Seroprevalence of toxoplasmosis, syphilis, hepatitis B, hepatitis C, rubella, cytomegalovirosis and human immunodeficiency virus infection among pregnant patients followed up from 2008 to 2012 at hospital universitário Antônio Pedro, Niterói (RJ)

Soroprevalência para toxoplasmose, sífilis, hepatite B, hepatite C, rubéola, citomegalovírus e vírus da imunodeficiência humana em gestantes atendidas no hospital universitário Antônio Pedro, Niterói (RJ) entre 2008 e 2012

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ABSTRACT

Introduction: Screening and treatment of infectious diseases in pregnant women have great importance in planning preventive actions and development of maternal and child health policies. **Objective:** To evaluate the seroprevalence of toxoplasmosis, syphilis, hepatitis B, hepatitis C, rubella, cytomegalovirosis and human immunodeficiency virus (HIV) infection among pregnant women followed up at a University Hospital of Niterói, RJ. **Methods:** A cross-sectional study was done by reviewing serological tests recorded in the medical records of pregnant women attending the antenatal service of the Hospital Antônio Pedro, Universidade Federal Fluminense, from 2008 to 2012. **Results:** The seroprevalences found were 61.4 (IgG) and 2.4% (IgM) for toxoplasmosis; 95.1 (IgG) and 0.5% (IgM) for rubella; 95.1 (IgG) and 1.2% (IgM) for cytomegaloviruosis; 0.9% for hepatitis B surface antigen; 1.6% for hepatitis C virus; 1.5% for syphilis and 5.8% for HIV infection. There were no statistically significant differences between seroprevalences of patients with or without HIV infection. The rates of congenital transmission were 4.2% (2/48) for HIV, 33.3% (5/15) for toxoplasmosis, and 22.2% (2/9) for syphilis. There were congenital abnormalities in 1/5 newborn whose mother was seropositive for rubella IgG and/or IgM in the prenatal routine. Coinfection HIV/toxoplasmosis was found in one newborn. **Conclusion:** The large proportion of pregnant women susceptible to toxoplasmosis (38.8%) and hepatitis B (66.3%) shows the necessity of diagnostic and preventive measures for toxoplasmosis and HBV vaccination to reduce the risk of vertical transmission of these infections, thus improving the health of mother and newborn.

Keywords: seroepidemiologic studies; pregnant women; infectious disease transmission, vertical.

RESUMO

Introdução: A triagem e o tratamento das doenças infecciosas em gestantes são de grande importância para o planejamento de ações preventivas e a elaboração de políticas de saúde materno-infantil. **Objetivo:** Determinar a soroprevalência de toxoplasmose, sífilis, hepatite B, hepatite C, rubéola, citomegalovírus (CMV) e infecção pelo vírus da imunodeficiência humana (HIV) em gestantes acompanhadas no Hospital Universitário Antônio Pedro, Niterói (RJ). **Métodos:** Foi feito um estudo transversal por meio de revisão de testes sorológicos registrados nos prontuários médicos de gestantes atendidas, de 2008 a 2012, no Ambulatório de Pré-Natal. **Resultados:** As prevalências encontradas foram: 61,4 (IgG) e 2,4% (IgM) para toxoplasmose; 95,1 (IgG) e 0,5% (IgM) para rubéola; 95,1 (IgG) e 1,2% (IgM) para CMV; 0,9% para hepatite B (HBsAg); 1,6% para hepatite C; 1,5% para sífilis; e 5,8% para infecção pelo HIV. Não houve, entre gestantes infectadas e não infectadas pelo HIV, diferenças estatisticamente significativas nas frequências das infecções estudadas. As taxas de transmissão vertical foram de 4,2% (2/48) para o HIV; 33,3% (5/15) para toxoplasmose; e 22,2% (2/9) para sífilis. Foram detectadas alterações compatíveis com rubéola congênita em 1/5 crianças cuja mãe apresentava IgM e IgG positivas para tal infecção durante a gestação. A coinfecção HIV/toxoplasmose ocorreu em uma criança. **Conclusão:** O número de gestantes susceptíveis à toxoplasmose (38,8%) e ao vírus da hepatite B (VHB) (66,3%) revela a necessidade de medidas diagnósticas e preventivas da toxoplasmose durante a gestação e vacinação para o VHB, visando diminuir o risco dessas infecções durante a gravidez, melhorando, assim, a saúde materno-infantil.

Palavras-chave: soroprevalência; gestante; transmissão vertical.

INTRODUCTION

Toxoplasmosis, rubella, hepatitis B, hepatitis C, syphilis, cytomegaloviruses, and human immunodeficiency virus (HIV) are infections that can affect pregnant women and be vertically transmitted to the newborn. These infections are often asymptomatic among adults, and can result in severe consequences when contracted by the child during the pregnant-puerperal period, both throughout pregnancy and at the time of labor or while breast-feeding. The conduction of serological tests in the prenatal period allows the diagnosis of these infections and the adoption of measures which would enable the reduction of the harms they could cause to neonatal health[1].

In this context, it is important to monitor the susceptibility of women at reproductive age to these infections. Population serological surveys allow obtaining precise estimations of the seroprevalence, according to age group. However, these activities take a while, are

Study carried out at *Hospital Universitário Antônio Pedro* (HUAP), *Universidade Federal Fluminense* (UFF) – Niterói (RJ), Brazil.
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expensive, and have momentary results, considering that the proportion of seropositive people may change with the improved socioeconomic and sanitary conditions, or with the adoption of national prevention and vaccination programs.

Some of the alternatives capable of providing useful approximations of population seroprevalence, for purposes of monitoring the susceptibility to these diseases include the use of serum samples collected for other population surveys, and the aliquots of serum obtained for other ends. These samples are suitable for the detection of groups of susceptible people and suggest adjustment in vaccinations. An alternative would be to use the routine tests carried out by pregnant women during the prenatal period, in order to favor an approximate awareness of the epidemiological status of the infections in the study population.

Considering the importance of knowledge on the main infectious diseases that can be transmitted from the pregnant woman to the fetus, the change in their epidemiological profile in the last years, and the lack of national publications, studies that aim at determining their prevalence are very relevant to plan for preventive actions and to elaborate on maternal and child health policies.

OBJECTIVE

This paper aimed at determining the prevalence of antibodies for toxoplasmosis, syphilis, hepatitis B and C, rubella, cytomegaloviruses, and HIV, as well as the frequency of transmission of these infections among pregnant women who were present at the Pre-Natal Outpatient ward of Hospital Universitário Antônio Pedro (HUAP), Niterói (RJ), from January 2008 to December 2012.

METHODS

This is a cross-sectional study conducted through the revision of clinical and epidemiological data and laboratory tests obtained from the medical records of pregnant women assisted from January 2008 to December 2012, in the High Risk Prenatal Outpatient Ward of HUAP. In cases of clinical and/or laboratorial suspicion of vertical transmission of the analyzed infections, a descriptive study was carried out by revising the medical records of the newborns.

Exclusion criteria

The following cases were excluded:

1. when the medical records of pregnant women and newborns were unavailable in the Medical Files of HUAP;
2. the pregnant woman did not attend the prenatal appointments, be it for abortion or changes in health service;
3. the results of the HIV serology were not in the medical records;
4. pregnancy was embryonic and/or resulted in hydatidiform mole;
5. there was no continuity in the follow-up of newborns in the medical appointments at HUAP.

Analyzed variables

The variables studied were age, schooling, city of residence, number of previous pregnancies, number of previous abortions, comorbidities and qualitative results of serological tests to detect antibodies for toxoplasmosis, syphilis, hepatitis B and C, rubella, CMV, HIV, and detection of the hepatitis B surface antigen (HBV) (HBsAg).

Laboratory tests

Serological examinations were carried out in HUAP's laboratory, according to the recommendations of the manufacturers, and the results were classified as "positive," "negative," or "undetermined." The following tests were conducted:

1. toxoplasmosis: detection of IgM (LIASON – Toxo IgM, DiaSorin S.p.A, Italy) and IgG (LIASON – Toxo IgG, DiaSorin S.p.A, Italy);
2. rubella: detection of IgM (LIASON – Rubella IgM, DiaSorin S.p.A, Italy) and IgG (LIASON – Rubella IgG, DiaSorin S.p.A, Italy);
3. hepatitis B: detection of the surface antigen (HBsAg) (ADVIA Centaur CP Anti-HBs, Siemens Healthcare Diagnostics Inc., USA) and of antibodies for the hepatitis B surface antigen – anti-HBs (ADVIA Centaur CP Anti-HBs, Siemens Healthcare Diagnostics Inc., USA) through chemiluminescent immunoassay;
4. hepatitis C: detection of hepatitis C antibodies (anti-HCV) (ADVIA Centaur CP HCV, Siemens Healthcare Diagnostics Inc., USA);
5. syphilis: VDRL (WAMA Diagnóstica, Brazil);
6. CMV: detection of IgG (LIASON – CMV IgG II, DiaSorin S.p.A, Italy) and IgM (LIASON – CMV IgM II, DiaSorin S.p.A, Italy);
7. HIV: detection of antibodies for HIV-1/HIV-2 (ADVIA Centaur HIV 1/0/2 Enhanced Healthcare Diagnostics Inc., USA).

Statistical analysis

The data of interest were recorded, stored, and analyzed with the Statistical Package for the Social Sciences (SPSS), version 17. The categorical and continuous variables were calculated by frequencies, means, and medians. The difference between the proportions of categorical variables was carried out with Pearson's χ^2 test, with statistical significance of 5%.

The study was approved by the Research Ethics Committee of HUAP (CEP/HUAP n. 140/2011).

RESULTS

General characteristics of the population

In the book of the First Care Prenatal Outpatient at HUAP, from January 2008 to December 2012, a total of 1,112 patients were registered. Seventy-four (6.7%) patients were excluded according to the following situations: absence of medical record (36 cases); in case of pregnant women, discontinuity in attending the prenatal appointments (24 cases); absence of the results of the serologic tests for HIV (6 cases); abortion (4 cases); hydatidiform mole (2 cases); and pseudocyesis (2 cases). Therefore, the study universe was composed of 1,038 patients with properly documented serological results.

The age of the pregnant women ranged from 13 to 46 years old (mean: 26.86 years; median: 27 years), the most common being the age group of 21–30 years old (507 cases – 48.8%), followed by

31–40 years old (279 cases – 26.9%). Two-hundred and seventeen (20.9%) patients were younger than 20, and 35 (3.4%) were older than 41 years old (**Table 1**).

As to the origin, 479 (46.1%) pregnant women came from the city of Niterói; 395 (38.1%) came from São Gonçalo; and 115 (11.1%) came from other cities in the State of Rio de Janeiro.

Regarding schooling, it was observed that 391 (37.7%) pregnant women had completed elementary school, and 293 among them (28.2%) had completed high school. For 354 patients (34.1%), it was not possible to assess this item in the analyzed records (**Table 1**).

Pregnant women were assessed according to the positive or negative results of the HIV serologic tests, and considered in each one of the two groups according to the following variables: age group, schooling, and origin. The different frequencies observed between these two groups were not significant (**Table 1**).

The mean of pregnancies was 2.4 (variation of 1 to 13), and 344 (33.1%) patients were primigravida. It was observed that 279 of 1,038 (26.9%) patients had a previous history of abortion. The mean gestational age at the time of the first prenatal appointment was 20.9 weeks: 487 (47%) were in the second trimester, 266 (25.6%) were in the first trimester, and 285 (27.4%) were in the last trimester of pregnancy.

Seroprevalence study

IgG anti-*Toxoplasma gondii* antibodies were detected in 624 (61.4%) of the 1,017 pregnant women whose results were known (**Table 2**). In 24 (2.4%) patients, IgM antibodies were detected. Susceptibility to toxoplasmosis, that is, the absence of IgG, was observed in 395 (38.8%) pregnant women. There was no statistically significant association between the frequency of IgG anti-*Toxoplasma gondiii* and sociodemographic variables (data not shown). An association was observed between the older age and the values of frequencies of the antibodies against *Toxoplasma gondii,* and this result was statistically significant (p<0.0001) (**Table 3**).

IgG antibodies against rubella were detected in 951 (95.1%) of the 1,000 pregnant women whose results were known. There were IgM antibodies in five (0.5%) cases. Of the 943 pregnant women tested for IgG and IgM antibodies against CMV, 897 (95.1%) and 11 (1.2%) were positive, respectively.

Nine pregnant women carried the HBsAg antigen (prevalence of 0.9%) (**Table 2**).The positive aspect of this marker was distributed in all age groups studied, and was found only in the group of pregnant women not infected with HIV. The anti-HBs antibodies were present in 296 (33.7%) of the 879 pregnant women tested. The frequency of these antibodies reduced with age, and this association was statistically significant (p<0.0001) (**Table 4**). Fifteen patients were anti-HCV positive, which represents prevalence of 1.6%. Out of these 15 HCV-positive pregnant women, 2 belonged to the HIV-positive group.

Regarding syphilis, 15 (1.4%) of the 1,034 blood samples tested by VDRL were positive, but in none of the cases the FTA-ABS test was carried out to confirm the infection.

HIV was positive in 58 (5.6%) pregnant women. Among these, two (3.4%) presented the HIV/HCV coinfection, and two others (3.4%), the HIV/syphilis coinfection. One pregnant woman (1.7%) had the HIV/toxoplasmosis/rubella/herpes/HPV coinfection. Eight (13.8%) were primigravida. Of the total, 37 (63.8%) pregnant women had prior knowledge of their condition of being infected with HIV, and 21 (36.2%) among them were diagnosed with it because of the prenatal routine. Of the 58 HIV-positive pregnant women, 10 (17.2%) had already acquired immune deficiency syndrome (AIDS), and 48 (82.8%) were asymptomatic. The use of antiretroviral therapy (ART) was observed in 56 (96.6%) pregnant women, and the therapeutic scheme zidovudine, lamivudine, lopinavir, and ritonavir (AZT/3TC/LPVr) was used for most patients (39 cases – 67.2%).

Even though there were differences in the seroprevalence analyzed in HIV-positive and HIV-negative pregnant women, these changes were not statistically significant (**Table 2**).

Comorbidities

Comorbidities most commonly presented by the 1,038 pregnant women analyzed were: arterial hypertension (187

Table 1 – Sociodemographic characteristics of the population according to the result of the serological test for the human immunodeficiency virus

Characteristics	HIV			P-value
	Positive n=58 (%)	Negative n=980 (%)	Total n=1,038 (%)	
Age group (in years)				
<20	11 (19.0)	206 (21)	217 (21)	0.3662
21–30	33 (56.9)	474 (48.4)	507 (48.8)	
31–40	14 (24.1)	265 (27.0)	279 (26.9)	
≥41	0 (0)	35 (3.6)	35 (3.3)	
Schooling				
Elementary school	31 (53.4)	360 (36.7)	391 (37.7)	0.0921
High school and higher education	13 (22.4)	280 (28.6)	293 (28.2)	
Not informed	14 (24.1)	340 (34.7)	354 (34.1)	
Origin				
Niterói	23 (39.7)	456 (46.5)	479 (46.1)	0.1129
São Gonçalo	30 (51.7)	365 (37.2)	395 (38.1)	
Others	4 (6.9)	111 (11.3)	115 (11.1)	
Not informed	1 (1.7)	48 (4.9)	49 (4.7)	

HIV: human immunodeficiency virus.

cases – 18%), obstetric and gynecologic as well as fetal changes (151 cases – 14.5%), type II and/or gestational diabetes (126 cases – 12.1%), obesity (50 cases – 4.8%), and thyroid dysfunction (29 cases – 2.8%).

Vertical transmission

Of the 24 children exposed to toxoplasmosis during pregnancy, 15 were followed-up at HUAP. In 10 children, the infection was ruled out due to the quantitative reduction in IgG values and the absence of IgM antibodies in serial serological examinations carried out after birth. Congenital toxoplasmosis was confirmed in five children, and one of them was coinfected with HIV. One child died a few hours after labor due to severe brain, cardiac, and hepatic changes, and the other four were treated with sulfadiazine, pyrimethamine, and folinic acid. Among these children, the one infected with HIV was simultaneously treated with zidovudine, lamivudine, and nevirapine. It was not possible to establish the outcome in nine children due to the lack of data in medical records (**Table 5**).

Out of the five newborns exposed to rubella, the infection was ruled out for two of them as their serological tests for IgG and IgM antibodies against rubella were negative. During the follow-up in the Neuropediatric Service of HUAP, there was one case of macrocephaly and retardation in psychomotor development. Even though the serologic tests had been negative for IgM

Table 3 – Frequency of the studied infections (rubella, cytomegalovirus, toxoplasmosis, syphilis) according to the result and the age group of the pregnant women.

Age group	[a]anti-rubella IgG+	anti-rubella IgG-	P-value
<20	155 (93.4%)	11 (6.6%)	
20–29	471 (95.2%)	24 (4.8%)	
30–39	278 (95.5%)	13 (4.5%)	0.573*
≥40	47 (97.9%)	1 (2.1%)	
	[b]anti-CMV IgG+	anti-CMV IgG-	
<20	148 (96.7%)	5 (3.3%)	
20–29	445 (94.7%)	25 (5.3%)	0.609*
30–39	262 (94.6%)	15 (5.4%)	
≥40	42 (97.7%)	1 (2.3%)	
	[c]anti-toxoplasma IgG +	anti-toxoplasma IgG-	
<20	90 (53.6%)	78 (46.4%)*	
20–29	294 (55.9%)	213 (46.6%)	<0.0001*
30–39	205 (69.7%)	89 (30.3%)	
≥40	35 (72.9%)	13 (27.1%)	
	[d]VDRL+	VDRL-	
>20	6 (3.5%)	164 (96.5%)	
20–29	8 (1.5%)	507 (98.5%)	0.0455**
30–39	1 (0.3%)	299 (99.7%)	
≥40	0 (0.0)	49 (100%)	

*Pearson χ^2; **Fisher test; CMV: cytomegalovirus; [a]in 38 cases the result of anti-rubella IgG was ignored; [b]in 95 cases the result of anti-CMV IgG was ignored; [c]in 21 cases the result of anti-toxoplasma IgG was ignored; [d]in 4 cases the result of VDRL was ignored.

Table 2 – Frequency of the infections studied as per the results of the serologic tests for the human immunodeficiency virus.

Serology	HIV			P-value
	Positive n=58 (%)	Negative n=980 (%)	Total n=1,038 (%)	
Toxoplasmosis (IgG)				
Positive	34 (58.6)	590 (60.2)	624 (60.1)	
Negative	22 (37.9)	371 (37.9)	393 (37.9)	0.9684*
Not informed	2 (3.5)	19 (1.9)	21 (2)	
Rubella (IgG)				
Positive	49 (84.5)	902 (92.0)	951 (91.6)	
Negative	5 (8.6)	44 (4.5)	49 (4.7)	0.1184**
Not informed	4 (6.9)	34 (3.5)	38 (3.7)	
CMV (IgG)				
Positive	48 (82.8)	849 (86.6)	897 (86.4)	
Negative	2 (3.4)	44 (4.5)	46 (4.4)	0.5538**
Not informed	8 (13.8)	87 (8.9)	95 (9.2)	
Syphilis (VDRL)				
Positive	2 (3.4)	13 (1.3)	15 (1.4)	
Negative	55 (94.9)	964 (98.4)	1.019 (98.2)	0.1983**
Not informed	1 (1.7)	3 (0.3)	4 (0.4)	
Hepatitis B (HBsAg)				
Positive	0 (0.0)	9 (0.9)	9 (0.9)	
Negative	57 (98.3)	938 (95.7)	995 (95.9)	0.5896**
Not informed	1 (1.7)	33 (3.4)	34 (3.2)	
Anti-HBs				
Positive	24 (41.4)	272 (27.8)	296 (28.5)	
Negative	30 (51.7)	553 (56.4)	583 (56.2)	0.1141*
Not informed	4 (6.9)	155 (15.8)	159 (15.3)	
Hepatitis C (anti-HCV)				
Positive	2 (3.4)	13 (1.3)	15 (1.4)	
Negative	53 (91.4)	854 (87.7)	907 (87.4)	0.2237**
Not informed	3 (5.2)	113 (11.5)	116 (11.2)	

*Pearson χ^2; **Fisher test; HIV: human immunodeficiency virus; CMV: cytomegalovirus; HCV: hepatitis C virus.

antibodies and positive for IgG antibodies against rubella, this child was confirmed as a case of congenital rubella syndrome by the clinical-epidemiological criterion. In two cases, it was not possible to evaluate the follow-up of children because of the lack of data in medical records (**Table 5**).

In 6 out of the 11 children exposed to CMV, congenital infection was ruled out during clinical and laboratory follow-up. In the five others, it was not possible to rule out the infection due to the lack of data in medical records (**Table 5**).

Of the 15 (1.5%) newborns exposed to syphilis, congenital infection was registered in two newborns, who were then treated with crystalline penicillin. The infection was ruled out in seven newborns after clinical and laboratory follow-up (long bone x-ray, transfontanelar ultrasound, fundoscopy, VDRL, and analysis of liquor). In six children, it was not possible to assess the occurrence of vertical transmission due to the lack of data in medical records (**Table 5**).

Of the nine children exposed to HBV, seven were vaccinated against hepatitis B and received anti-hepatitis B immunoglobulin in the first 12 hours of life. However, it was not possible to rule out infection in the nine newborns due to the lack of data in medical records (**Table 5**).

Table 4 – Frequency of infections caused by the viruses of hepatitis B and C according to the age group of the pregnant women.

Age group	[a] anti-HBs IgG+	anti-HBs IgG-	P-value
<20	75 (54.0%)	64 (46.0%)	
20–29	172 (38.6%)	273 (61.4%)	<0.0001*
30–39	45 (17.8%)	208 (82.2%)	
≥40	4 (9.5%)	38 (90.5%)	
	[b]HBsAg+	HBsAg-	
<20	1 (0.6%)	165 (99.4%)	
20–29	2 (0.4%)	498 (99.6%)	0.0538**
30–39	4 (1.4%)	287 (98.6%)	
≥40	2 (4.4%)	45 (95.7%)	
	[c] anti-HCV IgG+	anti-HCV IgG-	
>20	0 (0.0%)	151 (100%)	
20–29	7 (1.5%)	453 (98.5%)	0.1638**
30–39	7 (2.6%)	259 (97.4%)	
≥40	1 (2.2%)	44 (97.8%)	

*Pearson χ^2; **Fisher test; HCV: hepatitis C virus; [a]in 159 cases, the result of anti-Hbs IgG was ignored; [b]in 34 cases, the result of HBsAg was ignored; [c]in 21 cases the result of anti-HCV IgG was ignored.

It was not possible to assess the occurrence of infection in the 15 children born from anti-HCV positive mothers due to the lack of data in medical records.

Forty-nine children, born from the 58 HIV-positive pregnant women, were followed-up at the Pediatric Infectology Service of HUAP. For 46 of them, HIV infection was ruled out with anti-HIV serological tests and viral load quantification. At the end of this study, one child was still being followed-up to complete the laboratory examinations. HIV vertical transmission was observed in two children, and one of them also had congenital toxoplasmosis. Because of the lack of medical records, it was not possible to establish the outcome for nine children followed-up at another service (**Table 5**).

DISCUSSION

The results of our study demonstrate that even though there national programs addressed to controlling these diseases (including sexually transmitted diseases – STDs), women at fertile age are still prone to the infections analyzed here, with the risk of transmitting them to their children, leading to fetal loss, congenital malformations, and neonatal death. National and international studies have been showing the importance of the early screening of infectious, vertically transmitted diseases during the prenatal period, enabling treatment, and the introduction of preventive measures to control congenital infections[1].

The seroprevalence of IgG anti-toxoplasma antibodies in our study was 61.4%. The values described for pregnant women in national studies ranged from 31%, in Caxias do Sul (RS)[2], to higher percentages, like 74.4%, in Recife (PE)[3], and 91% in Mato Grosso do Sul[1]. According to Detanico et al.[2], seroprevalence is higher among pregnant women aged more than 30 years old, and when there is handling of raw meats, consumption of raw vegetables or meat, raw unpasteurized milk, direct contact with the ground[4], contact with cats and/or dogs, low socioeconomic and schooling levels, and little knowledge about the disease[5].

In international studies, seroprevalence values of IgG anti-toxoplasma antibodies among pregnant women are also variable: 18.8% in Spain[6], 50.6% in Morocco[7], and 80.3% in Congo[8]. The factors associated with higher prevalence are similar to those described by national authors.

In our study, IgM antibodies were detected in 2.4% (24) of pregnant women, suggesting current or recent infection caused by this protozoan, with possibility of transmission to the fetuses. Vertical transmission took place in 5 (33.3%) of the 15 followed-up

Table 5 – Outcome of children exposed to toxoplasmosis, rubella, hepatitis B, hepatitis C, syphilis, cytomegalovirus and human immunodeficiency virus.

Infection	Children exposed	Infection ruled out	Vertical transmission	Ignored
Toxoplasmosis	24	10 (41.7%)	5 (20.8%)	9 (37.5%)
Rubella	5	2 (40%)	1 (20%)*	2 (40%)
Hepatitis B	9	**	–	9 (100%)
Hepatitis C	15	–	–	15 (100%)
Syphilis	15	7 (46.7%)	2 (13.3%)	6 (40%)
CMV	11	6 (54.5%)	–	5 (45.5%)
HIV	58	46 (79.3%)	2 (3.4%)	10 (17.3%)

*Clinical diagnosis; **prophylaxis in 7 children; HIV: human immunodeficiency virus; CMV: cytomegalovirus.

cases, confirming the possibility of transmission to the fetus when the infection occurs during the gestational period, and this event may have severe consequences. In the national papers, the positive result for IgM anti-toxoplasma antibodies ranged from 0.4 to 3.4%[9,10].

Our results demonstrated there is still a large proportion (38.8%) of pregnant women prone to toxoplasmosis (negative IgG), who are, therefore, exposed to the risk of a prime infection during the gestational period, which indicates the need to implement measures to prevent and control toxoplasmosis during pregnancy.

The seroprevalence of IgG antibodies against rubella among the pregnant women assessed in this study was 95.1%. This result is higher to the percentages found in other national analyses: 89% in Paraná[11], 93.1% in São José do Rio Preto (SP)[10], and 92.5% in Niterói (RJ)[12]. The high values for seroprevalence may be associated with the implantation of the National Plan for the Control of Rubella and Congenital Rubella Syndrome in Brazil, in 1998[13], which contemplates, among other strategies, the vaccination of women at a fertile age. The maintenance of high rates of immunization coverage is essential to control the congenital rubella syndrome. Even if not expected, the congenital rubella syndrome may occur in locations with low rates of susceptibility, as demonstrated by Désinor et al.[14] in a region of Haiti, where only 4% of the pregnant women were susceptible.

Seroprevalence for CMV observed in our study was 95.1%, higher to the value (76.6%) found by Inagaki et al.[9] among pregnant women in Sergipe, and lower to that (97.5%) found by Spano et al.[15] in Vitória (ES). In the state of Mato Grosso do Sul, Figueiró-Filho et al.[1] detected the seroprevalence of 82%, is lower to that observed in this study. However, unlike what we observed here, chronic infection by CMV was statistically associated with older age among pregnant women.

Even though some studies have demonstrated lower percentages of seroprevalence for CMV in pregnant women than those we found – 46.8% in France[16] and 68.3% in Italy[17] – similar or higher values were found in the international literature in general: 92.6% in Havana, Cuba[18]; 87.3% in Nagasaki, Japan[19]; and 95% in Santiago, Chile[20]. According to Yamamoto et al.[20], the high seroprevalence for CMV suggests that maternal reinfection would be the main form of congenital infection, which would lead to the search of the virus directly in the fetuses or in the newborns, using detection in the blood, urine, and saliva through viral culture or polymerase chain reaction.

The seropositivity for syphilis detected in our study was 1.4%, similar to that found in a study conducted with pregnant women in Paraná: 1.6%[11]. The difference is that, in this study, it was possible to observe a statistically significant association between the increasing seroprevalence and the age of the women. Other studies with pregnant women, conducted in South America, also showed similar frequencies: 4.5% in Cochabamba, Bolivia[21] and 0.6% in Lima, Peru[22]. In both studies, the frequency of syphilis was significantly higher among pregnant women with previous history of STD.

Unlike the observations in this study, an analysis carried out in Malawi, Zambia, and Tanzania[23] showed 6.6% seroprevalence of syphilis. Potter et al.[23] observed that the positivity for syphilis was higher among HIV-positive pregnant women (7.3%) than among HIV-negative pregnant women (2.5%). In the study by Potter et al.[23], seven independent and statistically significant factors were correlated with the prevalence of syphilis and HIV:

1. different cities in the studied countries;
2. HIV infection;
3. age between 20 and 24 years old;
4. being a widow, separated or divorced;
5. having been treated for genital ulcer in the past year;
6. history of stillbirth;
7. history of preterm birth.

In our study, HBsAg was detected in 0.9% of the cases, which is within the positive range (0.3–1.8%) found in national studies conducted with pregnant women[1,10,11,24-26]. Values that are similar to those observed in Brazil are also described in the global literature: 0.2% in Cordoba, Argentina[27]; 0.6% in Granada, Spain[28]; 0.9% in India[29]; and 1.5% in Tripoli, Libya[7]. Studies carried out with pregnant women from African countries and China detected higher frequencies, like 8.2% in Nigeria[30] and 6.7% in Jiangsu, east of China[31]. The differences found are related mainly to the regional differences and to the age when the infection occurred[32].

Considering the high risk of HBV vertical transmission, prophylaxis with vaccine and hyperimmune immunoglobulin in the first 12 hours of life was performed in seven of the nine children exposed in this study. However, it was not possible to rule out the occurrence of vertical transmission, since newborns were not properly followed-up after birth. Results that are similar to ours were described by Perim et al.[33] in a study about the prevalence of HbsAg conducted with pregnant women from Ribeirão Preto (SP): out of the 26 newborns of women who were HBsAG positive, only in 18 prophylaxis for hepatitis B was conducted properly.

An unexpected finding of this study was the lower frequency of anti-HB antibodies in older age groups. These antibodies were present in 296 (33.7%) of the 879 pregnant women tested. The frequency of these antibodies decreased with age, and this association was statistically significant ($p<0.0001$). It is possible that this prevalence among pregnant women aged less than 30 years old is related to the immunization program against hepatitis B instituted by the government.

The frequency of antibodies against the hepatitis C vírus (anti-HCV) in our study was 1.6% higher than the values found in other national studies carried out with pregnant women, as follows: 0.3 in Mato Grosso do Sul[25], 0.6% in Espírito Santo[26], and 0.7% in São Paulo[10]. Higher frequencies of anti-HCV in pregnant women are described in the international literature: 2.1% in Gabon, Central Africa[34], and 15.8% in Egypt[35]. These frequencies reflect the higher HCV seroprevalence in the general population of these countries.

HCV transmission from mother to child is not a common incidence. The estimations of the percentage of vertical transmission range from 3 to 10%[36]. In large studies, the risk seems do not exceed 4%[37,38]. Some of the risk factors would be HIV coinfection, high maternal viral load, previous or current intravenous use of illicit drugs, vaginal labor, breastfeeding, and the female gender of the child[37]. Many of these risk factors were never confirmed. The risk of transmission is maximum in mothers coinfected with HIV[36]. The high viral load at the

time of birth is also a risk factor, especially when the virus is associated with mononuclear cells in peripheral blood. Female infants have twice as much the chance of acquiring the infection from their mothers, when compared to male infants[37]. The time when the transmission occurs is uncertain, but evidence points to intrauterine transmission[39]. HCV is present in maternal milk, but the incidence of infection among the infants who are breast-fed is similar to those who are bottle-fed[36,38]. However, a recent systematic study was incapable of identifying any measure (types of childbirth, type of feeding) capable of reducing the transmission from mother to child[36].

Even though this study has observed higher frequency of anti-HCV in HIV-positive pregnant women (3.4%), in comparison that observed among non-infected pregnant women (1.3%), this result was not statistically significant. Higher frequencies in HIV-positive pregnant women were also observed by other authors. Jamieson et al.[40], in Bangkok, Thailand, observed that the frequency of HCV was 3.8% in pregnant women infected by HIV, and 0.3% in HIV-negative pregnant women. The risk factors identified for the HCV infection were use of injectable drugs, a partner with a history of use of injectable drugs and a previous history of blood transfusion.

The frequency of seropositivity for HIV in our study was 5.8%, 14 times higher than the national estimated value (0.4%)[41]. However, one must consider the fact that HUAP is a reference center for the prenatal follow-up of prenatal women infected with HIV; for this reason, there is a concentration of a large number of pregnant women referred from other health units, in this hospital. In a study with similar characteristics, Gonçalves et al.[10] found seroprevalence of 2.1% for HIV in 574 pregnant women who were present at the High Risk Pregnancy Unit from the Base Hospital of São José do Rio Preto (SP), from January 2006 to December 2007.

Other national studies have reported different prevalence rates among pregnant women, depending on the location and the characteristics of the study population. In the Metropolitan Region of Vitória (ES), Lima et al.[26] assessed 332 parturients and 202 pregnant women from February to October 1999, and obtained prevalence rates of HIV infection in both groups, and in total the percentage of women (534) was 0.9, 0 and 0.6%, respectively. The risk factors associated with HIV infection were the report of STD and the fact of having a partner with history of blood transfusion, drug usage, or seropositive for HIV. In another study, also conducted in Vitória, from January to December 1999, Miranda et al.[24] found prevalence of 0.8% for HIV among the 1,068 pregnant women studied. The associated risk factors were a previous history of STD, negligence regarding the use of condoms, prostitution, blood transfusions, and use of injectable drugs. One case of coinfection by HIV and HBV was identified in one of the women, by HIV and syphilis, in another one, and HBV and syphilis, in five of them[24].

A study about the estimated prevalence of HIV, conducted by the spatial analysis of pregnant women in Porto Alegre (RS), assessed all of the live births registered in the data base of the National System of Live Births (SINASC), and all of the newborns exposed to HIV during pregnancy registered in the data base of the National System of Disease Notification (SINAN) in 2003. These were geo-referenced data, and the estimations of HIV seroprevalence obtained among pregnant women ranged from 0 to 8%. The areas with high prevalence of HIV-positive pregnant women were those close to slums, where the income and the schooling is lower, but fertility rates are high[42].

Considering the specificity of our study, the HIV seroprevalence observed here is also high, when compared to values observed in other countries, as follows: 0.5% of seroprevalence for HIV among pregnant women in Lima, Peru[22] and 0.54% in Cordoba, Argentina[27]. Other studies presented even lower frequencies, like 0%, in Spain, in a study conducted by Ramos et al.[43]. Also in Spain, seroprevalence rates of 0.15 and 0.16% were described by Gutierrez-Zufiaurre et al.[6] and Sampedro et al.[28], respectively.

This study had the limitations of any retrospective analysis, especially regarding the identification of vertical transmission. A study involving the revision of medical records may be affected by the difficulty to locate the records, the quality of medical records, the possible loss of test results, and especially by the lack of response from those in charge of the children at the health service, thereby confirming or ruling out the vertical transmission of the infections assessed.

However, our study was capable of detecting important rates of vertical transmission of HIV, toxoplasmosis, and syphilis. One child presented changes compatible with congenital rubella, and five presented congenital toxoplasmosis; one of these had congenital coinfection with HIV and toxoplasma. The large number of pregnant women prone to toxoplasmosis reinforces the need for diagnostic and preventive measures against this infection during pregnancy.

Therefore, the results of this study demonstrate the importance of early prenatal serological screening for the described infections, with the goal of reducing the incidence of congenital transmission. Besides, it is important to increase the publication of information about how to prevent these infections and the necessary hygiene habits, as well as to encourage and improve the immunization coverage against rubella and hepatitis B, aiming to reduce the risk of these infections during pregnancy, thus contributing toward a better mother–child health.

Conflict of interest

The authors declare there is no conflict of interest.

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