

**BIOLOGICAL CHARACTERISTICS OF TORCH INFECTION PATHOGENS IDENTIFIED FROM VARIOUS TYPES OF PATIENT BIOMATERIALS**

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**Abstract.** TORCH infections represent a group of congenital infections caused by *Toxoplasma gondii*, Rubella virus, Cytomegalovirus, Herpes simplex virus, and other pathogens such as *Treponema pallidum* and Parvovirus B19. These infections are characterized by their ability to cross the placental barrier and infect the fetus during pregnancy. The aim of this study was to describe the biological characteristics of TORCH pathogens identified in different types of patient biomaterials. Special attention was given to their morphological structure, replication mechanisms, pathogenic properties, and diagnostic significance. Biomaterials including blood serum, amniotic fluid, placental tissue, saliva, and urine were analyzed using serological and molecular methods. The study emphasizes the importance of integrated diagnostic approaches in identifying TORCH pathogens and preventing congenital infections.

**Keywords:** TORCH infections, congenital infections, biomaterials, molecular diagnostics, pathogens

**Introduction**

TORCH infections are a group of congenital infections transmitted from mother to fetus during pregnancy or childbirth. These infections remain a major cause of fetal morbidity and mortality worldwide. The acronym TORCH includes *Toxoplasma gondii*, other infectious agents such as syphilis or parvovirus B19, Rubella virus, Cytomegalovirus, and Herpes simplex virus.

These pathogens are capable of crossing the placental barrier and affecting fetal development, leading to miscarriage, intrauterine growth restriction, congenital anomalies, and neonatal mortality.

Congenital infections associated with TORCH pathogens can cause neurological disorders, hearing loss, visual impairment, and developmental delay.

Early identification of TORCH infections is essential for preventing complications during pregnancy. Modern laboratory diagnostics rely on molecular biology techniques such as PCR as well as serological methods detecting IgM and IgG antibodies.

**Materials and Methods**

This study involved laboratory analysis of biomaterials obtained from patients suspected of TORCH infections.

**Biomaterials examined**

- Blood serum
- Saliva
- Urine
- Amniotic fluid
- Placental tissue

**Diagnostic methods**

1. **Serological analysis**
  - ELISA for IgM and IgG antibodies
2. **Molecular diagnostics**
  - PCR detection of viral DNA/RNA

### 3. Microbiological analysis

- pathogen identification

The biological characteristics of detected pathogens were analyzed based on their structural features, genetic material, replication strategies, and pathogenic mechanisms.

**Table 1**

**Main TORCH pathogens and biological characteristics**

Pathogen	Type	Genome	Transmission	Main complications
<i>Toxoplasma gondii</i>	Protozoan parasite	DNA	Food, cat feces, placenta	Hydrocephalus, chorioretinitis
<i>Rubella virus</i>	RNA virus	ssRNA	Respiratory, placenta	Congenital rubella syndrome
<i>Cytomegalovirus</i>	DNA virus	dsDNA	Body fluids	Hearing loss, neurodevelopment disorders
<i>Herpes simplex virus</i>	DNA virus	dsDNA	Sexual contact, birth canal	Neonatal herpes
<i>Parvovirus B19</i>	DNA virus	ssDNA	Respiratory	Fetal anemia

### Results

The study showed that TORCH pathogens demonstrate significant biological diversity.

#### **Toxoplasma gondii**

An obligate intracellular protozoan parasite capable of forming cysts in host tissues. The parasite persists in neural and muscular tissues and may reactivate during immunosuppression.

#### **Rubella virus**

An RNA virus belonging to the *Togaviridae* family. It causes congenital rubella syndrome when maternal infection occurs during early pregnancy.

#### **Cytomegalovirus**

CMV is a DNA virus belonging to the *Herpesviridae* family. It is the most common congenital viral infection worldwide and may remain latent in host cells for life.

#### **Herpes simplex virus**

HSV-1 and HSV-2 establish latent infection in neuronal tissues and can be transmitted during childbirth.

These pathogens were detected in multiple types of biomaterials, demonstrating the importance of comprehensive laboratory screening.

### **Discussion**

The biological characteristics of TORCH pathogens explain their ability to persist within host cells and evade immune responses. Many TORCH infections are asymptomatic at birth but may lead to severe complications later in life.

Modern diagnostic technologies, especially PCR, allow highly sensitive detection of pathogens in biomaterials such as blood, amniotic fluid, and saliva. Early detection plays a crucial role in preventing congenital infections.

### **Conclusion**

TORCH pathogens possess diverse biological properties that allow them to infect the fetus and cause congenital diseases. Comprehensive diagnostic screening using molecular and serological methods is essential for early detection and prevention.

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