INTRODUCTION

In Tunisia, Toxoplasma infection prevalence is high (estimated at 58.4%), justifying the assessment of the Toxoplasma immune status in pregnant women. The follow-up of obstetrical toxoplasmosis involves the systematic serological screening for Toxoplasma-specific IgG and IgM antibodies which is usually performed using ELISA techniques. We may face three serological profiles that need specific management: the absence of immunity, chronic infections and acute infections. In the following situations, however, screening tests used routinely are not sufficient and require additional techniques to determine the Toxoplasma immune status. These are (i) an equivocal IgG titre or (ii) the presence of IgM with the absence of IgG.

In both contexts, the Immunoblot is considered the best method to identify specific anti-Toxoplasma IgG even present at a very low level. Nevertheless, Immunoblot kits on the market such as Toxo II require additional techniques to determine the Toxoplasma immune status.

Contribution of the Toxoplasma ICT IgG IgM® test in determining the immune status of pregnant women against toxoplasmosis

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Abstract

Background: An immunochromatography technology (ICT) rapid diagnostic test, the Toxoplasma ICT IgG-IgM®, was recently developed. Our aim was to study its contribution to establish accurately the Toxoplasma immune status in Tunisian pregnant women using Western blot (WB) Toxo II IgG® as a reference technique.

Methods: Thirty-nine sera were selected for the study from among 2,615 which were already tested by IgG and IgM ELISA. They displayed equivocal IgG titres (4.4–9 IU/ml) in absence of IgM (19 sera) or IgM anti-Toxoplasma antibodies in absence of IgG titre <4.4 IU/ml (20 sera). All these sera were additionally tested by WB Toxo II IgG®.

Results: Immunochromatography technology Sensitivity in the detection either of low IgG titres in absence of IgM or of specific anti-Toxoplasma IgM was 100%. Only one serum with equivocal IgG titre by ELISA and negative with Toxo II IgG® test revealed positive in ICT. However, this serum showed a P30 band in WB analysis. On the other hand, three sera positive in ELISA IgM and negative in ELISA IgG revealed positive in ICT and negative in WB Toxo II IgG®, the reference test.

Conclusion: Results confirm the high sensitivity of Toxoplasma ICT IgG-IgM® in detecting both specific anti-Toxoplasma IgG and IgM, and highlight the usefulness of this rapid test as a first or second-line Toxoplasma serological test in pregnant women.

KEYWORDS
pregnant women, Toxoplasma ICT IgG-IgM®, toxoplasmosis, western blot Toxo II IgG®
IgG® (LDBIO Diagnostics, France) remain expensive, and their use is limited to reference laboratories, mainly in developed countries. Recently, an immunochromatography technology-based (ICT) test, Toxoplasma ICT IgG-IgM® (LDBIO Diagnostics) was developed. This is a low-cost qualitative test detecting simultaneously specific anti-Toxoplasma IgG and IgM antibodies. According to several studies, Toxoplasma ICT IgG-IgM® has a high sensitivity for IgG detection, close to the Western blot (WB) technique sensitivity. Furthermore, this ICT test was able to distinguish between non-specific IgM and specific IgM; natural IgM being not identified. The aim of this study was to assess the contribution of the Toxoplasma ICT IgG-IgM® test in determining the Toxoplasma immune status of pregnant women in Tunisia.

2 | METHODS

2.1 | Samples

Thirty-nine anonymous sera available from the collection of the Parasitology Department of the Pasteur Institute of Tunis were included in this study. They were selected from among 2,615 sera collected during the period 2015–2018 in the setting of the routine Toxoplasma serological screening in pregnant women. Sera were selected according to their anti-Toxoplasma IgM and IgG antibodies titres in “Platelia Toxo IgG, IgM®” (Biorad, France). Western blot Toxo II IgG® was performed for all the sera in order to precisely determine their exact Toxoplasma immune status. WB Toxo II IgG® is routinely performed in our laboratory for sera that display (i) equivocal IgG titres (4.4–9 IU/ml) in absence of IgM4 or (ii) Toxoplasma-specific IgM without IgG (titre <4.4 IU/ml). In this latter case, WB Toxo II IgG® use aims to detect even a low IgG level early that always appears following Toxoplasma-specific IgM. In the absence of Toxoplasma-specific IgG during 2-month follow-up, detected IgM is considered non-specific.

The 39 selected sera were grouped as follows:

- Group 1: 19 samples with IgG titres (4.4–9 IU/ml) and absence of IgM in ELISA corresponding to 17 positive and two negative samples in WB Toxo II IgG®.
- Group 2: 20 samples with the presence of IgM and absence of IgG in ELISA corresponding to seven positive and 13 negative samples in WB Toxo II IgG® performed during the 2-month follow-up.

It is important to note that according to the manufacturer, a positive WB Toxo II IgG® is defined by the detection of at least three of the 30, 31, 33, 40 or 45 kDa bands.

2.2 | Toxoplasma ICT IgG-IgM®

Toxoplasma ICT IgG-IgM® (LDBIO, France) is a rapid, simple, qualitative test based on immunochromatography technology (lateral flow). A positive test reveals the presence of anti-Toxoplasma antibodies but does not distinguish between IgG and IgM classes.

2.3 | Statistical analysis

All serological data were entered using Excel and analysed using IBM SPSS version 23.0 software. Toxoplasma ICT IgG-IgM® sensitivity was computed considering WB Toxo II IgG® as the reference test. The diagnostic performance of laboratory tests was evaluated using their sensitivity and specificity. Positive and negative predictive (PPV and NPV) values were calculated using Bayes’ theorem.

3 | RESULTS

In the absence of IgM and presence of IgG equivocal titres in ELISA, Toxoplasma ICT IgG-IgM® and WB Toxo II® results were 94.7% (73.9–99.8) concordant. All positive samples in WB were also positive in ICT (Table 1). As a result, ICT sensitivity in detecting low levels of IgG antibodies was 100% (82.3–100.0) whereas specificity was 50% (28.8–75.5). PPV and NPV were, respectively, 100% (82.3–100) and 34% (16.3–61.6). However, the small number of samples did not allow an accurate specificity assessment. One of the two negative samples in WB Toxo II IgG® was positive in ICT (Table 1). This sample presented only two apparent bands at 30 kDa and 31 kDa in WB Toxo II IgG®.

In the presence of IgM and absence of IgG in ELISA, results of Toxoplasma ICT IgG-IgM® and WB Toxo II® were 85% (62.1–96.8) concordant.
concordant. All positive samples in WB Toxo II® follow-up were also positive in ICT (Table 2). As a result, ICT sensitivity in detecting specific anti-Toxoplasma IgM was 100% (83.2–100.0). Of the 13 negative samples in WB Toxo II®, three were positive by ICT which show specificity of 76.9% (46.2–94.9). PPV and NPV were respectively 100% (69.4–100.0) and 69.3% (44.9–92.21).

4 | DISCUSSION

As reported by other authors, the ICT test appeared to be as sensitive as the WB Toxo II IgG® method to confirm a low level of specific IgG antibodies in absence of IgM.5,7,8 This result was expected as the ICT test is calibrated with the Toxo II IgG® assay marketed by the same company. One false-IgG positive case was detected with an ICT test. It presented two bands by WB Toxo II IgG® including the P30 kDa. This result may suggest a higher sensitivity of the ICT test compared to that of the WB Toxo II IgG®. It also highlights the importance of the presence of the only anti-P30 antibodies in several cases. In fact, Jost et al. have demonstrated that the 30 kDa band tends to appear first during seroconversion based on the follow-up of pregnant women whose first serology was IgM positive and IgG negative or equivocal by routine methods.5 To elucidate this hypothesis, only the use of a sufficiently sensitive confirmatory technique such as the Dye test would lead to reliable conclusions.9,10

The ICT test was also associated with 100% sensitivity in screening specific IgM. Such findings correspond to those of Mahinc’s study that described the ICT test as a very useful tool for IgM without IgG detection.5 In addition, Mahinc et al. also supported the ability of ICT to distinguish non-specific from specific IgM.5 Three out of 13 sera (23.1%) with the presence of IgM and the absence of IgG during the 2-month follow-up were positive in ICT. Since ICT does not distinguish between IgG and IgM classes, positivity may suggest, as previously discussed, a higher sensitivity than Toxo II IgG® to detect IgG in an early sampling. However, the absence of IgG presence during follow-up may indicate false specific IgM detection.

Regarding its simplicity, low cost and high sensitivity in detecting specific anti-Toxoplasma IgG and IgM, the ICT test could be used as a first-line technique in the serological screening and could be recommended for the follow-up of seronegative pregnant women. Positive results, however, should be confirmed by other more specific reference techniques. On the other hand, ICT could also be useful as a second-line test following IgG and IgM ELISA to confirm low IgG titres and specific IgM. To our knowledge, our study is the first using this new technology to establish the Toxoplasma immune status of pregnant women in North Africa. The results obtained correspond to those of Mahinc et al. on a similar panel of sera. A survey using a larger group of samples would strengthen the conclusions and lead to new recommendations.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article.

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