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TORCH Infection during Pregnancy: A Comprehensive Review from Diagnosis to Treatment

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***Abstract*— TORCH is a group of pathogens that can infect a pregnant woman and subsequently transmit the infection to the fetus. These include the parasite Toxoplasma gondii, and other pathogens such as Treponema pallidum, parvovirus B19, rubella, Human cytomegalovirus, and herpes simplex virus. TORCH infections are among the most significant risks to fetal development, leading to congenital malformations and other complications transmitted from the mother and causes congenital malformations. Therefore, this review aims to provide a comprehensive overview of TORCH infection, including diagnostic methods, such as serological tests, PCR, and ultrasound imaging, to detect fetal malformations such as cerebral calcifications, hydrocephalus, and organ enlargement. The review also explained the treatment used for this infection, If a mixture of pyrimethamine and sulfadiazine is used with folic acid to treat, while the vaccine is used before pregnancy for the purpose of preventing German infection, as for CMV infection, acyclovir or ganciclovir is usually used, while penicillin is the treatment for Treponema pallidum. This review focuses on the clinical manifestations on the clinical manifestations of TORCH infection as a cause of congenital malformations in fetuses, presents the most important methods that can be used for accurate diagnosis, compares the protocols used for treating each infection in this group, and evaluates methods of prevention.**

***Keywords*:*Toxoplasma gondii*, *Treponema pallidum*, parvovirus, rubella, human cytomegalovirus, and herpes simplex virus.**

I. INTRODUCTION

TORCH infections are a group of infections that affect fetuses and thus the outcome of pregnancy and newborns when infected during pregnancy. These include infection with toxoplasmosis and other diseases such as syphilis, *Treponema pallidum*, varicella zoster, rubella, human cytomegalovirus and herpes simplex virus. Infection with these infections causes congenital malformations and miscarriage, but appropriate treatment is of paramount importance to improve pregnancy outcomes. The aim of this review is to focus on the pathophysiology, clinical signs, diagnosis, and treatment strategies for TORCH infections.

TORCH infection during pregnancy causes serious complications for the mother and fetus, including a group of five important diseases:

A. *Toxoplasmosis*

Toxoplasmosis is a disease caused by the parasite *Toxoplasma gondii*. When a pregnant woman is infected during the first months of pregnancy, the parasite can be transmitted to the fetus, causing serious deformities, including hydrocephalus, encephalopathy, delayed mental development, and retinitis [1,2].

B. *Other infections*

Other infections include diseases such as HIV, *Treponema pallidum*, and other infections within the TORCH group include *Treponema pallidum* and parvovirus B19 [3,4].

C. *Rubella*

Many studies have reported the effects of infection with rubella (German measles) during the first trimester of pregnancy, as it leads to pathological complications, including heart defects, hearing loss, and blindness in the newborn-[5].

D. *Human Cytomegalovirus (CMV)*

Human Cytomegalovirus (CMV) is one of the most common congenital infections, in which children infected with it do not show any symptoms, estimated at 85%-90%. However, a small percentage, estimated at 5%-10%, show symptoms at birth, including sensorineural hearing loss (SNHL) [6].

E. *Herpes Simplex Virus (HSV)*

HSV can lead to neonatal herpes if the infection is transmitted to the fetus during birth, causing severe neurological damage and fetal death [7].

II. DIAGNOSIS

Early diagnosis is crucial to reducing the risk of TORCH infection to the fetus. Common diagnostic methods include:

A. Serological Tests

In these tests, antibodies such as IgM and IgG are measured, especially in herpes viruses, measles, chickenpox,

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toxoplasmosis, and CMV. By measuring the tities of IgG and IgM, it is possible to determine whether the infection is recent or old. well as other infections [8].

B. Ultrasound

Ultrasound is a safe and non–invasive method through which the fetus's condition can be monitored and, based on it, subsequent interventions such as taking samples or amniocentesis can be directed. This examination can be used to assess the degree of typical or anatomical changes that occur with infection, such as hepatomegaly, hydrops fetalis, calcifications within the brain, intrauterine growth retardation, and changes in the amniotic fluid, considering account that normal imaging results do not confirm that the fetus is free of infection because they appear in the late stages [9].

C. Amniocentesis

Amniocentesis is an important method for collecting samples of fetal amniotic fluid when maternal infection with a number of pathogens is suspected, such as Human cytomegalovirus, *Toxoplasma gondii*, and herpes simplex virus. This test enables serological and molecular analyses to assess the fetus's susceptibility to fetal infection after confirmation of infection [10].

III. Therapeutic Interventions

Treatments vary depending on the pathogen, as the treatment protocol depends on the type of pathogen, its method of transmission, and the patient's condition. Common treatments used to treat various causes can be mentioned within the TORCH group:

A. Toxoplasmosis

In cases of maternal infection where fetal infection does not appear after the use of spiramycin, as this primary infection appears in the mother during the first weeks of pregnancy, this treatment is the first choice because its effect is concentrated on the placenta and it does not cross it at high concentrations. So, decreasing transmission of the infection to the fetus. However, when fetal infection is proven, the classic treatment is used, which is represented by the combination of pyrimethamine, sulfadiazine, and folic acid [11].

B. Rubella

The best way to prevent congenital rubella syndrome is vaccination before pregnancy, as there is no specific antiviral treatment. The treatment given in cases of German measles infection during pregnancy is supportive treatment [12].

C. Human Cytomegalovirus

The use of ganciclovir followed by valacyclovir therapy is safe lead to good results in treating hearing loss resulting from congenital CMV infection when used in long-term treatment [13,14].

D. Herpes simplex virus (HSV)

Valacyclovir can be used as suppressive therapy in pregnant women with a history of recurrent HSV infection to reduce the risk of reactivation near term. However, when the infection is active, a cesarean section is recommended to avoid transmitting the virus to the child, as infection with it can be either fatal or cause permanent neurological damage [7].

IV. Prevention and Vaccination

The rubella vaccine usually contains a live but weakened virus and is prohibited for use during pregnancy. It is worth noting that no cases of congenital rubella syndrome have been reported after vaccination [15].

There are many preventive practices recommended by studies to prevent toxoplasmosis, including maintaining personal hygiene, washing hands, being careful when cleaning the cat litter box, cooking meat thoroughly, and washing fruits and vegetables [16].

Studies have shown that consistent condom use plays an effective role in preventing HIV infection, also decreases the risk of other sexually transmitted infections, with a protection rate of between 70% and 80% [17,18].

TABLE I: Seroprevalence of TORCH infection among pregnant women

Pathological factor	TORCH incidence (%)	Source
Toxoplasma gondii	36.7%	[19]
Rubella virus	**86.5%**	[20]
Human Cytomegalovirus (CMV)	**94.0%**	[20]
Herpes Simplex Virus 1 (HSV-1)	**97.3%**	[20]
Herpes Simplex Virus 2 (HSV-2)	**48.9%**	[20]

This table shows the Seroprevalence of various infections among pregnant women based on available scientific studies. It shows the different Seroprevalence rates of TORCH infection in pregnant women, according to several studies. These data contribute to understanding the prevalence of infection and the importance of early detection during pregnancy to reduce risks to the mother and fetus. It can be seen that the incidence of TORCH infection is higher in pregnant women than in healthy individuals, reinforcing the importance of ongoing screening.

TABLE II: Clinical effects of TORCH on pregnancy and the fetus

Infection	Effects on the mother	Effects on the fetus	source
Toxoplasma gondii	Asymptomatic	Congenital malformations, blindness, mental retardation	[1]
Other infections	It can cause indirect health complications.	Premature birth, congenital malformations	[3]
rubella	mild symptoms	Heart problems, hearing impairments, and blindness	[21]
Human Cytomegalovirus	Mild infection in some cases	mental retardation, deafness, developmental delay	[13]
herpes simplex virus	Recurrent skin infections in some cases	encephalitis, fetal death	[7]

This table shows the clinical effects of each type of TORCH infection on the mother and fetus. It highlights the complications that the mother and child may experience as a result of this infection. It helps better understand the negative effects that can lead to birth defects or serious health problems for the fetus.

This table shows the laboratory methods for diagnosing TORCH infection in pregnant women, explaining the importance of conducting an IgM and IgG antibody test in both toxoplasmosis and rubella infections, conducting a PCR test and examining the fetal amniotic fluid in the case of infection with cytomegalovirus, and conducting a PCR test and measuring antibodies in the case of infection with herpes simplex virus. For other infections, PCR can be used to detect the DNA of parasites or viruses that cause other infections.

TABLE III: Laboratory diagnosis of TORCH during pregnancy

Infection	diagnostic tests	Notes	Source
Toxoplasma gondii	IgM and IgG antibodies	Blood test antibodies	[23]
Other infections	PCR to detect the DNA of the parasite or virus	PCR testing	[24]
rubella	IgM and IgG antibody testing	Serological testing	[22]
Human Cytomegalovirus	PCR and amniotic fluid test	Amniotic fluid virus test	[13]
herpes simplex virus	PCR and antibody	Determine the presence of active infection	[7]

TABLE IV: Treatments used for TORCH during pregnancy

Infection	The treatment which used	Treatment recommendations	Source
Toxoplasma gondii	Primethamine and sulfadiazine	Used to treat infections during pregnancy	[25]
Other infections	Penicillin in *Treponema pallidum*	Penicillin is recommended for the treatment of Treponema pallidum	[3]
Rubella	There is no specific treatment after infection.	Pre-pregnancy prevention with vaccination	[5]
Human Cytomegalovirus	Valacyclovir or guanociclovir	Treatment in severe cases	[13]
Herpes simplex virus	Acyclovir or famciclovir	Medications that can be used to treat an active infection.	[7]

This table shows the most important treatments that can be used for TORCH infection, such as using Primethamine and sulfadiazine to treat toxoplasmosis, using Valacyclovir or ganciclovir to treat cytomegalovirus, and using Acyclovir or famciclovir to treat herpes simplex virus.

TABLE V: Prevention of TORCH infection during pregnancy

Infection	Preventive method	Preventive recommendations	Source
Toxoplasama gondii 	Avoid contact with cat feces and refrain from eating raw meat.	Wear gloves when cleaning the garbage containers	[1]
Other infections 	keeping food and drink clean	Avoid close contact with infected people.	[3]
Rubella 	Taking the vaccine before pregnancy	Rubella vaccination for women of childbearing age	[5]
Human Cytomegalovirus 	Avoid close contact with infected people.	Avoid contact with the urine or saliva of infected children	[13]
Herpes simplex virus 	condoms usage	Avoid unprotected sexual relations	[7]

Table V shows the preventive measures that can be adopted to avoid infection during pregnancy, which include avoiding contact with cat feces and eating raw meat to avoid infection with toxoplasmosis, taking the vaccine before pregnancy to avoid infection with the rubella virus, avoiding close contact with infected people in case of avoiding infection with the human cytomegalovirus, and using condoms to avoid infection with the herpes simplex virus.

V. CONCLUSIONS

TORCH infections are group of infectious diseases that cause serious consequences for the mother and fetus. Therefore, early diagnosis and appropriate treatment may help reduce the risk of infection. A vaccine can be used to prevent infection with rubella (German measles), but at the same time, there is no vaccine to prevent infection with the herpes simplex virus.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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