Congenital Toxoplasmosis in two Health Institutions in Trinidad

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ABSTRACT

Toxoplasmosis is the most widespread zoonosis and an important human disease particularly in children where it could cause visual and neurological impairment and mental retardation. This study was conducted to determine the prevalence of toxoplasmosis, especially congenital toxoplasmosis in patients at two health institutions in Trinidad. A total of 504 cord blood samples of newborn babies were collected: 174 from a women's hospital and 330 from a general hospital. In order to elicit maternal and prenatal risk factors for toxoplasmosis, mothers of the newborns completed a questionnaire. Enzyme-immuno assay (EIA) was used to detect IgG and IgM to Toxoplasma gondii. *Overall, of 504 serum samples tested, 220 (43.7%) were seropositive for IgG while the prevalence of congenital toxoplasmosis as reflected by IgM was 0.4%. The prevalence of IgG and IgM by health institutions was not significantly different (*$p > 0.05$*; chi-square). The prevalence of toxoplasmosis using IgG was highest in neonates of mothers who were of East Indian descent (54.1%), had four children (52.9%), kept cats in households (47.7%), practised outdoor gardening (50.8%), consumed raw meat (66.7%), had experienced miscarriage(s) (47.3%), stillbirths (66.7%), or who had eye problem(s) (52.9%) and mental retardation (50.0%). The study prevalence of congenital toxoplasmosis revealed a high seroprevalence of toxoplasmosis in neonates but there was 0.4% serological evidence of congenital disease. It indicates a need for sensitization of the population and healthcare workers and for follow-up of infected children for clinical evidence of the disease. This would be necessary to fully appreciate the impact of toxoplasmosis in Trinidad and Tobago. The differences from comparison groups were however not statistically significant (*$p > 0.05$*; chi-square).*

Toxoplasmosis Congénita en dos Centros de Salud de Trinidad

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RESUMEN

La toxoplasmosis es la zoonosis más extendida y una enfermedad humana importante, particularmente en niños, a quienes puede causar daño visual y neurológico, y retraso mental. Este estudio se llevó a cabo con el propósito de determinar la prevalencia de la toxoplasmosis, especialmente la toxoplasmosis congénita en pacientes de dos centros de salud en Trinidad. Se recogieron un total de 504 muestras de sangre de cordón umbilical de neonatos: 174 de mujeres en un hospital de mujeres y 330 en un hospital general. A fin de obtener información sobre los factores de riesgo maternos y prenatales en relación con la toxoplasmosis, las madres de los recién nacidos llenaron una encuesta. Un ensayo inmunoenzimático (EIE) fue usado para detectar anticuerpos IgG e IgM contra el Toxoplasma gondii. En general, de 504 muestras de suero examinadas, 220 (43.7%) resultaron seropositivas al IgG, mientras que la prevalencia de la toxoplasmosis congénita reflejada por el IgM fue 0.4%. La prevalencia de IgG e IgM por parte de las instituciones de salud no fue significativamente diferente ($p > 0.05$*; chi-cuadrado). La prevalencia de la toxoplasmosis usando IgG fue más alta en los neonatos cuyas madres eran ascendencia indoriental (54.1%), tenían cuatro niños (52.9%), mantenían gatos en sus casas (47.7%), practicaban jardinería al aire libre (50.8%), consumían carne cruda (66.7%), habían tenido aborto(s) (47.3%), partos de feto muerto (66.7%), o tenían problema(s) de los ojos (52.9%) y retardo mental (50.0%). Este estudio de la toxoplasmosis congénita, reveló una alta seroprevalencia de toxoplasmosis en neonatos, pero hubo 0.4% de evidencia serológica de enfermedad congénita. Esto*

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apunta a la necesidad de sensibilizar a la población y a los trabajadores del cuidado de la salud, e igualmente indica la necesidad de realizar seguimientos a los niños infectados, en busca de evidencia clínica de la enfermedad. Esto es necesario si se quiera valorar totalmente el impacto de la toxoplasmosis en Trinidad y Tobago. Sin embargo, las diferencias entre los grupos de comparación no fueron estadísticamente significativas ($p > 0.05$; chi-cuadrado).

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INTRODUCTION

Toxoplasmosis is a multi-species zoonotic disease with the cat as its natural host (1) but several animal species serve as the intermediate host of the agent, *Toxoplasmosis gondii* (*T gondii)*, from which man gets exposed (2, 3). Several risk factors for human toxoplasmosis have been reported including exposure to cats (1, 4), consumption of raw meat (5), outdoor gardening (6) and age of the mother (7) but some reports have failed to observe statistically significant associations between most of these factors and the disease (8–10).

Toxoplasmosis in humans is generally asymptomatic with the exception of immuno-compromised individuals particularly those with HIV/AIDS (11, 12) and congenital infections (13, 14). The clinical consequences of congenital toxoplasmosis are well documented in the literature (14–16) as well as the on-going debate on the need for routine prenatal screening for toxoplasmosis (13, 16, 17) prophylactic treatment of seropositive women (18, 19) and neonatal screening (20, 21). In the Caribbean region, few reports exist on human toxoplasmosis (22–24) and the first and only report to date of congenital toxoplasmosis was documented in Jamaica almost five decades ago (25).

This study was conducted to determine the seroprevalence of toxoplasmosis in neonates in two healthcare institutions in Trinidad using their cord blood; as well as the incidence of congenital toxoplasmosis detected by IgM antibodies. The investigation also related the maternal risk factors for toxoplasmosis to the seroprevalence of the infection detected in neonates.

SUBJECTS AND METHODS

Between November 2002 and September 2003, the Port of Spain General Hospital (POSGH) and the Mount Hope Maternity Hospital (MHWH) in Trinidad served as sources of cord blood samples from neonates born in these hospitals. A questionnaire was administered to expectant mothers, who consented to participate in the study, to elicit demographic data (ethnic group, age, religion, marital status, number of children) and maternal and neonatal risk factors for toxoplasmosis such as the presence of cats in the household, handling of cat's litter, practice of outdoor gardening, work on farm and consumption of raw meat.

Overall, a total of 504 cord blood samples was collected: 174 from POSGH and 330 from MHWH. The ethics committees of the University of the West Indies, Faculty of Medical Sciences, and of both hospitals approved the study prior to its commencement. After delivery of women identified for the study, a 5 millilitre (ml) specimen of blood was collected under sterile conditions, accessing either an umbilical cord vessel or one of the fetal surface of the placenta.

All cord blood samples were allowed to clot overnight at 4°C after which serum was harvested following centrifugation. Enzyme immunoassay (EIA) test kits (Diamedix, Miami, USA) with appropriate positive and negative controls provided by the manufacturer were used to detect immunoglobulins to T gondii. The IgG and the IgM capture test kits were used to detect IgG and IgM.

The seroprevalence of IgG and IgM in neonates by hospital source as well as any possible relationship between maternal risk factors and neonatal seroprevalence for toxoplasmosis were analyzed using the Statistical package for Social Sciences (SPSS), version 10. All statistical tests were two-sided and interpreted at the 5% level of significance.

RESULTS

The seroprevalence of toxoplasmosis in the neonates was 43.7% (220 of 504) as detected by IgG and 0.4% (2 of 504) as detected by IgM for *T gondii* (Table 1). The seroprevalence of toxoplasmosis by hospital source of cord blood, 40.2% (POSGH) and 45.5% (MHWH) was not statistically significantly different ($p > 0.05$).

Table 1: Frequency of detection of *T gondii* IgG and IgM in cord blood of children in two hospitals

Source	No of serum samples tested	No (%) of samples positive for: IgG	IgM
Port of Spain General Hospital	174	70 (40.2)	0 (0.0)
Mount Hope Women's Hospital	330	150 (45.5)	2 (0.6)
Total	504	220 (43.7)	2 (0.4)

The seroprevalence of toxoplasmosis in neonates related to risk factors in mothers is shown in Table 2. For the seven risk factors studied, seroprevalence was higher in those with associated factors but there were no statistically significant differences ($p > 0.05$).

Seroprevalence increased with the age of mothers as those aged # 30 years had a seroprevalence of 41.8% (169 of 404) compared with a seroprevalence of 52.3% (46 of 88) found in mothers older than 30 years. East Indians in the population had a much higher (54.1%) seroprevalence ($p = 0.07$) compared to other ethnic groups in Trinidad.

Table 2: Prevalence of *T gondii* IgG and IgM agglutinins in cord blood by mother-related risk factors

Risk Factor	No of women sampled	No (%) of cord samples positive for IgG/IgM[a]	p-value
Ethnic Group			
East Indian	98	53 (54.1)	0.07
African	231	84 (36.4)	
Mixed	167	79 (47.3)	
Other	8	3 (37.5)	
Number of children			
One	249	96 (38.6)	0.24
Two	108	47 (46.9)	
Three	63	33 (53.4)	
Four	34	18 (52.9)	
Five or more	22	11 (50.0)	
No response	28	14 (50.0)	
Presence of cat(s) in household			
Yes	65	31 (47.7)	0.92
No	411	175 (42.6)	
No response	28	13 (46.4)	
Handle cat's litter			
Always	5	3 (60.0)	0.59
Sometimes	7	4 (57.1)	
Never	52	23 (44.2)	
Other	1	1 (100.0)	
Practice of outdoor gardening			
Yes	120	61 (50.8)	0.39
No	356	145 (40.7)	
No response	28	13 (46.4)	
Work on farm			
Yes	31	16 (51.6)	0.83
No	440	187 (42.5)	
No response	33	16 (48.5)	
Consume raw meat			
Sometimes	3	2 (66.7)	0.21
Never	441	191 (43.3)	
No response	11	1 (9.1)	
Vegetarian			
Yes	18	8 (44.4)	0.91
No	445	195 (42.9)	
No response	31	16 (51.6)	

[a]Positive for IgG or IgM; No = Number

The relationship between published sequelae of toxoplasmosis in pregnant women and the seroprevalence detected in cord blood of neonates is shown in Table 3. Seroprevalence of toxoplasmosis was higher among mothers of neonates who had experienced miscarriage(s) (47.3%) and stillbirths (66.7%), who had children with eye problems (52.9%) and mental retardation (50.0%) compared to mothers who did not.

Table 3: Frequency of *T gondii* IgG and IgM agglutinins in cord blood by experiences of mothers and children

Experience[a]	No of women sampled	No (%) of cord blood for T gondii IgG/IgM	p-value
Experience of miscarriage			
Yes	91	43 (47.3)	0.85
No response	382	161 (42.1)	
No response	31	15 (48.4)	
Experience of stillbirth			
Yes	9	6 (66.7)	0.71
No	464	199 (42.9)	
No response	31	14 (45.2)	
Experience of premature baby			
Yes	29	11 (37.9)	0.97
No	443	194 (43.8)	
No response	32	14 (43.8)	
Difficult delivery due to large fetal head			
Yes	3	2 (66.7)	0.97
No	410	180 (43.9)	
No response/not applicable	91	37 (40.7)	
Eye problem in child			
Yes	17	9 (52.9)	0.98
No	381	165 (43.3)	
No response/not applicable	106	45 (42.5)	
Mental retardation in child			
Yes	2	1 (50.0)	0.98
No	396	173 (43.7)	
No response/not applicable	106	45 (42.5)	
Neurological problem in child			
Yes	3	1 (333.3)	0.99
No	395	173 (43.8)	
No response / not applicable	106	45 (42.5)	

[a]As reported by mother of children whose cord samples were collected

DISCUSSION

Seroprevalence for toxoplasmosis, based on IgG, in neonates has been reported to be similar to those of their mothers (20, 26). The seroprevalence in this study (43.7%) is comparable to the 43.3% reported for pregnant women attending antenatal clinics in Trinidad (22) but is slightly lower than the 57% seroprevalence found in pregnant women in Jamaica (23). However, it is to be noted that a seroprevalence of 45% was reported in young Jamaicans (24). The detection of IgG immunoglobulins to *T gondii* in other countries is variable: United Kingdom, 7.7% (27); Norway, 10.9 (28); Sweden, 14–25.7% (29); Brazil, 50–76% (30) and Nigeria, 75.4% (31). The need to exercise caution in comparing seroprevalence studies cannot be over-emphasized as the assay methods used may have had different specificities and sensitivities which would affect detection rates (17).

IgM evidence of serological congenital toxoplasmosis was 0.4 % in the present study with both cases detected at the MHWH where the seroprevalence was 0.6%. These findings agree with a prevalence of 0.5% for congenital toxoplasmosis in one hospital in Brazil (13). Comparatively, much lower seroprevalence rates of toxoplasmosis have been reported ranging from 0.0% to 0.1% in various countries (14, 20, 22, 33, 34). Stirling and Dixon (25) reported congenital toxoplasmosis in a Jamaican child in 1959. Clinical manifestations, particularly retinochoroiditis (13, 16) in the IgM-positive cases detected in the present study are being assessed and followed-up to determine the full impact of this finding. High seroprevalence of toxoplasmosis (IgG) and congenital toxoplasmosis has mandated countries to institute routine prenatal screening (13, 16, 17), prophylactic treatment in pregnant mothers with demonstrable primary infection (18, 19) and neonatal screening followed by prophylactic treatment of children with congenital toxoplasmosis (20, 21). Cost benefit analysis (35) has confirmed the need for prenatal screening while it has been suggested by others that each local prevalence status and population practices should dictate the institution of preventive measures (36).

These findings in the current study on maternal-related factors, particularly with the detected increase in seroprevalence with age agree with published reports by others (37, 38). The detection of higher seroprevalence of toxoplasmosis amongst East Indian mothers in the present study may be related to eating habits. An association between ethnic group and seroprevalence to toxoplasmosis has been documented elsewhere (37).

In this study, mothers with 3–4 children, cats in households, who handled cat's litter, practised outdoor gardening, worked on a farm and consumed raw meat had higher risks for toxoplasmosis as earlier documented in the literature (1–6) but no statistical significance was also reported by others, including the keeping of cats in households (9, 10).

The prevalence of toxoplasmosis was higher, albeit not statistically significant, in mothers who had experienced miscarriages, stillbirths or have had children who had experienced toxoplasmosis-related symptoms (mental retardation or eye problems) compared to mothers who did not have such experiences. This is because similar findings have been reported elsewhere (16, 39). Some of the mothers did not respond to certain specific questions and this may have affected the statistical analysis in this study. All the sequelae mentioned earlier have been associated with toxoplasmosis (9, 10, 21, 28, 37).

The results of this study demonstrate evidence of serological congenital toxoplasmosis in the Caribbean region and it is imperative that a follow-up of the seropositive (IgM) individuals be done to investigate possible clinical manifestation of toxoplasmosis. The finding that mothers with known important risk factors for toxoplasmosis, as well as mothers who had reported having children with sequelae of the disease, were found to have higher seroprevalence of toxoplasmosis compared with those without, albeit without statistical significance, may be an indication that toxoplasmosis has more clinical implications in the population than is known. This is because, no routine prenatal screening, prophylactic treatment or neonatal screening for toxoplasmosis is done in Trinidad or in the Caribbean region at large. However, it is not until the regional or local situation is fully assessed that a cost effective preventive programme can be recommended.

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