

Congenital Toxoplasmosis diagnosed through abnormal newborn screening: a University Hospital Study in Minas Gerais, Brazil

Diagnóstico da toxoplasmose congênita por triagem neonatal alterada: estudo em Hospital Universitário no Estado de Minas Gerais

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ABSTRACT

Introduction: Congenital Toxoplasmosis (CT) represents a public health challenge in Brazil due to often delayed diagnosis and the potential for sequelae, which motivated its inclusion in neonatal screening. **Objective:** To evaluate the clinical outcomes during the first year of life of infants with suspected or confirmed CT, followed in Juiz de Fora, Minas Gerais, Brazil. **Methods:** This was a retrospective study of medical records of infants referred due to a positive neonatal screening (NS) test for CT, or a diagnosis of maternal toxoplasmosis during pregnancy, who were at least one year old. Maternal data (demographics, toxoplasmosis serology, and treatment) and infant data (anthropometric measures, toxoplasmosis serology at birth, NS results, fundus examination, and imaging findings) were collected. **Results:** Fifty-four patients were included, 94.4% of whom had a positive NS for toxoplasmosis, and 14.8% had maternal toxoplasmosis. Most infants had toxoplasmosis ruled out or considered unlikely (61.0%), and 18.5% were treated for CT. The prevalence of abnormalities in fundus examination and cranial imaging was 3.7% and 24.1%, respectively. No significant differences were observed in birth anthropometric measures or prematurity rates between infants with confirmed or excluded toxoplasmosis. **Conclusions:** NS is important for the diagnosis of CT, given the underdiagnosis of maternal toxoplasmosis and the possible absence of clinical signs at birth. The frequency of false-positive NS results highlights the need for confirmatory testing and close follow-up of these patients.

Keywords: Toxoplasmosis, Congenital; Neonatal Screening; Infectious Disease Transmission, Vertical; Public Health.

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RESUMO

Introdução: A toxoplasmose congênita (TC) representa um desafio para a saúde pública brasileira, devido ao diagnóstico frequentemente tardio e evolução com sequelas, o que motivou sua inclusão na triagem neonatal. **Objetivo:** Avaliar os desfechos clínicos no primeiro ano de vida de lactentes com TC, suspeita ou confirmada, acompanhados em Juiz de Fora/MG. **Métodos:** Estudo retrospectivo de prontuários de lactentes encaminhados por exame de triagem neonatal (TN) positivo para TC ou por diagnóstico de toxoplasmose gestacional, com no mínimo um ano de vida. Foram coletados dados maternos (demografia, sorologia para toxoplasmose, tratamento realizado) e do lactente (antropometria, sorologia para toxoplasmose ao nascimento, resultado da TN, fundo de olho, exame de imagem). **Resultados:** Foram incluídos 54 pacientes, sendo 94,4% com TN positiva para toxoplasmose, sendo 14,8% casos de toxoplasmose gestacional. A maioria teve a toxoplasmose descartada ou considerada improvável (61,0%), e 18,5% foram tratados para TC. A prevalência de alterações nos exames de fundo de olho e imagem craniana foi de 3,7% e 24,1%, respectivamente. Não houve diferença significativa nas medidas antropométricas ao nascimento ou na prevalência de prematuridade entre pacientes com toxoplasmose descartada ou confirmada. **Conclusão:** A TN é importante para o diagnóstico de TC, pelo subdiagnóstico de toxoplasmose gestacional, e porque sinais clínicos podem estar ausentes ao nascimento. A frequência de falsos positivos na TN dá destaque à necessidade de exames confirmatórios e de acompanhamento rigoroso desses pacientes.

Palavras-chave: Toxoplasmose congênita; Triagem neonatal; Transmissão vertical de doenças infecciosas; Saúde pública.

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INTRODUCTION

Congenital toxoplasmosis is a zoonotic disease caused by infection with the intracellular parasite *Toxoplasma gondii*¹. Transmission occurs through the consumption of raw or undercooked meat, as well as exposure to water and food contaminated with the protozoan's cysts, which represent its infectious form². In humans, *T. gondii* is also capable of crossing the placental barrier and infecting the fetus, characterizing vertical transmission³. The global transmission rate during pregnancy is approximately 29%, with an increasing risk as gestational age advances, highlighting its epidemiological relevance and the public health challenges it poses^{1,4}. The clinical manifestations in infected infants vary widely, ranging from subclinical forms — often undetected at birth — to severe conditions involving chorioretinitis, intracranial calcifications, hydrocephalus, and other serious neurological lesions. In extreme cases, congenital toxoplasmosis can lead to fetal death or spontaneous abortion, emphasizing the importance of prevention and timely treatment^{4,5}.

Despite advances in technology and basic sanitation in Brazil, which would be expected to reduce exposure to contaminated water and food, toxoplasmosis remains a significant public health concern⁶. Brazilian children have a fivefold greater risk of developing severe toxoplasmosis compared to European children, and they also exhibit a much higher prevalence of intracranial lesions detectable by computed tomography than those from European countries³. It is estimated that 5 to 23 infected children are born for every 10,000 live births in Brazil, 90% of whom are asymptomatic at birth, which can hinder early diagnosis⁷. Moreover, in a country with continental dimensions, marked by population heterogeneity and disparities in information dissemination, there is still a lack of consistent data regarding the management of congenital toxoplasmosis^{5,8}. Despite the existence of well-established diagnostic and treatment protocols, clinical management is not always implemented in a timely or appropriate manner, either due to a lack of awareness among healthcare professionals or to patients' limited access to healthcare services⁵. This results in frequent delayed

diagnoses, gaps in controlling vertical transmission, and a lack of standardized follow-up protocols for affected patients⁵.

Early diagnosis of maternal infection and appropriate treatment are crucial to reducing the morbidity and mortality associated with congenital toxoplasmosis⁹. In Europe, data suggest that early treatment initiation can reduce sequelae in infected infants by up to two-thirds^{4,10}. In Brazil, serological screening during prenatal care, as established by the Ministry of Health, is the main strategy to identify at-risk pregnant women⁷. However, late diagnosis remains a reality in many cases, compromising vertical transmission control and timely treatment for infected pregnant women¹¹. To mitigate this issue, congenital toxoplasmosis was recently included among the conditions screened by the National Neonatal Screening Program. All newborns with positive screening results must be evaluated promptly by a specialized team to determine the most appropriate management, as established by legislation published in 2021^{7,12}. In particular, in the state of Minas Gerais — where previous experiences with population-based neonatal screening revealed a high prevalence and severity of congenital toxoplasmosis — prenatal and neonatal screening programs began in early 2022^{4,7}.

Preventing vertical transmission through maternal prophylactic treatment depends on the interval between maternal infection and fetal transmission. If transmission occurs, treatment is expected to also mitigate the severity of fetal damage. Estimates of prenatal toxoplasmosis incidence can be obtained in three ways: first, through reported cases; second, through calculations based on maternal infection rates during pregnancy; and third, through newborn screening⁴. However, a negative prenatal screening result does not guarantee that the fetus is free from congenital infection. Children must be followed at birth to detect congenital infection. In France, since the establishment of surveillance by the National Reference Center for Toxoplasmosis, approximately 10% of false-negative diagnoses are identified annually⁴.

Given the absence of specific risk-based screening algorithms and the recent inclusion of congenital toxoplasmosis in the neonatal screening program, studies are needed to describe the clinical and epidemiological profiles of newborns and infants with suspected or confirmed infection. In the United States, some states conduct routine neonatal screening for toxoplasmosis, and this tool has proven valuable in identifying affected infants, preventing delayed symptomatic treatment, and enabling preventive interventions instead¹³.

Pre- and postnatal screening (in both newborns and infants) is essential to guide prevention, diagnostic, and treatment strategies—especially in regions with a high infection burden and greater virulence, such as Brazil. Therefore, the objective of this study is to evaluate the clinical outcomes at the end of the first year of life in infants with suspected or confirmed congenital toxoplasmosis, who were followed at a referral outpatient clinic in Juiz de Fora, Minas Gerais, which serves several cities in the Zona da Mata region.

METHODS

This was a retrospective study based on the analysis of electronic medical records of newborns and infants referred to the Childcare Outpatient Clinic of the University Hospital of the Federal University of Juiz de Fora (HU-UFJF), due to a positive neonatal screening test for congenital toxoplasmosis, or a maternal diagnosis of toxoplasmosis during pregnancy, who had completed at least one year of life. The study was approved by the institution's Research Ethics Committee involving human subjects, under CAAE number 76970124.5.0000.5133, with a waiver of the signature on the Informed Consent Form.

The Childcare Outpatient Clinic at HU-UFJF is a referral center for the care of newborns and infants from the city of Juiz de Fora and the Southeastern region of Minas Gerais who present with an altered result on the neonatal screening test for toxoplasmosis. It is part of a referral flow coordinated by the NUPAD – Center for Diagnostic Support Research and Actions of the Faculty of Medicine at the Federal University of Minas Gerais (UFMG), the institution responsible for neonatal screening in the state of Minas Gerais. As soon as the NUPAD's Monitoring and Care Sector identifies an altered screening result, the patient is scheduled for a consultation at the outpatient clinic, where care is provided according to the institutional clinical protocol for congenital toxoplasmosis. After a detailed anamnesis, the patient undergoes confirmatory testing, pharmacological treatment, and clinical follow-up when indicated.

Patients admitted to the clinic starting in January 2022, and who had completed one year of life by June 2024, were included. Exclusion criteria were: patients who discontinued follow-up before completing one year of life and those with incomplete medical records that prevented assessment of the study's primary outcome.

The following data were collected from the patients' electronic medical records: (i) Maternal data: demographic information, toxoplasmosis serology, gestational age at seroconversion, maternal treatment; (ii) Patient data: birth anthropometrics, toxoplasmosis serology at birth, neonatal screening test result (heel prick test), presence of any neurological abnormality (based on physical examination, neuroimaging, or cerebrospinal fluid analysis [CSF]), findings on physical or ophthalmological examination; presence of chorioretinitis, diagnosed by an ophthalmologist; intracranial calcifications, diagnosed via ultrasound, computed tomography, or magnetic resonance imaging; CSF abnormalities (white blood cell count $>20/\text{mm}^3$ and/or protein concentration $>150 \text{ mg/dL}$); and hearing loss, detected by auditory brainstem response (ABR).

The primary outcome was the confirmation of congenital toxoplasmosis based on clinical and laboratory criteria defined in the institutional protocol.

For statistical analysis, the collected data were entered into a Microsoft Excel spreadsheet, and statistical tests were conducted using the Statistical Package for Social Sciences (SPSS), version 22.0. Descriptive analyses included the calculation of frequencies, means, and standard deviations

for the studied variables. The independent samples t-test was used to compare birth anthropometric parameters, and abnormalities in complementary exams with the final diagnosis of gestational or congenital toxoplasmosis. A p -value < 0.05 was considered statistically significant.

RESULTS

A total of 54 patients were included in the study. Most were male (53.7%) and from municipalities outside the city of Juiz de Fora (70.4%). The mean age at the time of data collection was 22.8 months (standard deviation: 5.4 months). The mean age at admission to the outpatient clinic was 2.3 months (standard deviation: 2.7 months), and 40.7% of the children had their first consultation within the first month of life. Regarding birth data, most patients were born at term (88.9%), and the mean values for weight, length, and head circumference were within normal limits. Table 1 presents detailed sociodemographic data and birth-related clinical characteristics of the study population.

Most patients (94.4%) had a positive result on the neonatal screening test for toxoplasmosis. During pregnancy, 8 mothers (14.8%) had a confirmed diagnosis of toxoplasmosis, and 7 (13.0%) received treatment for gestational toxoplasmosis. Among the newborns and infants followed in the study, toxoplasmosis was ruled out or considered unlikely in most cases (61.0%), and 10 patients received treatment for congenital toxoplasmosis. Most underwent fundus examination and neuroimaging, which revealed abnormalities in 3.7% and 24.1% of cases, respectively. Only 12 patients underwent cerebrospinal fluid (CSF) analysis, with 50.0% showing some abnormality. At the time of the study, 16

patients (29.6%) had already been discharged from follow-up, while 20 (37.1%) were still under outpatient care. Table 2 provides additional information on complementary exams and diagnostic classifications of the patients in the sample.

Only three patients in the sample had a normal neonatal screening test for toxoplasmosis. One of them was referred to the outpatient clinic because the mother had a confirmed diagnosis of gestational toxoplasmosis; this child's final diagnosis was congenital toxoplasmosis ruled out. In the other two cases, the mothers had a diagnosis of possible gestational toxoplasmosis: one infant was diagnosed with confirmed congenital toxoplasmosis, and the other was classified as having possible congenital toxoplasmosis.

Among the 11 pregnant women diagnosed with probable or confirmed gestational toxoplasmosis, only 7 received treatment during pregnancy. Seven of the infants born to these women were diagnosed with acute congenital toxoplasmosis, 3 were classified as having vertical exposure to toxoplasmosis, and 1 case remained under investigation.

There were no statistically significant differences in birth weight, length, head circumference, or prevalence of prematurity between infants born to mothers with probable or confirmed gestational toxoplasmosis, and those born to mothers with possible, unlikely, or gestational toxoplasmosis ruled out (Table 3). The same was observed when comparing infants with confirmed acute congenital toxoplasmosis to those without a confirmed diagnosis. Regarding complementary exams, the prevalence of abnormal fundus examination findings was significantly higher in the congenital toxoplasmosis group; however, no statistically significant differences were found between groups for central nervous system imaging abnormalities.

Table 1. Sociodemographic data and birth clinical characteristics of patients followed at the reference outpatient clinic for congenital toxoplasmosis.

	n	%
Male sex (n = 54)	29	53.7
City of origin (n = 53)		
Juiz de Fora	15	27.8
Other city in Minas Gerais	38	70.4
Gestational age at birth (n = 53)		
37 to 41 weeks and 6 days	48	88.9
< 37 weeks	5	9.3
≥ 42 weeks	0	0
	Mean	SD
Age in months (n = 54)	22.8	5.4
Age at admission to the outpatient clinic, in months (n = 54)	1.9	1.8
Birth weight (g) (n = 54)	3170.4	499.7
Birth length (cm) (n = 52)	47.9	2.3
Head circumference at birth (cm) (n = 53)	34.1	1.6

Caption: SD = Standard Deviation.

Source: By the authors, 2025.

Among the 51 patients with an altered neonatal screening test, 9 (17.6%) were classified as having acute congenital toxoplasmosis and received treatment. Statistically, the

probability of a positive neonatal screening test result in the group with acute toxoplasmosis, compared to those with vertical exposure, did not reach statistical significance ($p=0.49$).

Table 2. Results of the neonatal screening test, complementary exams, and final diagnosis of gestational and congenital toxoplasmosis in patients followed at the reference outpatient clinic.

	n	%
Abnormal neonatal screening test	51	94.4
Gestational toxoplasmosis (n = 54)		
Confirmed	8	14.8
Probable	3	5.6
Possible	12	22.2
Unlikely	12	22.2
Absent	14	25.9
No information	5	9.3
Congenital toxoplasmosis (n = 54)		
Acute congenital toxoplasmosis	10	18.5
Vertical exposure to toxoplasmosis	44	81.5
Maternal treatment	7	13.0
Infant treatment	10	18.5
Abnormal complementary exams		
Fundoscopy (n = 48)	2	3.7
CNS imaging (n = 40)	13	24.1
CSF analysis (n = 12)	6	50.0
Patient outcomes		
Discharged from outpatient follow-up	16	29.6
Lost to follow-up	17	31.5
Still in follow-up	20	37.1
Transferred to another service	1	1.8

Caption: CNS = Central Nervous System; CSF = Cerebrospinal Fluid

Source: By the authors, 2025.

Table 3. Comparison of gestational outcomes, anthropometric measurements, and abnormalities in complementary exams, according to the final diagnosis of gestational and congenital toxoplasmosis.

	Probable or confirmed gestational toxoplasmosis (n = 8)		Possible, unlikely, or absent gestational toxoplasmosis (n = 37)			
	Mean	SD	Mean	SD	t	p
Birth weight (g)	3121.5	362.4	3217.6	557.8	0.46	0.65
Birth length (cm)	48.4	1.2	47.9	2.4	0.49	0.62
Head circumference at birth (cm)	33.9	1.7	34.3	1.7	0.60	0.55
	n	%	n	%	χ^2	p
Positive neonatal screening	7	87.5	35	94.6	0.53	0.47
Gestational age < 37 weeks	0	0	4	10.8	0.95	0.33

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	Acute congenital toxoplasmosis (n = 10)		Vertical exposure to toxoplasmosis (n = 44)			
	Mean	SD	Mean	SD	t	p
Birth weight (g)	3187.4	382.4	3166.5	526.3	0.12	0.90
Birth length (cm)	47.9	1.8	47.9	2.5	0.04	0.97
Head circumference at birth (cm)	34.6	1.2	33.9	1.7	1.08	0.28
	n	%	n	%	χ^2	p
Positive neonatal screening	9	90.0	42	95.5	0.46	0.49
Gestational age < 37 weeks	0	0	5	11.4	1.28	0.26
Abnormal complementary exams						
Fundoscopy	2	20.0	0	0	7.93	0.005
CNS imaging	4	40.0	9	20.5	0.34	0.56

Caption: CNS = Central Nervous System; SD = Standard Deviation.

Source: By the authors, 2024.

DISCUSSION

This study described clinical and laboratory data from infants referred to a university hospital in Minas Gerais due to an altered neonatal screening test for congenital toxoplasmosis, or confirmed maternal toxoplasmosis during pregnancy. Of the 54 patients evaluated, 10 were confirmed to have acute congenital toxoplasmosis. There were no statistically significant differences in birth weight, length, head circumference, or gestational age compared to infants without a confirmed diagnosis. This finding reinforces the concept that most prenatal infections are subclinical at birth, although they may evolve with late sequelae, particularly ocular⁴.

However, a previous Brazilian study found an association between low birth weight and congenital toxoplasmosis, although no relationship was observed between the diagnosis and risk of prematurity or altered head circumference¹⁴. This suggests that, while congenital toxoplasmosis may be associated with complications such as prematurity and low birth weight, these clinical parameters alone are insufficient to distinguish cases of vertical exposure to *T. gondii*, highlighting the importance of neonatal screening as the starting point of the diagnostic process¹⁵.

The results of this study underscore the complexity of diagnosing and treating congenital toxoplasmosis, and reinforce the need for a multidisciplinary and longitudinal approach in the follow-up of pregnant women and newborns exposed to *Toxoplasma gondii*¹. Despite advancements in screening and diagnostic protocols, significant challenges remain—especially with regard to early confirmation of infection and timely treatment for both pregnant women and infants¹⁶. Although congenital toxoplasmosis is now part

of the National Neonatal Screening Program, the mean age at admission to the referral clinic was 2.3 months, indicating delays in appropriate diagnostic workup. This delay may result from factors such as limited access to healthcare services or insufficient guidance from healthcare professionals, and it may negatively impact patient outcomes³.

In our sample, 94.4% of patients had altered neonatal screening results. Among the three patients with negative screening tests, one was ultimately diagnosed with confirmed congenital toxoplasmosis. This suggests high sensitivity of the screening test, reinforcing its importance as a screening tool—despite the occurrence of a substantial number of false positives. Therefore, protocols for confirmatory testing with higher specificity must be established, along with a streamlined referral pathway to specialized outpatient clinics^{11,12}. Moreover, longitudinal follow-up — starting in the prenatal period with adequate antenatal care, and extending into pediatric care through routine follow-up visits — is essential. Both obstetricians and pediatricians should analyze maternal serology results, regardless of the neonatal screening outcome¹⁷. Similar findings have been reported in other studies and in French screening programs where approximately 10% of congenital toxoplasmosis cases are false negatives requiring close clinical follow-up, even in cases with initially normal screening results^{4,13}. Finally, it is worth noting that the polymerase chain reaction (PCR) test for Toxoplasmosis, which could play an important confirmatory role in such cases, was not available at the institution — a situation that is not uncommon within the Brazilian public healthcare system.

Seroprevalence of toxoplasmosis in Brazil is high and increases with age, exceeding 70% in certain age groups¹⁷. Factors such as tropical climate and food-handling practices

create favorable conditions for the survival of *T. gondii* and contamination of human hosts. Therefore, active evaluation and counseling of pregnant women regarding the risk of congenital toxoplasmosis are crucial. In our sample, only 5 of the 11 pregnant women with confirmed or probable toxoplasmosis received treatment during pregnancy. This is concerning, as adequate maternal treatment can significantly reduce the risk of vertical transmission and associated complications¹². The lack of treatment may reflect shortcomings in obstetric care, such as delayed diagnosis or inadequate counseling on the importance of pharmacologic therapy⁶. Improving prenatal care to ensure that pregnant women with toxoplasmosis receive timely and appropriate treatment is therefore critical^{8,18}.

A recent Brazilian study reported wide variation in the incidence of congenital toxoplasmosis across the country, with a positive association between case numbers and social vulnerability, and evidence suggesting underreporting in the North and Northeast regions¹⁹. Another study found that mortality from congenital toxoplasmosis is increasing in Brazil, and is higher in the North and Northeast regions²⁰. Although no deaths related to congenital toxoplasmosis were observed in our study, abnormalities in the fundus examination were detected in 20.0% of cases, and central nervous system imaging abnormalities in 40.0%, potentially indicating future morbidity. These rates are lower than those reported in another Brazilian study, in which 79.0% of patients with congenital toxoplasmosis had ocular lesions, and 53.5% had central nervous system (CNS) imaging abnormalities¹⁴. This discrepancy may be related to the timing of diagnosis and treatment initiation, as well as methodological differences between studies. Lesions tend to be more severe and frequent when maternal seroconversion occurs during the first or second trimester of pregnancy, respectively⁴. The timing of maternal seroconversion was not collected in the present study.

In addition, more pathogenic genotypes of *T. gondii* are found in South America and Africa compared to other parts of the world, and studies have shown that Brazil has a higher proportion of cases progressing to chorioretinitis and more severe clinical presentations². This supports the argument for early diagnosis and treatment. A study evaluating ocular outcomes of congenital toxoplasmosis in vulnerable areas of Brazil found that most chorioretinitis cases were unilateral and centrally located, affecting the macula, which is directly responsible for central vision and visual acuity²⁰. Even in late-onset infections, severe clinical forms can occur, as observed in a study conducted in Rio Grande do Sul, where children with congenital toxoplasmosis presented with ocular findings. This contrasts with European data, where severe forms are more consistently associated with early gestational infection^{4,21}.

The rate of confirmation of congenital toxoplasmosis in newborns with positive screening tests in our sample was only 17.6%, which falls within the range observed in a global narrative review, reporting a high false-positive rate in screenings conducted in Brazil^{1,4,10}.

Prevention of fetal infection through maternal prophylactic treatment depends on the interval between maternal infection and fetal transmission. If the fetus is already infected, treatment is also expected to limit disease severity^{2,4,14}. In the present study, 63% of pregnant women with confirmed or probable toxoplasmosis received treatment during pregnancy. This gap is concerning, particularly considering that, in France, early maternal treatment reduced the rate of congenital transmission from 59.4% (before universal screening became mandatory in 1992) to 46.6% afterward⁴. While treatment during pregnancy is important, it does not eliminate the need for mother-infant follow-up in the postnatal period, since complications can still arise even with adequate prenatal care. In a U.S. study, 11 of 120 congenitally infected children recruited into a treatment program died within four years, despite receiving treatment²³.

Although assigning a monetary value to human life is ethically questionable, every nation must allocate public resources across competing health demands, including the prevention of disabling diseases. A cost-effectiveness study of prenatal screening in Austria estimated a lifetime cost of €103 per birth with prenatal screening, compared to €323 without it⁴. Although the present study did not conduct a formal economic analysis, prolonged follow-up and multiple clinical interventions were observed in late-diagnosed cases. It is reasonable to assume that some of the more severe cases — where prenatal screening and/or treatment were not performed — could have been prevented through earlier identification and intervention, reducing both health burdens and healthcare costs.

Some limitations of this study should be acknowledged. This was a single-center study involving patients followed by a team adhering to a specific protocol, limiting the generalizability of the findings. Furthermore, the cross-sectional design does not allow causal relationships to be established between the variables studied. However, it is important to highlight that this research collected data following the implementation of congenital toxoplasmosis screening in the state of Minas Gerais — one of the first states to adopt it. Thus, these data may prove valuable for other referral centers emerging across the country as the national screening program expands.

This study reinforces the importance of early diagnosis and adequate treatment of both gestational and congenital toxoplasmosis, showing that there is still room for improvement. Despite advances in screening and diagnostic protocols, significant gaps remain in prenatal care and patient follow-up. There is an urgent need for the implementation of more effective public health policies aimed at strengthening the diagnosis and surveillance of gestational and congenital toxoplasmosis. These should be complemented by awareness campaigns directed at both the general population and healthcare professionals, as well as by investments to expand access to specialized prenatal care for suspected cases and to preemptive treatment for confirmed gestational infections. In addition, it is essential to ensure immediate pediatric follow-up for newborns of mothers with gestational infection or positive neonatal screening, in order to enable timely

diagnosis and early initiation of treatment for the infant. Enhancing obstetric and pediatric care, educating healthcare professionals, and raising public awareness about the risks of toxoplasmosis are essential steps toward reducing the morbidity and mortality associated with this disease.

CONCLUSION

Neonatal screening tests are an important tool for the early diagnosis of congenital toxoplasmosis, especially considering that not all cases of maternal toxoplasmosis are diagnosed and treated, and that clinical signs of the disease may be absent at birth. However, the high rate of false positives in neonatal screening highlights the need for confirmatory testing, close follow-up of these patients, and appropriate social and psychological support for their families. In light of the impending nationwide implementation of neonatal screening for congenital toxoplasmosis in Brazil, it is essential that healthcare professionals and support services be adequately prepared to face these challenges.

AUTHOR'S CONTRIBUTIONS

We describe contributions to the papers using the taxonomy (CRediT) provide above:

Conceptualization, Investigation, Methodology, Visualization & Writing – review & editing: YR Pedrosa; NV Medeiros; VF Alvim; STF Grunewald. *Project administration, Supervision & Writing – original draft:* YR Pedrosa, NV Medeiros, VF Alvim, STF Grunewald. *Data Curation & Formal Analysis:* STF Grunewald.

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REFERENCES

- Dubey JP, Lago EG, Gennari SM, Su C, Jones JL. Toxoplasmosis in humans and animals in Brazil: high prevalence, high burden of disease, and epidemiology. *Parasitology*. 2012;139(11):1375-424.
- Petersen E, Meroni V, Vasconcelos-Santos DV, Mandelbrot L, Peyron F. Congenital toxoplasmosis: Should we still care about screening? *Food Waterborne Parasitol*. 2022 May;27:e00162. DOI: <https://doi.org/10.1016/j.fawpar.2022.e00162>.
- Robert-Gangneux F, Dardé ML. Epidemiology of and diagnostic strategies for toxoplasmosis. *Clin Microbiol Rev*. 2012;25(2):264-96.
- Dubey JP, Murata FHA, Cerqueira-Cézar CK, Kwok OCH, Villena I. Congenital toxoplasmosis in humans: an update of worldwide rate of congenital infections. *Parasitology*. 2021; 148(12):1406-16. DOI: <https://doi.org/10.1017/S0031182021001013>.
- Strang AGGF, Ferrari RG, do Rosário DK, Nishi L, Evangelista FF, Santana PL, et al. The congenital toxoplasmosis burden in Brazil: Systematic review and meta-analysis. *Acta Trop*. 2020 Nov;211:105608. DOI: <https://doi.org/10.1016/j.actatropica.2020.105608>.
- Carneiro ACAV, Andrade GMQ, Costa JGL, Pinheiro BV, Vasconcelos-Santos DV. Toxoplasmosis in Brazil: a neglected disease with high prevalence. *Rev Soc Bras Med Trop*. 2019;52:e20180323.
- Ministério da Saúde (Brasil). Protocolo de notificação e investigação: toxoplasmose gestacional e congênita. Brasília (DF): Ministério da Saúde; 2018; [access in 2025 Dec 20]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/protocolo_notificacao_investigacao_toxoplasmose_gestacional_congenita.pdf.
- Reis MM, Tessaro MM, D'Azevedo PA. Prevalence and risk factors for *Toxoplasma gondii* infection in pregnant women in Southern Brazil. *Rev Inst Med Trop Sao Paulo*. 2019;61:e45.
- Peyron F, McLeod R, Ajzenberg D, Contopoulos-Ioannidis D, Kieffer F, Mandelbrot L, et al. Maternal and congenital toxoplasmosis: diagnosis and treatment recommendations of a French multidisciplinary working group. *Pathogens*. 2019;8(1):24.
- Berrébi A, Assouline C, Bessières MH, Lathière M, Cassaing S, Minville V, et al. Long-term outcome of children with congenital toxoplasmosis. *Am J Obstet Gynecol*. 2010;203(6):552.e1-6. DOI: <https://doi.org/10.1016/j.ajog.2010.06.002>.
- Andrade GMQ, Vasconcelos-Santos DV, Carellos EVM, Romanelli RMC, Vitor RWA, Carneiro ACAV. Congenital toxoplasmosis in a reference center of Southeastern Brazil: a cross-sectional study. *Rev Soc Bras Med Trop*. 2018;51:e20170325.
- Ministério da Saúde (Brasil). Diretriz nacional para a conduta clínica, diagnóstico e tratamento da toxoplasmose adquirida na gestação e toxoplasmose congênita. Brasília (DF): Ministério da Saúde; 2022; [access in 2025 Dec 20]. Available from: <https://www.gov.br/saude/pt-br/assuntos/saude-de-a-a-z/t/toxoplasmose/arquivos/diretriz-nacional-para-a-conduta-clinica-diagnostico-e-tratamento-da-toxoplasmose-adquirida-na-gestacao-e-toxoplasmose-congenita>.
- Hampton MM. Congenital toxoplasmosis: a review. *J Pediatr Health Care*. 2020;34(5):274-83. DOI: <https://doi.org/10.1016/j.pedhc.2019.11.004>.
- Vivacqua DPF, Paz AB, Frota ACC, Penna CRR, Martins MG, Abreu TF, et al. Antenatal factors related to congenital toxoplasmosis in Rio De Janeiro, Brazil. *J Matern Fetal Neonatal Med*. 2022 Dec;35(25):7200-6. DOI: <https://doi.org/10.1080/14767058.2021.1946507>.
- Montoya JG, Liesenfeld O. Toxoplasmosis. *Lancet*. 2004 Jun 12;363(9425):1965-76. DOI: [https://doi.org/10.1016/S0140-6736\(04\)16412-X](https://doi.org/10.1016/S0140-6736(04)16412-X).
- Oliveira GKA, Ferreira SRR, Moura VOL, Siqueira VDS, Reis TSA, Bridi V, et al. Biological screening for congenital toxoplasmosis in newborns from Jataí, Goiás, Brazil: a cross-sectional study. *Rev Esc Enferm USP*. 2024 Jul 15;58:e20230408. DOI: <https://doi.org/10.1590/1980-220X-REEUSP-2023-0408en>.

17. Lozano TDSP, Benitez A, Santos JCD, Navarro IT, Nagata WB, Pinto MDS, et al. Seroprevalence of *Toxoplasma gondii* and Associated Risk Factors in Pregnant Women in Araçatuba, São Paulo, Brazil: A Multi-Level Analysis. *Microorganisms*. 2024 Oct 30;12(11):2183. DOI: <https://doi.org/10.3390/microorganisms12112183>.
18. Firmino SS, Santos-Doni TR, Silva VME, Micheletto AC, de Souza MS, Hortêncio BL, et al. *Toxoplasma gondii* Seropositivity and Co-Infection with TORCH Complex Pathogens in Pregnant Women from Araçatuba, Brazil. *Microorganisms*. 2024 Sep 6;12(9):1844. DOI: <https://doi.org/10.3390/microorganisms12091844>.
19. Melo MS, Freitas LRS, Lima-Júnior FEF, Vargas A, Pereira JDS, Brito-Júnior PA, et al. Spatial pattern of congenital toxoplasmosis incidence and its relationship with vulnerability and national health indicators in Brazil. *Spat Spatiotemporal Epidemiol*. 2024 Nov;51:100693. DOI: <https://doi.org/10.1016/j.sste.2024.100693>.
20. Melo MS, Cabrera LAA, Lima SVMA, Dos Santos AD, Oliveira LMGB, de Oliveira RC, et al. Temporal trend, spatial analysis and spatiotemporal clusters of infant mortality associated with congenital toxoplasmosis in Brazil: Time series from 2000 to 2020. *Trop Med Int Health*. 2023 Jun;28(6):476-85. DOI: <https://doi.org/10.1111/tmi.13877>.
21. Salamoni AP, da Costa KCM, Giachini FR, Bressan AF. Ocular outcomes of toxoplasmosis in the Amazon-Cerrado transition zone, Brazil: a population-based study. *Trans R Soc Trop Med Hyg*. 2025 Feb 4;119(2):113-7. DOI: <https://doi.org/10.1093/trstmh/trae078>.
22. Conceição AR, Belucik DN, Missio L, Brenner LG, Monteiro MH, Ribeiro KS, et al. Ocular findings in infants with congenital toxoplasmosis after a toxoplasmosis outbreak. *Ophthalmology*. 2021;128(9):1346-55. DOI: <https://doi.org/10.1016/j.ophtha.2021.03.012>.
23. McLeod R, Boyer K, Karrison T, Kasza K, Swisher C, Roizen N, et al. Outcome of treatment for congenital toxoplasmosis, 1981–2004: the national collaborative Chicago-based, congenital toxoplasmosis study. *Clin Infect Dis*. 2006;42(10):1383–94. DOI: <https://doi.org/10.1086/501123>.

