February 2020. The study applied to married women aged 18 to 45 years with the exclusion of pregnant and unmarried women and those suffering from immunosuppressive diseases. A total number of 200 females were categorized into

two groups: Study group included 100 females who were infected with *Toxoplasma gondii,* another (control) group including 100 non-infected women, and without previous history of infection with toxoplasmosis.

2.2. Procedure

Five milliliters of antecubital venous blood was collected from each female in a sterile test tube and left for 30 minutes at room temperature until the clot has appeared in the blood. Then these blood samples were centrifuged to 4000 round/minute (for 10 minutes) to separate the serum. Sera were stored at -20°C till tested.

The serum samples were tested for IgG and IgM against *Toxoplasma gondii* antigens by using Biomerieux Mini VIDAS automated immunoassay system, which depended on the principle of Enzyme Linked Fluorescent Assay (ELFA) technology.

2.3. Statistical analysis

Statistical analysis was done using the statistical package for social sciences (SPSS version 18). Chi-square tests and descriptive statistics were applied to measure the frequencies and levels of significance—the values considered to be significant if P value < 0.05.

3. RESULTS AND DISCUSSION:

According to the findings in Table 1, it was revealed that the majority of infected women were located in the 21-25 years age group (38%). Almost more than half numbers of infected women were found in the first two groups compared to other groups. These results indicated that toxoplasmosis has occurred at an early age, more than the old ages of women in the current study. The findings have disagreed with many studies which found out that, the raised level of *Toxoplasma* infection was among 35-45 age groups, in comparison with a reduced rate of toxoplasmosis at 15-19 age groups (Al-Kalaby *et al.*, 2016; Sroka *et al.,* 2010; Jassam, 2010; AL-Ani, 2012; Al-Harthi *et al.,* 2006).

The indication of Table 1 was in agreement with findings of other studies, which demonstrated that the infection of *Toxoplasma* parasite was higher in the younger ages (Suhaila, 2008; Tasawar *et al.,* 2012). More upper infections that occur in young individuals may be due to the association with poor sanitary habits and lower immunity against this *Toxoplasma gondii* (Jones *et al.,* 2008).

Table 2 revealed that infected non-aborted women were 14 (14%) while non-infected women who had not any abortion history were 24 (24%). Sixty (60.0%) positive women had a history of one case of abortion while 40 (40.0%) negative women had a previous one abortion. According to the table, the infected women with a history of two abortion cases were 26 (26%), while those non-infected women who had the same number of abortions were 18 (18%). In the case of more than two abortion histories, the number of infected women was 14 (14%), while negative women for toxoplasmosis were 4 (4%). The comparative evaluation of these results indicates that there was a significant difference ($p < 0.01$) between non-infected and infected women with abortion.

The present study demonstrated that there was statically significant (p-value = 0.01) when applied cross-tabulation between infection and abortion (Table 2). Simultaneously, Table 3 showed that 35 (35.0%) of infected women had newborns with different anomalies compared to 14 (14.0%) of non-infected women (p-value = 0.001). These results were in line with several studies which indicated a correlation between infection with toxoplasmosis and congenital anomalies as well as previous history of abortion (Al-Kalaby *et al.*, 2016; Al-haris *et al.,* 2014, Muqbil *et al.*, 2014; Amin *et al.*, 2012; Mohamed *et al.*, 2012).

The findings of data analysis, as showed in Table 4 revealed that infected women with cesarean section deliveries were 17 (17.0%) in compared to 9 (9.9%) non-infected women who had deliveries by cesarean section. Contrarily, the infected women with standard deliveries were noticeably less than non-infected women 29, 49, respectively. Hence, the p-value was highly significant (0.005). These findings were approximately in agreement with the study that achieved in Lebanon (Kaakour *et al.,* 2019).

The correlation between toxoplasmosis premature babies was determined in Table 5 which revealed that there were 28 (28.0%) of infected women had premature babies while non-infected women were 11 (11.0%) only. The significant difference was high (p-value = 0.01). These findings were supported by another study, which indicated that the associations between prematurity and severity of congenital toxoplasmosis, including severe eye and brain disease (McLeod *et al.,* 2012).

4. CONCLUSIONS:

According to the study, it has been found that the Infection of women with *T.gondii* is associated with abortions and different anomalies that occur in fetuses and newborns. This infection may lead to cesarean section deliveries and preterm births.

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6. REFERENCES:

1. Lu, N.; Liu, C.; Wang, J.; Ding, Y.; Ai, Q. (2015). Toxoplasmosis complicating lung cancer: a case report. Int. Med. Case Rep. J., 8, 37–40.
2. Robert-Gangneux, F.; Darde, M. L. (2012). Epidemiology of and diagnostic strategies for toxoplasmosis. Clin. Microbiol. Rev., 25, 264– 296.
3. Kaakour, F.; Farhat, L.; Dia, Widad.; Kadry, Seifedine. (2019). Risk Factors and Altered Parameters in Pregnant Women Infected by *Toxoplasma gondii* in Lebanon. Global Journal of Health Science, 11(12), 65-79.
4. Soares, J. A. S.; Caldeira, A. P. (2019). Congenital toxoplasmosis: the challenge of early diagnosis of a complex and neglected disease. Rev Soc Bras Med Trop., 52, e20180228.
5. Montoya, J. G. ; Liesenfeld, O. (2004). Toxoplasmosis. Lancet 363, 1965–1976.
6. Agrawal, S.; Singh, V.; Ingale, S.; Jain, A. P. (2014). Toxoplasmosis of spinal cord in acquired immunodeficiency syndrome patient presenting as paraparesis: a rare entity. J. Glob. Infect. Dis., 6, 178–181.
7. Montoya, J.G. (2002). Laboratory diagnosis of *Toxoplasma gondii* infection and toxoplasmosis. J. Infect. Dis., 185, S73-S82.
8. Flegr, J. (2013). How and why *Toxoplasma* makes us crazy. *Trends Parasitol.,* 29 (4),156–163.
9. Kaakour, F.; Farhat, L.; Dia, W.; Kadry,; S. (2019). Risk Factors and Altered Parameters in Pregnant Women Infected by Toxoplasma gondii in Lebanon. Global Journal of Health Science, 11, 12.
10. Al-Kalaby, R. F.; Sultan B. A.; AL-Fatlawi S. N. (2016). Relationship between *Toxoplasma gondii* and abortion in aborted women in Najaf province. Journal of Kerbala University,14(1), 177-185.
11. Sroka, S.; Nina, B.; Andreas, W.; Jörg, H.; Liana, A.; Heliane, R.; *et al.*(2010). Prevalence and Risk Factors of Toxoplasmosis among Pregnant Women in Fortaleza, Northeastern Brazil. Am J Trop Med Hyg., 83(3), 528–533.
12. Jassam, F. S. (2010). Relationship between toxoplasmosis and testosterone hormone among schizophrenic patients in Baghdad. M.Sc. thesis, College of Health and Medical Technology, Foundation of Technical Education. Iraq.
13. AL-Ani, R. T. (2012). Study of Toxoplasma infection in women recurrent abortion in First trimester of pregnancy by Indirect immunoflurescent antibody test (IFAT), 8 (2) DJPS.
14. Al-Harthi, S. A.; Manal, B.; Jamjoom; Hani, O.; Ghazi; (2006). Seroprevalence of Toxoplasma Gondii Among Pregnant Women in Makkah, Saudi Arabia. Umm Al-Qura Univ. J. Sci. Med. Eng., 18(2), 217 - 227.
15. Suhaila, S.K.; (2008). Prevalence, serodiagonosis and some immunological aspects of toxoplasmosis among women in Baghdad province. M.Sc. thesis, College of Health and Medical Technology, Foundation of Technical Education. Iraq.
16. Tasawar, Z.; Aziz, F.; Lashari, M.H.; Shafi, S.; Ahmad, M.; Lal, V.; Hayat, C. S. (2012). Seroprevalence of Human toxoplasmosis in Southern Punjab, Pakistan. Pak. j. life soc. Sci., 10(10), 1-5.
17. Jones, J.L.; Kruszon-Moran, D.; Won, K.; Wilson, M.; Schantz, P.M. (2008). *Toxoplasma gondii* and *Toxocara* spp. co-infection. American Journal of Tropical Medical Hygiene, 78, 35-39.
18. Al-haris, F. M.; Hulal, S. S.; Karar, M. A. (2014). Investigation of Toxoplasmosis in Cord Blood of Newborns at Al-Najaf Province, Iraq by Searching for IgG and

IgM Antibodies. Journal of New Science Biotechnology,1(1), 1-10.

19. Muqbil, N. A.; Alqubatii, M. A. (2014). Seroprevalence of toxoplasmosis among women in Aden city, Yemen. Archives of Biomedical Sciences, 2 (2), 42-50.
20. Amin, Y. K.; Hataw, J. T.; Mustafa H.A. R. (2012). Screening of IgM and IgG against cytomegalovirus, rubella and toxoplasma infections among spontaneous miscarriages in Maternity Teaching Hospital- Erbil Province. Medical Sciences Proceeding Book, Vol, (I).
21. Mohamed, K; Kodym, P.; Maly, M.; Rayah, I. E. L. (2012) Socio-economical Risk Factors Associated with *Toxoplasma gondii* Infection in Rural Women at Childbearing Age in Sudan, 1,488.
22. McLeod, R.; Boyer, K. M.; Lee, D.; Mui, E.; Wroblewski, K.; Karrison, T.; Noble, G. A.; Withers, S.; Swisher, C. N.; Heydemann, P.T.; Sautter, M. ; Jane Babiarz, ; Peter Rabiah,; Meier, P.; Grigg, M. E. (2012). The Toxoplasmosis Study Groupb Prematurity and Severity are Associated with Toxoplasma gondii Alleles (NCCCTS, 1981–2009). Clinical Infectious Diseases, 54(11), 1595–605.

Table 1. *Distribution of the Women According to Toxoplasmosis and the ages*

Age (years)		Toxoplasmosis		P-value
		Infected	Uninfected	
20 and Less	**F**	14	22	Pearson Chi-Square = 0. 07 Ns
	%	14.0%	22.0%	
21-25	**F**	38	24	
	%	38.0%	24.0%	
26-30	**F**	16	26	
	%	16.0%	26.0%	
31-35	**F**	10	14	
	%	10.0%	14.0%	
36-40	**F**	18	12	
	%	18.0%	12.0%	
41-45	**F**	4	2	
	%	4.0%	2.0%	
Total	**F**	100	100	
	%	100%	100%	

F = Frequencies; % = Percentages; Ns = Non-Significant;

Table 2. *Demonstration of the association between Toxoplasma infections and the Number of Abortions*

Number of Abortion		Infected	Uninfected	P-value
None	**F**	14	24	Pearson Chi-Square = 0.01 (S)
	%	14.0%	24.0%	
One	**F**	60	40	
	%	60.0%	40.0%	
Twice	**F**	26	18	
	%	26.0%	18.0%	
Three and more	**F**	14	4	
	%	14.0%	4.0%	

F = Frequencies; % = Percentages; S = Significant*;*

Table 3. *Demonstration of the Association between Toxoplasma infections and the Anomalies*

Anomalies		Toxoplasmosis		P-value
		Infected	Uninfected	
Yes	**F**	35	14	Pearson Chi-Square = 0.001 (Hs)
	%	35.0%	14.0%	
None	**F**	34	51	
	%	34.0%	51.0%	

F = Frequencies; % = Percentages; Hs = Highly Significant;

Table 4. *Demonstration of the Association between Toxoplasma infections and Cesarean Sections*

Cesarean Sections		Toxoplasmosis		P-value
		Infected	Uninfected	
Yes	**F**	17	9	Pearson Chi-Square = 0.005 (Hs)
	%	17.0%	9.0%	
None	**F**	29	49	
	%	29.0%	49.0%	

F = Frequencies; % = Percentages; Hs = Highly Significant;

Table 5. *Demonstration of the Association between Toxoplasma infections and Premature Babies*

Premature Baby		Toxoplasmosis		P-value
		Infected	Uninfected	
Yes	F	28	11	Person Chi-Square = 0.01 (S)
	%	28.0%	11.0%	
None	F	37	56	
	%	37.0%	56.0%	

F = Frequencies; % = Percentages; S = Significant;