Epidemiological Insights Into TORZiCH Infections And Adverse Obstetric Outcomes: A Tertiary Care Hospital Study

S Mehreen, M Srinath, W Sultana, S Kumar, P Reddy, V Rani

Citation

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Abstract

Background: Maternal health during pregnancy significantly affects fetal outcomes, with adverse obstetric outcomes like miscarriages, stillbirths, and congenital abnormalities being concerning. Infections by TORZiCH pathogens—Toxoplasma gondii, Rubella virus, Cytomegalovirus (CMV), Herpes Simplex Virus (HSV), and Zika virus—play a pivotal role.

Aim: This cross-sectional study assessed aimed to assess TORZiCH infections in women with bad obstetrics history.

Materials and methods: Samples were collected from 81 women with bad obstetric history attending at a Osmania Medical College and General Hospital, Hyderabad, Telangana, India and tested for the presence of IgM antibodies for TORZiCH using ELISA testing.

Results: Results revealed 41 patients had multiple abortions, mainly in the first trimester. Notably, 10 patients faced single fetal deaths, while 3 encountered two fetal deaths. Rubella and Toxoplasma infections were linked to adverse outcomes. Toxoplasma, Rubella, CMV, and HSV seropositivity rates were 19.5%, 17.2%, 4.5%, and 3.4% respectively. Co-infections were observed, between Toxoplasma-Rubella (12.5%), Toxoplasma-CMV (1.3%), Toxoplasma-HSV (1.3%), Rubella-CMV (5%), Rubella-HSV (3.7%), and CMV-HSV (1.3%).

Discussion: The study underscores the need for comprehensive assessment of TORZiCH infections' impact on pregnancy outcomes, particularly in co-infection scenarios. Notably, Rubella and Toxoplasma infections were linked to adverse outcomes, underscoring the significance of addressing these infections during pregnancy.

Conclusions: Understanding the prevalence and interactions informs public health strategies, clinical management, and future research. The intricate dynamics of TORZiCH infections require ongoing surveillance and interventions for maternal and neonatal health.

INTRODUCTION

Maternal health during pregnancy is a pivotal determinant of neonatal and fetal outcomes, significantly influencing subsequent childhood morbidity and long-term health trajectories (Silveira et al, 2014). Adverse obstetric outcomes, encompassing recurrent miscarriages, stillbirths, and congenital abnormalities, are of paramount concern due to their profound implications for both maternal and child health (Dolk et al, 2010; Lawn et al, 2011). Among the manifold factors contributing to such outcomes, infections caused by TORZiCH pathogens—Toxoplasma gondii, Rubella virus, Cytomegalovirus (CMV), Herpes Simplex Virus (HSV), and Zika virus—have garnered substantial attention (Montoya and Liesenfeld, 2004; Cannon and Davis, 2010; Reef and Plotkin, 2011; Looker et al, 2015; Rasmussen et al, 2016). TORZiCH infections individually have demonstrated their potential to disrupt pregnancy and exert adverse effects on fetal development. Toxoplasmosis, for instance, can lead to congenital anomalies and neurodevelopmental impairments, while Rubella infection during pregnancy is associated with congenital rubella syndrome ((Montoya and Liesenfeld, 2004; Reef and

Plotkin, 2011). Likewise, CMV infections in expectant mothers have been linked to serious complications such as sensorineural hearing loss and developmental delay in neonates (Cannon and Davis, 2010). Additionally, HSV infections can cause neonatal herpes, leading to severe morbidity and mortality among newborns (Looker et al, 2015). The Zika virus, with its proven association with congenital Zika syndrome, has added complexity to the landscape of maternal infections (Rasmussen et al, 2016). While significant research has focused on individual TORZiCH infections in the context of pregnancy, the synergistic impact of co-infections involving these pathogens remains an area warranting exploration. Co-infections, defined as the concurrent presence of two or more pathogens, might amplify the risks associated with adverse obstetric outcomes. Yet, the intricacies of these interactions and their cumulative effects on maternal and neonatal health have not been comprehensively elucidated.

The present study aims to investigate the prevalence of TORZiCH infections, the patterns of co-infections, and their potential association with adverse obstetric outcomes. Furthermore, the present study envisaged to identify specific co-infection scenarios that might confer heightened risks for adverse obstetric outcomes.

MATERIALS AND METHODS

Study Design

This cross-sectional research study aimed to evaluate the presence of TOR-ZiCH (TORCH and Zika virus infections) using ELISA testing in women with bad obstetrics history attending at Osmania Medical College and General Hospital, Hyderabad, Telangana, India. A total of 81 women with bad obstetric history were included in the study. Participants were selected based on specific inclusion and exclusion criteria. The study's inclusion criteria consisted of female participants attending obstetric care at the tertiary care hospital. Female participants with diagnoses of adverse obstetric outcomes, such as recurrent miscarriages, stillbirths, or fetal abnormalities and the individuals falling within the age range of 18 to 45 years were considered as suitable candidates for inclusion. The participants who had a history of TORCH infections or Zika virus infection and with a medical background of other chronic conditions like diabetes, hypertension, or autoimmune disorders were excluded. Participants with a history of drug or alcohol abuse were also excluded from the study. Ethical approval was obtained from the Institutional Ethics Committee of Osmania Medical College, Hyderabad, Telangana, India. Informed consent was obtained from all participants prior to their inclusion in the study.

Sample Collection

Blood samples were collected from each participant. Aseptic techniques were followed during the sample collection process. Approximately 5 mL of venous blood was collected using sterile vacutainer tubes. The samples were labelled with unique participant identifiers and transferred to the laboratory for further processing.

ELISA Testing for TOR-Zik and data analysis

The collected blood samples were processed for TOR-Zik testing using an enzyme-linked immunosorbent assay (ELISA) kit. The specific ELISA kits (Toxoplasma, Rubella, Zika, CMV and HSV) utilized for TOR-Zik testing were procured from DiaPro Diagnostics (California, USA) and used according to the manufacturer's instructions. The data obtained from the ELISA testing were recorded and analyzed using appropriate statistical methods. Descriptive statistics, such as frequencies and percentages, were used to summarize the characteristics of the study participants and the presence of TOR-Zik antibodies. Further statistical tests, such as chi-square or Fisher's exact test, were employed to explore associations between TOR-Zik positivity and bad obstetric outcomes.

RESULTS

A total of 81 bad obstetric women attending a tertiary care hospital were included in this research study to assess the presence of TOR-Zik infections using ELISA testing. The participants' demographic and clinical characteristics are summarized in Table 1.

Table 1

Demographic and Clinical Characteristics of Study Participants

Variable	n (mean±SD)
Age	81 (24.97±4.0)
Gravida	49 (2.97±1.3)
Parity	36 (1.24±1.0)
Previous obstetric history	14 (1.1±0.8)
Recurrent miscarriages	41 (0.33±0.1)

The present study reveals that among the 81 participants, 41

women had experienced a two or more abortion, while 33 had undergone single abortions. Majority of the abortion or fetal demise occurred during the first trimester (58), followed by the third trimester (17) and the second trimester (7). Moreover, concerning the number of deaths experienced, 10 of participants had encountered a single fetal death, while 3 had experienced two fetal deaths (Table 2).

Table 2

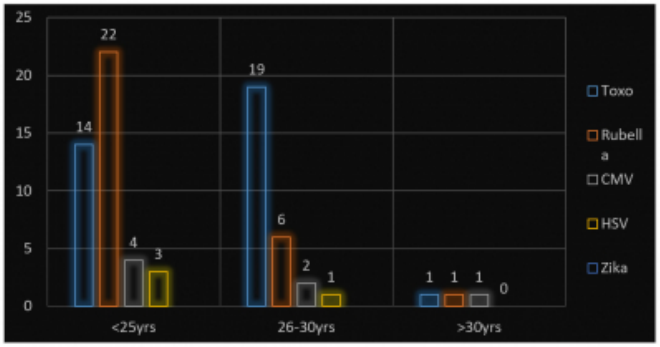
Characteristics of Abortion History and Associated Variables.

History of abortions	Variables	n (%)
Number of abortions	One	33 (40.2%)
	Two or more	41 (50%)
Time of abortion/death	First trimester	58 (70.8%)
	Second trimester	7 (8.5%)
	Third trimester	17 (20.8%)
Number of deaths	One	10 (12.2%)
	Two	3 (3.7%)

Maximum number of seropositive cases of abortion/death (29 and 18) were associated with Rubella and Toxoplasma, respectively. Abortion/death cases were less in CMV and HSV infections (7 and 4 cases). Out of the 87 bad obstetric women, the presence of TOR-Zik infections was evaluated using ELISA testing. Seventeen participants (19.5%) tested positive for Toxo antibodies, indicating a previous or current infection with the parasite. Fifteen participants (17.2%) showed positive results for Rubella antibodies, suggesting previous exposure or an ongoing infection with Rubella virus. Four participants (4.5%) tested positive for CMV antibodies, indicating a past or current CMV infection. Three participants (3.4%) demonstrated positive results for HSV antibodies, indicating either a previous or current HSV infection (Figure 1).

Figure 1

Seropositivity of TORZiCH pathogens across varied age groups.



All the participants were negative for Zika antibodies. The seropositivity rates for different viral infections across age groups revealed, Toxoplasma variation, with 25% under 25 years, 90.5% at 26-30 years, and 20% over 30 years ($p < 0.01$) whereas Rubella differences are less pronounced, with rates of 39.3%, 28.5%, and 20% respectively ($p = 0.517$). The CMV infections shows minimal variation (7.1%, 9.5%, 20%; $p = 0.604$) whereas HSV infection differs marginally in the three age groups (5.4%, 4.7%, 0%; $p = 0.916$). No cases of Zika were reported. In conclusion, seropositivity varies across infections and ages, with Toxoplasma and Rubella showing distinct age-related patterns (Table 3). Co-infections were observed in the study in which Toxoplasma (Toxo) and Rubella co-infections were identified in 10 cases (12.5%). Co-infections involving Toxo with Cytomegalovirus (CMV) and Toxo with Herpes Simplex Virus (HSV) were each present in 1 case (1.3%). Furthermore, Rubella and CMV co-infections were found in 4 cases (5%), Rubella and HSV co-infections in 3 cases (3.7%), and CMV and HSV co-infection in 1 case (1.3%).

Table 3

Seropositivity rates of various viral infections across different age groups.

Seropositivity of viral infection (n; %)		Less than 25yrs (n=56; %)	26-30yrs (n=21; %)	More than 30yrs (n=5; %)	p value
Toxoplasma gondii *(n=34; 41.4%)*	Positive	14; 25%	19; 90.5%	1; 20%	**<0.01**
	Negative	42; 75%	2; 9.5%	4; 80%	
Rubella virus *(n=29; 35.4%)*	Positive	22; 39.3%	6; 28.5%	1; 20%	0.517
	Negative	34; 60.7%	15; 71.5%	4; 80%	
Cytomegalo virus *(n=7; 8.5%)*	Positive	4; 7.1%	2; 9.5%	1; 20%	0.604
	Negative	52; 92.9%	19; 90.5%	4; 80%	
Herpes simplex virus *(n=4; 4.9%)*	Positive	3; 5.4%	1; 4.7%	0	0.916
	Negative	53; 94.6^%	20; 95.3%	5; 100%	
Zika virus *(n=0)*	Positive	0	0	0	-
	Negative	56; 100%	21; 100%	5; 100%	

DISCUSSION

The infections caused by TORZiCH pathogens are responsible for neonatal and fetal mortality and contribute significantly to the morbidity in early and later childhood stages. Serological testing for TORZiCH infections is essential and should be conducted prior to or immediately after confirming pregnancy. The present study investigated the prevalence of TORZiCH infections, including Toxoplasma gondii (Toxo), Rubella virus (Rubella), Cytomegalovirus (CMV), Herpes Simplex Virus (HSV), and Zika virus, in a selected group of participants. The overall seropositivity of TORZiCH infections in the present study was 91%. These findings shed light on the epidemiological characteristics of these infections and their potential interactions within the study population. Toxoplasma gondii

is a widely distributed intracellular protozoan parasite that can infect both humans and animals. The seroprevalence of Toxo antibodies in our study population was found to be 41.9%. This indicates that a significant proportion of participants had either a previous or current infection with the parasite. The high prevalence of Toxoplasma infection warrants attention, especially in pregnant individuals, as it poses a risk for congenital transmission (Montoya & Liesenfeld, 2004; Adam et al., 2017). Rubella virus is known to cause a mild viral illness characterized by a rash, but it can have severe consequences if transmitted to pregnant women, leading to congenital rubella syndrome. In our study, 35.8% of participants tested positive for Rubella antibodies, indicating past exposure or ongoing infection with the virus. The presence of Rubella antibodies highlights the need for continued efforts in vaccination programs, especially in vulnerable populations, to prevent adverse outcomes related to Rubella infections (Plotkin & Reef, 2011; Khairallah et al., 2013). Cytomegalovirus (CMV) is a member of the herpesvirus family and is typically asymptomatic in healthy individuals. However, it can cause severe complications in immunocompromised individuals and pregnant women, leading to congenital CMV infection. In our study, 8.6% of participants tested positive for CMV antibodies, indicating a past or current CMV infection. Regular screening and awareness campaigns are crucial in managing CMV infections, particularly in high-risk groups (Cannon et al., 2010). Herpes Simplex Virus (HSV) infections are common, with two main types: HSV-1 and HSV-2. The presence of HSV antibodies in 4.9% of our study participants suggests either a previous or current HSV infection. These findings emphasize the need for comprehensive sexual health education and safe sexual practices to reduce the transmission of HSV infections (Looker et al., 2015). Zika virus, a mosquito-borne pathogen, gained global attention due to its association with congenital Zika syndrome. In our study, none of the participants tested positive for Zika antibodies, indicating the absence of ongoing or past Zika virus infections in the studied population. This finding is reassuring, but continuous monitoring of Zika virus circulation is necessary, particularly in regions with active mosquito populations (World Health Organization, 2017). Numerous studies have reported an association between ToRCH seropositivity and adverse obstetric outcomes. However, limited information is available regarding the influence of ToRCH co-infections on pregnancy outcomes. Coinfections were observed in our study. Toxoplasma exhibited the highest number of co-infection cases, a maximum of 12, followed by Rubella with 7 cases. Coinfections involving Toxoplasma and Rubella were present in 12.5% of cases, while coinfections involving Rubella and CMV were found in 5% of cases. Additionally, some individuals exhibited concurrent infections with both HSV and Rubella (3.7%). In previous studies by Alsamarai et al (2014) and Rasti et al (2015), the co-infection of Toxo and CMV was identified as higher than the other co-infections. Contrarily, in the current study, co-infection involving Toxoplasma (Toxo) and Rubella is observed at a higher rate compared to other co-infection scenarios. Similar results were identified by Rajani (2018) in the North Indian population. The coinfections were becoming a potent risk factor in increasing the development of bad obstetrics history (BOH). These coinfections warrant further investigation to understand their clinical implications and potential interactions between the pathogens. Overall, the findings of this study provide valuable insights into the prevalence of TORZiCH infections in the studied population. They underscore the importance of public health interventions, including vaccination strategies, health education, and awareness campaigns, to control and manage these infections effectively. Further research is necessary to explore the underlying factors contributing to coinfections and to develop targeted interventions to mitigate their impact on public health. Additionally, ongoing surveillance is essential to track changes in infection rates and assess the effectiveness of preventive measures over time.

CONCLUSION

The present study contributes insights into the prevalence of TORZiCH infections in the studied population, emphasizing the need for public health interventions such as vaccinations, health education, design of preventive programs and awareness campaigns. Further research is crucial to comprehend co-infection factors and develop tailored interventions. Ongoing surveillance remains pivotal to assess the effectiveness of preventive measures over time. The data underscores the intricate interplay between TORZiCH infections and adverse obstetric outcomes, highlighting their significance for public health management.

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Conflict of interest

The authors declare that they do not have any conflict of interest.

Authors contribution

Concept and study design: SFM, MS; Sample collection and testing: WS; Data analysis: WS, MS; Manuscript preparation: WS, MS, SFM; Manuscript review and funding: VSR, PSR. All the authors read and approved the final version of the manuscript.

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Author Information

Syeda Fakiha Mehreen
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India

Mote Srinath
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India

Waseema Sultana
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India

Surya Prem Kumar
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India

Palkonda Shashikala Reddy
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India

Vannavada Sudha Rani
Viral Research and Diagnostic Laboratory, Department of Microbiology, Osmania Medical College Hyderabad, Telangana, India