SEROLOGIC PROFILE FOR INFECTIOUS AGENTS AMONG PREGNANT WOMEN SEEN AT A PUBLIC HOSPITAL IN SOUTHERN BRAZIL

PERFIL SOROLÓGICO PARA AGENTES INFECCIOSOS DE GESTANTES ATENDIDAS EM UM HOSPITAL PÚBLICO DO SUL DO BRASIL

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ABSTRACT

The objective of this study was to verify the seropositivity rates and registration of exam requests for infectious agents for pregnant women seen in the extreme south of Brazil. We carried out the study at HE-UFPel-EBSERH. The data search was carried out between the years 2017-2018, in the ADS-Hospitalar and AGHU systems. Test results were searched for the following infectious agents: *Toxoplasma gondii* (IgG and IgM), cytomegalovirus (IgG and IgM), human immunodeficiency virus (HIV), *Treponema pallidum* (Syphilis - VDRL), hepatitis C virus (HCV), hepatitis B virus (HBV). In addition to tests for syphilis in neonates of positive pregnant women. It is concluded that the recommended exams were performed, however, these were not in all pregnant women. For toxoplasmosis, HCV and HBSAg more than 90% of these were evaluated. For syphilis and HIV, these were 28.01% and 23.12%. For cytomegalovirus this was significantly lower, 2.14%. Although neonates were not followed up in the present study, these infections can be transmitted vertically. It would be important to have criteria that enable the monitoring of all stages of pregnancy, including delivery, by the same health team that performed the prenatal care and, if possible, that the health history of the pregnant woman be included in a single technological tool with easy access.

KEYWORDS: Pregnancy, Diagnosis, Sorology.

1. INTRODUCTION

Pregnancy is a physiological event intrinsic to women, corresponding to the period before delivery[1]. In that phase, several changes take place, including dietary alterations/restrictions and susceptibility to infections, which may occur due to gestational immunosuppression[2,3,4].

Since women are vulnerable to acquire infectious and parasitic diseases during this period, tracking several diseases is required to assess whether they have had contact with some infectious agent and/or potential vector prior to or during pregnancy so as to ensure they receive the needed care and prevent maternal and child morbidity-mortality[5,6,7].

Therefore, irrespective of social class, marital status, or age, pregnant women must follow a care program recommended by the Ministry of Health, which comprise medical visits and routine exams, including serologic tests[8].

Such tests should be performed periodically to detect antibodies against HIV, syphilis and hepatitis (B and C), *Toxoplasma gondii* and cytomegalovirus as proposed by the Ministry of Health in Brazil. Thus, these tests are highly relevant, as these biological agents can cause irreversible damage to the mother and the fetus. In the case of a positive diagnosis for potential biological agents, pregnant women should be evaluated clinically and, when necessary, treated appropriately[9,2,10].

In face of that, this study aimed to investigate the registration rate of serological tests of the main infectious diseases and their respective seropositivity in pregnant women attended in Southern Brazil.

2. MATERIAL AND METHODS

Data from the information service of the Teaching Hospital of the Federal University of Pelotas (HE-UFPel), where the study was carried out, were obtained through the descriptive cross-sectional model[11,12]; aiming to collect information on hospitalized pregnant patients. The hospital, located in the city of Pelotas, Rio Grande do Sul, Brazil, is a reference center in healthcare in the southern portion of the state and receives patients from 28 municipalities of the region exclusively through SUS (Public Healthcare System).

Sociodemographic data and the results of laboratory tests of all pregnant women seen between 2017 and 2018 were acquired from the ADS-hospitalar (Software Analysis and Development – hospitals) and AGHU

(Management Applications for University Hospitals) systems. The ADS-hospitalar system features, among other information, test results and patient evolution, whereas the AGHU system has sociodemographic data and medical records.

Test results for *Toxoplasma gondii* (IgG and IgM), cytomegalovirus (IgG and IgM), human immunodeficiency virus (HIV), *Treponema pallidum* (syphilis – VDRL) hepatitis C virus (HCV), and hepatitis B virus (HBV) were surveyed. Results of syphilis tests in newborns from positive mothers were also investigated.

Authorization for data collection from the HE-UFPel systems was sought through a letter of intent sent to the Teaching and Research Management (GEP) of the hospital and, after approval, the project was forwarded to the Research Ethics Committee involving humans of the Medical School of UFPel, where it was approved under protocol 2.692.075

Data statistical analysis was performed in the software IBM SPSS® version 22 for Windows® (IBM Corp. Released 2013). In order to compare the quantitative parameters of two, three, or more independent groups, the study of correlation of quantitative parameters, and assessed the significance of the association among variables (serology associated with age group and skin color) using p-value below 0.05 as the significance threshold.

3. RESULTS

The sample comprised 653 women between 14 and 47 years old. The subjects were split into categories, with the age groups between 19 and 28 years old (46.1%) and 29 to 38 years old (37.5%) being the most prevalent. Mean age was 29.1±7.1 years old (Table 1). Most patients (80.4%) self-reported having white skin (Table 1).

Table 1. Data on age and skin color of pregnant women seen at the HE-UFPel (2017-2018).

VARIABLES	CATEGORIES	*N (%)
Age	14-18	56 (8.6)
	19-23	150 (23)
	24-28	151 (23.1)
	29-33	122 (18.7)
	34-38	123 (18.8)
	39-43	45 (6.9)
	44-47	6 (0.9)
Total		653 (100)
Skin color*	White	448 (80.4)
	Black	90 (16.2)
	Pardo**	19 (3.4)

* 96 (14.7%) of the medical records were unfilled for skin color.
** Official term used by the Brazilian census, meaning dark-skinned.
Source: the Authors.

About three quarters (78.6%) of the pregnant women seen at the hospital were from Pelotas, as shown in Table 2.

It is noteworthy that some laboratory tests were not performed or their results were entered into the information system at the hospital. Thus, only one record (0.2%) was present for toxoplasmosis (IgG avidity), whereas cytomegalovirus status (IgG and IgM) was recorded for 14 patients (2.1%). HIV and syphilis data were present for 151 (23.1%) and 183 (28%) patients, respectively. The tests performed in over 90% of the women were toxoplasmosis IgG (99.4%), toxoplasmosis IgM (98.3), anti-HCV (94.3%), and HBsAg (91.1%) (Table 3).

The correlations between test results for different agents and age were obtained through Spearman's coefficient. The results obtained in the analyses were close to zero and non-significant (p > 0.05), which indicated no significant correlation between age and any of the parameters assessed.

Table 2. Municipality of residence of pregnant women seen at the HE-UFPel (2017-2018).

Municipality	Number of patients	Percentage
1. Pelotas	513	78.6
2.Capão do Leão	58	8.9
3. Canguçu	15	2.3
4. Morro Redondo	10	1.5
5. Arroio Grande	7	1.1
6. Pinheiro Machado	6	0.9
7. Piratini	6	0.9
8. São Lourenço	6	0.9
9. Herval	6	0.9
10. Cristal	4	0.6
11. Jaguarão	4	0.6
12. Others*	18	2.8

*Santana da Boa Vista, Turuçu, Arroio do Padre, Cerrito, Pedro Osório, Amaral Ferrador, Bagé, Caxias do Sul, Pedras Altas, Rio Grande, Santa Vitória do Palmar. **Source:** the Authors.

Table 3. Results of tests for infectious and parasitic agents among pregnant women seen at the HE-UFPel (2017-2018).

Serology*	N	N (%) Non-Reagent	N (%) Undetermined	N (%) Reagent
Toxo IgG	649	301 (46.4%)	13 (2%)	335 (51.6%)
Toxo IgG – Avidity	1	-	-	-
Toxo IgM	642	639 (99.5%)	-	3 (0.5%)
CMV IgG	14	1 (7.1%)	-	13 (92.9%)
CMV IgM	14	11 (78.6%)	2 (14.3%)	1 (7.1%)
Anti-HIV	151	151 (100%)	-	0
Syphilis	183	169 (92.3%)	-	14 (7.7%)
Anti-HCV	616	613 (99.5%)	-	3 (0.5%)
HBsAg	595	595 (100%)	-	0

*Toxo (Toxoplasmosis), CMV (Cytomegalovirus). **Source:** the Authors.

Result values for the correlation between positive syphilis seroreactivity and age (mean age of 25.9 years) were slightly lower than non-reagent results (mean age of 28.1 years), but with non-significant differences (p = 0.293).

Significant differences were found among the skin colors for toxoplasmosis IgG results (p < 0.001).

Table 4. Association of syphilis seroreactivity between mothers and their newborns at the HE-UFPel (2017-2018).

MOTHER	TITRATION						
	NEWBORN						
T I T R A T I O N	1:1	1:2	1:4	1:16	F.D.	N.R.	Total
1:1	2	0	0	0	0	1	3
1:2	4	2	0	0	0	0	6
1:8	0	0	1	0	0	0	1
1:32	0	0	0	2	0	0	2
1:64	0	0	0	0	1	0	1
Total	6	2	1	2	1	1	13

N.R.: non-reagent; F.D.: fetal death. **Source:** the Authors.

Table 5. Serology for toxoplasmosis IgG by age group among pregnant women seen at the HE-UFPel (2017-2018).

Age (years)	N (%)			
	Non-reagent	Undetermined	Reagent	Total
14-18	26 (46.4%)	1 (1.8%)	29 (51.8%)	56
19-23	79 (53.4%)	1 (0.7%)	68 (45.9%)	146
24-28	75 (50.3%)	3 (2.0%)	71 (47.7%)	147
29-33	46 (37.7%)	2 (1.6%)	74 (60.7%)	12
34-38	58 (47.2%)	4 (3.3%)	61 (49.6%)	123
39-43	16 (35.6%)	1 (2.2%)	28 (62.2%)	45
44-47	01 (16.7%)	1 (16.7%)	4 (66.7%)	6
Total	301 (46.4%)	13 (2.0%)	335 (51.6%)	649
	p = 0.071			

Source: the Authors.

Women of black skin color (average 63.35) had significantly higher mean IgG values than whose of white (average 31.53) and *pardo* color (average 35.68).

No significant differences were found for the other variables in relation to skin color (p > 0.05).

The percentages of women with non-reagent results for syphilis were 94.6% among white, 93.1% among black, and 85.7% among pardo subjects. Chi-squared test results showed no significant association between skin color and syphilis (p = 0.619).

A predominance of titration was observed regarding syphilis in mothers and newborns, with prevalences of 1:2 (46.2%) among mothers and 1:1 (46.2%) among newborns.

Table 4 shows that 11 newborns from 13 mothers (84.6%) also exhibited reagent results for syphilis. One newborn had fetal death (as per the hospital records) and one had non-reagent result. Matching syphilis reagent titration was observed in seven (63.6%) mothers and their respective newborns (values highlighted in Table 4).

All subjects tested for cytomegalovirus serology had positive results for IgG and/or IgM, of whom ten (71.4%) had positive results only for IgG antibodies.

Only one subject (7.1%) had positive results for both IgG and IgM.

Table 5 presents the distribution of the test results for IgG anti-*T. gondii* antibodies for each age group. The chi-squared test showed the differences among groups are close to statistical significance (p = 0.071). Only three subjects, all in the age group of 14 to 28 years, had positive results for IgM anti-*T. gondii* antibodies.

4. DISCUSSION

Most subjects were between 19 and 28 years old. That differs from the estimated standard for Brazil in recent years, as observed by Silva *et al*. (2015)[13], of over 20% of pregnant women being adolescents. In 2012, the Ministry of Health reported that 32% of the births that took place in SUS were by adolescents[14]. The present results showed a lower percentage of adolescent pregnancy, which accounted for 8.6% of the 653 cases. These figures confirm the estimates that Rio Grande do Sul has one of the lowest percentages of adolescent pregnancy in Brazil. In 2015, 14.54% of live births in the state were from mothers below 20 years old, whereas the Brazilian average was 18.15%[15].

Nonetheless, nearly 10% of pregnancies occurring among adolescent mothers is important since age may be a contributing factor for morbidities and mortality during gestation[16,17,18]. Younger patients may be at higher risk of clinical intercurrences as they still have immature reproductive organs and incomplete formation of skeletal musculature, which increases the odds of miscarriages, preterm births, and low weight at birth[18].

Pregnancies after 35 years old are considered late while mothers delivering after 45 years old are considered as having very advanced age. After that age group, women have a higher incidence of chronic diseases and are more likely to develop conditions that may hinder successful gestation such as obesity, gestational diabetes, and high blood pressure[19]. In the present study, the likelihood of the mothers studied presenting such issues was low since only six (0.9%) were at advanced gestational age.

Despite 14.7% of the subjects failing to self-report their skin color, over 80% stated being white, which is interesting for the region of the city of Pelotas since, unlike other municipalities in Rio Grande do Sul, the city has a large number of black persons. According to data from the Brazilian Institute of Geography and Statistics, 39% of the population in the region is composed of black people[20]. Records by the Ministry of Health emphasize that pregnant women may present different pathologies according to their ethnicity, e.g., issues related to high blood pressure are more common among black mothers. Moreover, the literature reports higher risk of diseases for the black population[21,22,23].

Studies have shown that skin color is a risk factor for infections. Although color by itself does not define the diseases, such differences are often associated with socioeconomic inequalities in the country. In Brazil, black persons tend to have lower schooling and income, to live in underprivileged communities, and to be

excluded from many social rights[24].

The serology tests surveyed revealed positive results for all agents except for HIV and HBV. Records of the toxoplasmosis avidity test was only found for one case (0.2%) despite three patients showing positive results for the IgM antibody. Likewise, data on serologic tests for cytomegalovirus IgG and IgM existed for only 14 women (2.1%). For toxoplasmosis IgG, toxoplasmosis IgM, anti-HCV, and HBsAg, results were present for over 90% of the subjects. Such inconsistencies in medical records, which can be considered a shortcoming of the present research, have also been detected in other evaluations. Baumgarten *et al.* (2011)[25], in a study also carried out in southern Brazil, reported that 68.1% of the medical records of pregnant women had results for HIV test; 87.2%, for hepatitis B; and 75.8% for toxoplasmosis. However, those authors did not collect data on cytomegalovirus or hepatitis C, which are reported for the South region of Brazil for the first time in this study. Despite the great importance of adopting and performing prenatal tests, the present study found a low incidence of requests. Depending on results, it is highly important to confirm disease diagnoses through complementary laboratory tests associated with the clinical evaluation of the patient. Allied to medical care in the follow-up of pregnant women, that allows identifying and minimizing many health issues that often affect mothers and their newborns[26].

Carrying out serologic tests during the gestational period is key to ensure healthy terms both for the mother and for the fetus under formation. Frischknecht *et al.* (2011)[27], found that serology tests among pregnant women for rubella and toxoplasmosis, hepatitis B, syphilis, and HIV were missing in 1.66%, 2.77%, 12.72%, and 30.57% of cases, respectively. The present study found no results for rubella, which were missing in 100% of cases, whereas 76.88% of the records lacked the HIV test. Such high rate of pregnant women not tracked for HIV infection clearly contradicts international guidelines[27], which points to the need of reassessing this practice. It is worth pointing out that HIV results may be undernotified since many pregnant women are followed by the Specialized Care Service for STI/AIDS (*Serviço de Atendimento Especializado em IST/AIDS* - SAE) in Pelotas and have deliveries at the hospital of the study.

The negative results for hepatitis B may be related to adhesion to the vaccine provided through the National Immunization Program in effect in Brazil[28].

The occurrence of syphilis during gestation has worried healthcare providers due to its large prevalence and severe repercussions to the fetal environment. The number of cases in Brazil increased by 1,047% between 2005 and 2013[29], while the notifications of congenital syphilis has increased by 135%. Overall, the issue with congenital syphilis has not been controlled yet although the etiological agent is well known, detection tests are available, and treatment with penicillin, a widely available and low-cost drug, is effective[30].

The percentage of reagent cases for toxoplasmosis was the lowest (42.6%) among the youngest age group (10 to 20 years old) and the highest (68.2%) among the oldest age group (41 to 50 years old). That may be related to higher exposure to *T. gondii* over time, which was also reported by Silva *et al.* (2015)[13] when discussing that the younger population is more vulnerable to infection by that pathogen. The present study found a 51.6% rate of positive results in the sample of pregnant women studied, which is within the range reported for this population in Brazil (31% to 91.6%).

The prevalence of women with negative results for toxoplasmosis IgG was high (46.4%), which makes them susceptible to acquire an acute primary infection during pregnancy and cause severe health risks to their fetuses[31]. The present results were higher than those reported by Rocha *et al.* (2015)[32], who found 22.5% of the pregnant women in their sample were seronegative. Pavan (2016)[33] highlights the importance of analyzing and knowing the local epidemiology so that the results found lay bases for educational programs with measures towards primary prevention against infection by this parasite. As previously mentioned, most women in the sample were from the city of Pelotas, where other works have found high prevalence of toxoplasmosis among different population groups such as HIV-positive persons[34] and oncology patients[35].

The results also showed the cytomegalovirus (CMV) test was little requested. The CMV belongs to the *etal* family and clinical signs of its infection vary from person to person, from slight discomfort and low fever to severe diseases of the digestive tract, central nervous system, and retina. It is important to point out that the CMV remains latent in the organism of patients so that any event of low immunity may reactivate the infection[36]. Since pregnant women have compromised immunity, CVM screening is of uttermost important as tracking the infection may determine levels of IgG and IgM antibodies, thus allowing treatment measures to be adopted aiming at good gestation and reduced risk to the fetus. Santos *et al.* (2000)[37] reported that, of the 292 newborns in their study, 20 (6.8%) were positive for CVM, which indicates congenital infection. The present research, however, obtained results only of the mothers, finding one (7.1%) with positive result for acute infection and two (14.3%) with undetermined results. The possible implications of such infection makes it very important to perform serologic follow-up of newborns.

Tests for hepatitis C were performed in 94.33% of the pregnant women. Of those, three (0.5%) were positive, a result that is close to reports of studies conducted in the states of Mato Grosso do Sul (0.2%)[38] and Espírito Santo (0.6%)[39]. The transmission of this virus is related to the use of injectable drugs, blood transfusions, sexual activities, surgical procedures, and use of illicit drugs, while vertical transmission may occur from nipple fissures that appear during breastfeeding, and the rate of transmission may increase if the mother is HIV positive[40].

5. CONCLUSION

The results obtained allow concluding that the tests recommended in the follow-up of pregnant women were carried out, however, not among all patients. Over 90% of the subjects were tested for toxoplasmosis, HCV, and HBsAg, whereas the rates for syphilis and HIV were 28.01% and 23.12%. The rate was markedly lower for cytomegalovirus at 2.14%. Although newborns were not targeted by the present study, it is relevant that such infections may be transmitted vertically.

The pregnancy period is very important in the life of mothers and adopting healthcare measures to meet the specific guidelines by the Ministry of Health concerning the health of mothers and newborns is essential.

It would be paramount to establish criteria that enable the follow-up in all phases of gestation, including delivery, by the same team responsible for prenatal care and, if possible, to record the medical history of pregnant women in a single, easily accessible technological tool.

6. ACKNOWLEDGMENT

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