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Management of Toxoplasma Seroconversions during Pregnancy in a Resource-Limited Setting: Experience from the Diamniadio Health District (Senegal)

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Abstract

Objective. To describe the management of toxoplasma seroconversions observed in 2024 in a resource-limited Senegalese district, detailing the laboratory strategy, ultrasound assessment, recourse to amniocentesis, and neonatal outcomes at 6 months. Methods. Multicenter observational study conducted from January to December 2024 in 16 public maternity units in the Diamniadio Health District. Women included were seronegative (IgG^-/IgM^-) at the first antenatal visit in the first trimester. Non-immune women underwent monthly serology. Any seroconversion was confirmed in a reference laboratory by a second blood draw and an IgG avidity test. Management combined immediate spiramycin, standard and targeted ultrasounds, and amniocentesis from 18 weeks' gestation with Toxoplasma gondii PCR. Neonates were followed up to 6 months. Results. Of 22,691 antenatal consultations, 5,249 were first-trimester first visits. Seven seroconversions were confirmed (incidence 0.13%). Median maternal age was 27 years (IQR 24 - 32). Three amniocenteses were performed (43%): two PCR-negative and one positive. Transient ultrasound findings (ventriculomegaly, ascites, hepatosplenomegaly, hydramnios) were observed and regressed spontaneously except in the PCR-positive case. That patient delivered prematurely at 34 weeks a neonate with congenital infection but with satisfactory progress at 6 months. Conclusion. In a context without legal termination for fetal anomaly, a simplified protocol combining spiramycin, IgG avidity, close ultrasound surveillance, and targeted amniocentesis appears feasible. PCR cost remains the main barrier, underscoring the need for structured neonatal follow-up and tailored parental counseling.

Keywords

Congenital Toxoplasmosis, Seroconversion, Pregnancy, Prenatal Ultrasound, Amniocentesis, Toxoplasma Gondii PCR, Spiramycin, Resource-Limited Settings, Senegal, Sub-Saharan Africa

1. Introduction

Toxoplasmosis in pregnant women is a major issue in maternal and neonatal health. Primary infection with Toxoplasma gondii during pregnancy exposes the fetus to a risk of vertical transmission that increases with gestational age: about 2% at 6 weeks, 23% at 18 weeks, and up to 56% at 30 weeks of amenorrhea [1]. The earlier the infection, the more severe the fetal consequences, including neurological involvement, intracranial calcifications, and chorioretinitis [2] [3]. Early European cohorts, notably those of Desmonts and Couvreur [1], established the relationship between gestational age and transmission risk. The introduction of early diagnostic and therapeutic strategies reduced the frequency and severity of congenital forms [4]-[6]. This approach involves several steps: immediate spiramycin therapy, infection dating by IgG avidity, recourse to amniocentesis with PCR, and, if positive, initiation of a combination therapy including pyrimethamine and sulfadiazine. The SYROCOT international meta-analysis confirmed that treatment effectiveness largely depends on earliness [7]. In the United States, the Chicago collaborative study followed more than 200 infected children and showed that prolonged treatments improved neurological and visual outcomes into adolescence [8]. Finally, the waterborne outbreak in British Columbia highlighted environmental exposures and the value of an integrated One Health approach [9].

In Africa, seroprevalence ranges from 30% to 50% depending on the setting. In Senegal, a study at Le Dantec Hospital reported a 34.5% seroprevalence among 941 pregnant women [10]. More recently, Diop *et al.* (2022) confirmed a prevalence of 28.9% among more than 10,000 pregnant women in Dakar, reflecting low population immunity [11]. Data from Ghana [12] and Nigeria [13] show similar profiles, while work from Morocco and Egypt confirms this regional vulnerability [14] [15]. A substantial proportion of pregnant women in sub-Saharan Africa is therefore exposed to the risk of seroconversion.

The Senegalese legal framework is a major constraint: medical termination of pregnancy is not authorized for fetal anomaly, including congenital infections. The Penal Code only provides for termination to save the mother's life [16] [17]. In this context, close ultrasound follow-up and neonatal surveillance are the main pillars of care. Moreover, while other maternal-fetal infections (HIV, syphilis, hepatitis B, tuberculosis) benefit from free national protocols and malaria is addressed by a proactive policy with free intermittent preventive treatment (sulfadoxine-pyrimethamine, SP) and management of severe forms [18]-[21], toxoplasmosis is not included in national programs, reinforcing the importance of local studies to

adapt international recommendations to Senegalese realities.

2. Methods

This multicenter descriptive observational study was conducted between January and December 2024 in sixteen public maternity units in the Diamniadio Health District, Dakar region, Senegal (Figure 1), following a standardized local protocol.

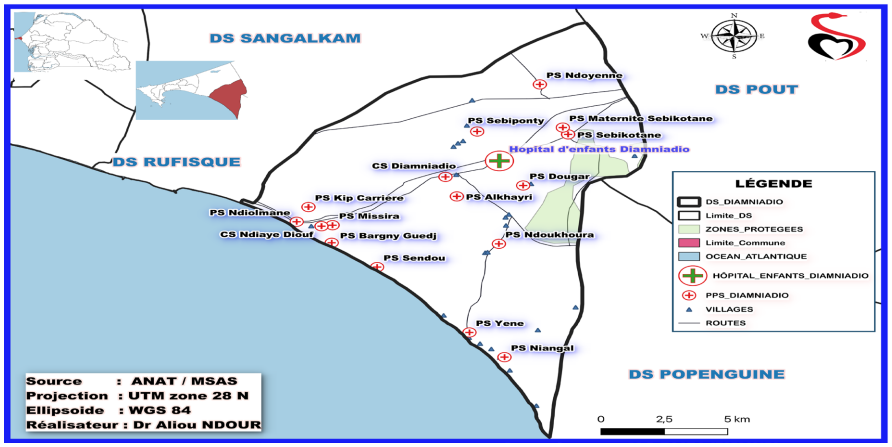


Figure 1. Diamniadio health district.

The study population comprised pregnant women who were seronegative (IgG^-/IgM^-) at the first antenatal visit in the first trimester and who had a confirmed seroconversion during follow-up. Exclusion criteria were lack of biological confirmation or incomplete ultrasound follow-up.

Laboratory. Toxoplasma serology was systematically performed in the first trimester. Immune women (IgG^+) were not subjected to additional surveillance, whereas non-immune women (IgG^-/IgM^-) were monitored monthly to detect early seroconversion. Any initial positivity was confirmed in a reference laboratory by a second sample with an IgG avidity test to date the infection. Rapid serology used an OnSite® Toxo IgG/IgM immunochromatographic test (turnaround 24 h - 48 h). In case of positivity, confirmation was performed by chemiluminescence (CMIA) on an Abbott Alinity i® analyzer, with a positivity threshold of 10 IU/mL for IgG and an index ≥ 1.1 for IgM. IgG avidity was interpreted using standard thresholds: low if < 0.3, intermediate 0.3 - 0.5 requiring repeat testing at 2 - 3 weeks, and high if > 0.5. When seroconversion was confirmed, amniocentesis was offered from 18 weeks' gestation and at least four weeks after infection. Amniotic fluid was analyzed by real-time PCR (Sacace® kit, Applied Biosystems 7500® platform) with a detection limit of ten copies/µL and an average turnaround of fourteen days. Costs ranged from 6,000 FCFA for rapid serology to 118,000 - 152,000 FCFA for PCR, as detailed in the annex. Senegal's guaranteed minimum wage (SMIG) is 64,000 FCFA (about 100 euros per month).

Imaging and fetal follow-up. A standard mid-trimester morphology scan (22 -

24 weeks) was systematically performed, in line with ISUOG and CNEOF standards. In case of seroconversion, targeted ultrasounds were scheduled every 2 - 3 weeks, with particular focus on the central nervous system, abdomen, and middle cerebral artery Doppler. Examinations were performed by obstetrician-gynecologists specialized in ultrasound using Mindray and SonoScape P9 devices with convex (2 MHz - 5 MHz) and endovaginal (5 MHz - 9 MHz) probes. Any suspicious finding was second-read by a specialist to ensure diagnostic reliability.

Therapy. Upon confirmation of seroconversion, spiramycin was started immediately. When amniocentesis was not performed or PCR was negative, this treatment was continued with close ultrasound surveillance. If PCR was positive, a triple therapy combining pyrimethamine, sulfadiazine, and folinic acid was introduced with weekly hematologic monitoring.

Data. Maternal data included age, gravidity, parity, obstetric history, and socio-epidemiological context (residence, cat exposure, gardening, dietary habits). Pregnancy follow-up included number of antenatal visits, serology schedule, and access conditions for tests. Each seroconversion was characterized by the date of the first negative sample, date of diagnosis, technique used, and quantitative values obtained. Obstetric management recorded spiramycin prescription and tolerance, amniocentesis and its results, ultrasound abnormalities (ventriculomegaly, calcifications, growth restriction, ascites, hepatosplenomegaly), and mode of delivery with indication. The Senegalese medico-legal context—absence of authorization for medical termination—was integral to the care pathway.

Neonatal. Parameters included gestational age at birth, weight, length, head circumference, Apgar score, and any resuscitation. Initial investigations comprised serology (IgG, IgM, IgA), PCR on blood or CSF, cranial ultrasound, and ophthalmologic exam. Short-term follow-up (1 - 3 months) assessed serologic dynamics, growth, neuroclinical progress, and complementary test results; at six months it evaluated psychomotor development, growth, potential complications (seizures, developmental delay, macrocrania), ophthalmologic exam, serology, and, if needed, EEG or MRI.

Outcomes. Primary endpoints were amniotic fluid PCR result, presence of significant ultrasound anomalies, 6-month neonatal outcome, and definitive confirmation of absence of infection by IgG negativization at 12 months.

Ethics. Data were anonymized and written consent was obtained for any invasive procedure. Management complied with national standards. The study adhered to the Declaration of Helsinki and was validated by the scientific committee of the Diamniadio Health District.

3. Results

In 2024, a total of 22,691 antenatal consultations were recorded in the Diamniadio Health District, including 5,249 first-trimester first visits at which initial toxoplasma serology was systematically performed. Seven confirmed seroconversions were identified (incidence 0.13%).

3.1. Case 1

25-year-old primigravida (G1P0), seroconversion in the first trimester (IgM^+, IgG^+, low avidity).

Management: spiramycin at diagnosis; no amniocentesis (refusal). Fetal morphology and follow-up ultrasounds showed small nonspecific choroid plexus cysts (**Figure 2**) that progressively disappeared within 2 months. Fetal growth was regular.

Neonatal data: term, appropriate for gestational age. Birth serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: at six months, normal growth and psychomotor development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

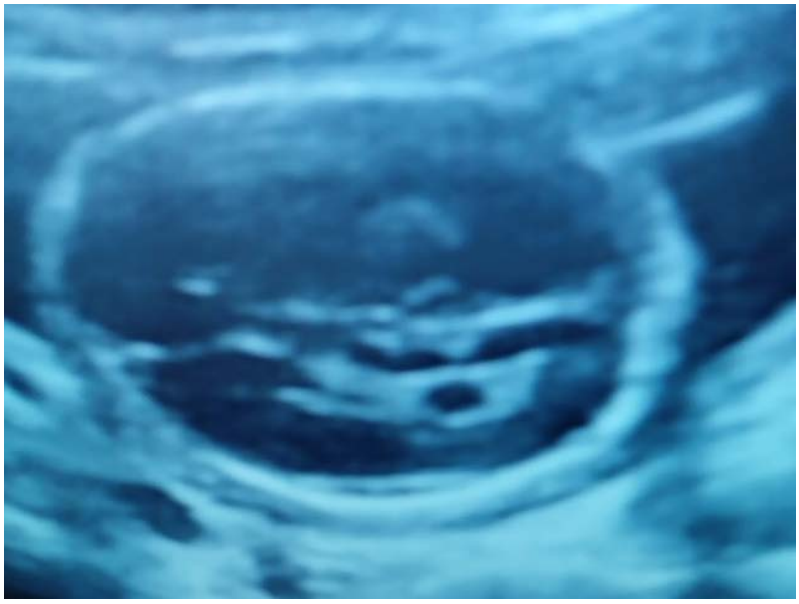


Figure 2. Transient right choroid plexus cyst, pregnancy at 22 weeks.

3.2. Case 2

30-year-old G2P1, seroconversion at 18 weeks (IgM^+, IgG^+, low avidity).

Management: spiramycin started; amniocentesis at 23 weeks, PCR negative. Ultrasound showed moderate ventriculomegaly (11 mm - 12 mm) and transient microcalcifications, all resolved by 30 weeks.

Neonatal data: term, appropriate for gestational age. Serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: satisfactory growth and neurological development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

3.3. Case 3

29-year-old G3P2, seroconversion in the second trimester (low avidity).

Management: spiramycin prescribed; no amniocentesis. Ultrasound showed isolated fetal ascites (Figure 3), regressive within three weeks.

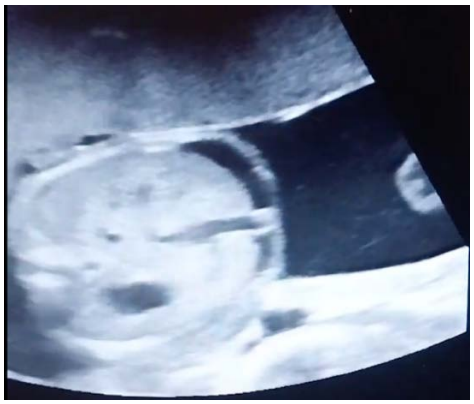


Figure 3. Moderate fetal ascites in a 29-year-old patient—six-month pregnancy.

Neonatal data: term, appropriate for gestational age. Serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: at six months, normal growth and development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

3.4. Case 4

26-year-old G2P1, seroconversion in the second trimester (low avidity).

Management: spiramycin started; no amniocentesis. Ultrasound showed moderate hepatosplenomegaly in the second trimester, normalized in the third trimester.

Neonatal data: term, harmonious growth. Serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: satisfactory development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

3.5. Case 5

32-year-old G4P3, seroconversion in the second trimester with low avidity.

Management: immediate spiramycin, then switch to triple therapy (pyrimethamine-sulfadiazine-folinic acid) after amniocentesis at 26 weeks, PCR positive for *T. gondii*. Follow-up ultrasounds showed moderate then severe ventriculomegaly (Figure 4) and progressive hydramnios around 28 weeks, with placentomegaly.

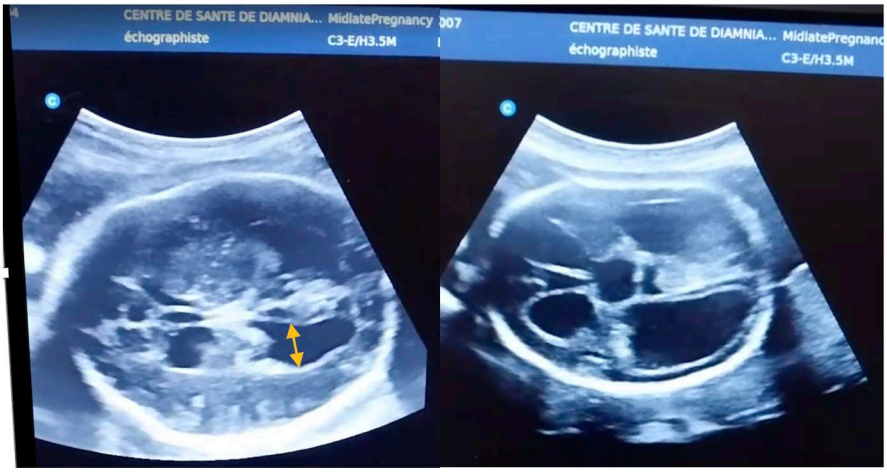


Figure 4. Progression of ventriculomegaly in the patient with positive Toxoplasma PCR on amniotic fluid.

Course progressed to a severe form (acute hydramnios) around 33 weeks, complicated by mirror syndrome. Therapeutic amniodrainage was performed under strict asepsis with antibiotic prophylaxis and post-procedure monitoring.

An eclamptic seizure required cesarean delivery at 34 weeks. Preterm neonate, 1,750 g, with persistent IgG and IgM, moderate ventriculomegaly, and normal fundus exam.

Postnatal follow-up: at six months corrected, serology still positive, confirming congenital infection. The child is currently treated with pyrimethamine-sulfadiazine-folinic acid (folinate) purchased by the family abroad. Overall development is satisfactory, with ongoing neuro-ophthalmologic follow-up.

3.6. Case 6

24-year-old G2P0, seroconversion in the first trimester (low avidity).

Management: spiramycin prescribed; no amniocentesis. Initial ultrasound showed head circumference at the lower limits of normal (−1.5 to −2.3 SD), suggesting borderline microcephaly. Measurements normalized during follow-up, indicating favorable evolution.

Neonatal data: term, normal growth. Serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: at six months, normal growth and development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

3.7. Case 7

31-year-old G3P2, seroconversion in the second trimester with initially intermediate avidity, confirmed low 18 days after the first sample.

Management: spiramycin started; amniocentesis at 22 weeks, PCR negative. Ul-

trasound showed isolated hydramnios in the second trimester, which spontaneously resolved in the third trimester.

Neonatal data: term, appropriate for gestational age. Serology: IgG present; IgM/IgA negative. Clinical exam, cranial ultrasound, and fundus exam normal.

Postnatal follow-up: harmonious development; serology trending to negativization.

Child probably uninfected; definitive confirmation expected after twelve months.

1. Synthesis of cases

Seven women had confirmed seroconversion during pregnancy (Table 1). In one case—a 32-year-old at 26 weeks—amniocentesis revealed a positive PCR for T. gondii and congenital infection was strongly suspected in the newborn due to persistent IgG and IgM at six months.

The six other patients, with seroconversions between 10 and 24 weeks, were treated with spiramycin alone. Three accepted amniocentesis, which was negative; the others refused. Amniocentesis acceptance was 43% (Figure 5).

Follow-up ultrasounds showed transient anomalies (mild ventriculomegaly, isolated ascites, borderline microcephaly, moderate hepatosplenomegaly, transient hydramnios), all regressing without neonatal sequelae. Newborns were term, appropriate for gestational age; birth serology IgG positive and IgM/IgA negative. Clinical exams, cranial ultrasounds, and fundus exams were normal. At six months, growth and psychomotor development were satisfactory, with serology trending to negativization. These infants are considered probably uninfected, with definitive confirmation expected after twelve months.

Thus, of the seven cases, one (14%) corresponded to confirmed congenital infection, while six (86%) were probably uninfected. Five pregnancies (71%) showed transient ultrasound anomalies, underlining the importance of serial follow-up to distinguish minor regressive signs from persistent involvement.

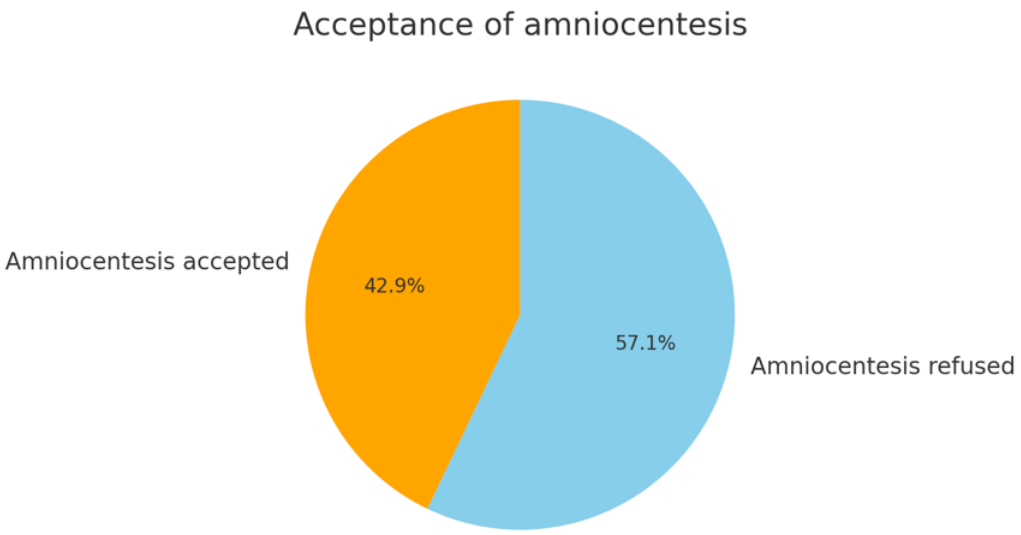
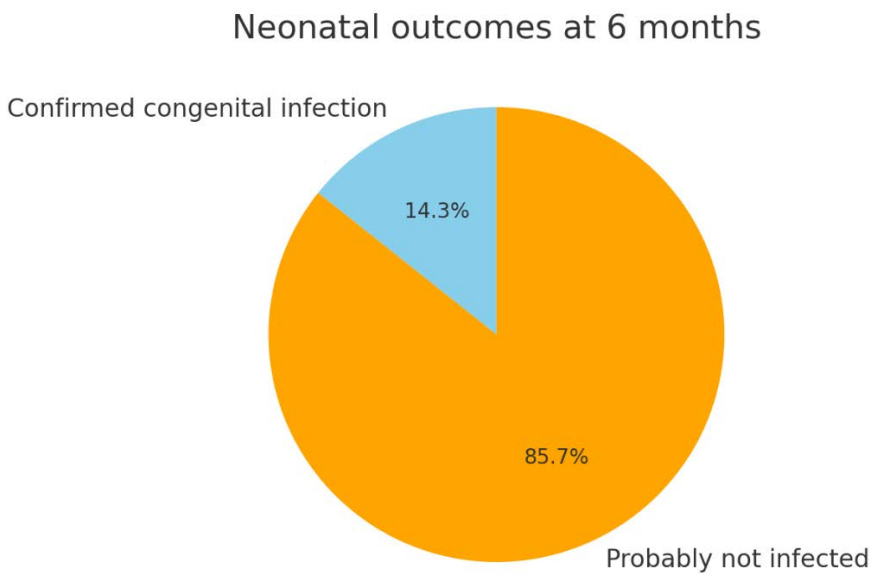


Figure 5. Acceptance of amniocentesis (n = 7).

Distribution of patients according to acceptance (43%) or refusal (57%) of amniocentesis.



Graph 2. Neonatal outcomes at 6 months (n = 7).

Six probably uninfected children (86%) and one confirmed congenital infection (14%).

Table 1. Case summary (Structure preserved from original: IgG avidity, amniocentesis, amniotic PCR, ultrasound anomalies, neonatal outcome, 6-month follow-up.)

Case	Maternal age, Gravidity/ Parity, Term	IgG avidity	Amniocentesis	Amniotic PCR	Ultrasound anomalies	Neonatal outcome	6-month follow-up
1	25, G1P0, T1	Low	No	Not performed	Transient choroid plexus cysts	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & development, serology negativizing
2	30, G2P1, 18 wks	Low	Yes (23 wks)	Negative	Moderate ventriculomegaly, transient microcalcifications	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & neurodevelopment, serology negativizing
3	29, G3P2, T2	Low	No	Not performed	Isolated regressive ascites	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & development, serology negativizing
4	26, G2P1, T2	Low	No	Not performed	Transient hepatosplenomegaly	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & development, serology negativizing

Continued

5	32, G4P3, 26 wks	Low	Yes (26 wks)	Positive	Severe ventriculomegaly, hydramnios, placentomegaly	Preterm 34 wks, 1750 g, IgG^+ IgM^+, moderate ventriculomegaly	Confirmed congenital infection, ongoing neuro-ophthalmologic follow-up
6	24, G2P0, T1	Low	No	Not performed	Borderline transient microcephaly	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & development, serology negativizing
7	31, G3P2, T2	Intermediate → Low	Yes (22 wks)	Negative	Transient isolated hydramnios	Term, AGA newborn, IgG^+, IgM/IgA^-, normal exam	Normal growth & development, serology negativizing

4. Discussion

This multicenter study in a resource-limited Senegalese district highlights the feasibility and safety of a simplified protocol for managing toxoplasma seroconversion during pregnancy. The combination "immediate spiramycin - IgG avidity testing - close serial ultrasounds - targeted amniocentesis - triple therapy if PCR positive" proved adapted to local realities and reproducible.

4.1. Main Lessons

Our results support monthly serologic follow-up and the use of IgG avidity to date infection. Serial ultrasound enabled documentation of regression of minor anomalies (mild ventriculomegaly, ascites), providing reassurance for patients refusing amniocentesis. This aligns with European and North American cohorts emphasizing the prognostic value of ultrasound follow-up [4]-[9].

4.2. Immunologic Context

Most pregnant women at baseline were seronegative, confirming the low immunity described in Senegalese surveys (28.9% - 34.5%) [10] [11] and in other West African countries [12] [13]. This vulnerability reflects later exposure linked to urbanization, improved hygiene, and changing dietary practices. Biologically, IgM interpretation remains tricky due to prolonged persistence. IgG avidity, reflecting immune maturation, remains the most reliable tool to date infection and complement serology interpretation [15] [16].

4.3. Environmental Factors

The small number of seroconversions (n = 7) may also be explained by ecological conditions unfavorable to oocyst survival. Their viability declines rapidly with drought and intense sunlight—features of the Sahelian climate of Diamniadio.

This hypothesis is supported by Moroccan data showing higher seroprevalence in humid coastal areas than in the arid interior [14]. The progressive decline in seroprevalence observed in Dakar over decades [10] [11] could thus reflect the combined effect of climate, urbanization, and improved dietary practices.

4.4. Economic Constraints and Acceptability

Amniocentesis acceptance was limited (43%), well below European rates (>70%) [4] [7]. Barriers included fear of miscarriage, the high cost of amniotic PCR (118,000 - 152,000 FCFA—nearly two months of minimum wage), and sociocultural pressures. The IgG avidity test, costing up to 67,000 FCFA, is also difficult to access.

Access to specific pediatric treatment is very limited: in our series, care for the infected newborn was initiated only thanks to family purchase of medications abroad. This illustrates both inequities in access and the crucial role of family solidarity.

4.5. Social and Legal Realities

In Senegal, medical termination of pregnancy is not authorized for fetal anomaly [16] [17]. This legal constraint requires a strategy centered on parental counseling and rigorous neonatal follow-up. The clinician's role is to support families by reconciling medical recommendations with cultural and religious realities.

4.6. Comparison with Other Maternal-Fetal Infections

Unlike HIV, syphilis, hepatitis B, or malaria—which benefit from free national programs—toxoplasmosis remains absent from priority programs [18]-[21]. This disparity exacerbates inequities in access, even though neonatal sequelae can be severe.

4.7. Ultrasound "Gray Zone"

Most detected anomalies were minor and transient. Such ultrasound signs, common in congenital infections [22] [23], require cautious interpretation. ISUOG 2022 guidelines stress the importance of serial follow-up and expert second reading [24].

4.8. One Health Approach

The circulation of T. gondii is maintained by animal reservoirs (stray cats, ruminants), as confirmed by recent Senegalese veterinary studies [25]-[28]. The Canadian waterborne outbreak [9] further underscores environmental sources. An integrated One Health approach linking human, animal, and environmental health is essential to reduce transmission risk.

4.9. Limitations and Perspectives

The small sample (n = 7) and refusal of amniocentesis in more than half the cases are limitations. Moreover, available neonatal follow-up currently covers only the

first 6 months, although follow-up to 12 months is planned to confirm infection status and detect late sequelae.

4.10. Clinical and Organizational Implications

Despite these limitations, the study shows that a "district-compatible" protocol is possible. Priorities to improve management include:

1) reducing the cost of molecular tests and avidity assays;

2) securing supply of antiparasitics (spiramycin, pyrimethamine, sulfadiazine) and folinic acid (folinate);

3) integrating toxoplasmosis into national maternal-fetal health programs;

4) strengthening parental counseling to adapt medical recommendations to cultural and religious realities.

5. Conclusions

This multicenter experience conducted in 2024 in the Diamniadio Health District shows that even in a resource-limited setting, it is possible to implement a pragmatic and reproducible protocol for managing toxoplasma seroconversion during pregnancy.

The strategy combining immediate spiramycin, serologic dating by IgG avidity, close ultrasound follow-up, selective amniocentesis, and triple therapy in case of positive PCR proved safe and adapted to local realities where medical termination for fetal anomaly is not authorized.

Several key lessons emerge:

1) most pregnant women remain vulnerable due to low seroprevalence, likely influenced by Sahelian environmental conditions (high sunlight, drought) that reduce oocyst survival;

2) economic (PCR and avidity costs) and sociocultural constraints (refusal of amniocentesis, absence of legal termination) limit optimal management;

3) serial ultrasound is central to distinguishing transient anomalies from persistent involvement and supports parental counseling;

4) limited availability of antiparasitics remains a major obstacle: in our series, treatment of the infected newborn could only be initiated thanks to family purchase of drugs abroad—illustrating both inequity of access and the decisive role of family solidarity.

Prevention should now be framed within an integrated One Health approach combining human, animal, and environmental health. Despite its limitations, this work underscores the urgency of integrating congenital toxoplasmosis into national maternal-fetal health programs alongside HIV, syphilis, hepatitis B, and malaria, to ensure test accessibility, treatment availability, and ultimately sustainably improve neonatal prognosis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Costs of biological investigations related to toxoplasmosis in pregnancy.

1) Rapid serology test (On Site® IgG/IgM): 6,000 FCFA (≈ 9 €).

2) IgG avidity test: 67,000 FCFA (≈ 100 €).

3) Confirmatory serology (CMIA, Abbott Alinity i®): 12,000 FCFA (≈ 18 €).

4) Amniotic fluid PCR (Sacace® kit, Applied Biosystems 7500® platform): 118,000 - 152,000 FCFA (≈ 180 €- 230 €).

5) Minimum interprofessional guaranteed wage (SMIG, Senegal 2024): 64,000 FCFA/month (≈ 100 €).