Toxoplasmosis

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Abstract

Toxoplasma gondii can infect all mammalian and avian species and currently infects approximately 1–2 billion of the world's human population. *Toxoplasma* oocysts shed in cat faeces can contaminate the environment. Common infection routes for humans are ingestion of oocysts directly from the environment or on raw, unwashed vegetables and fruit, or consumption of viable tissue cysts in raw or undercooked meat. *Toxoplasma* infection in immunocompetent individuals is usually asymptomatic but presents as a mild to moderate flu- or glandular fever-like illness in 10–20% of cases and is self-limiting. Maternal infection acquired during pregnancy can be transmitted to the unborn child, causing congenital abnormality or fetal death. In immunosuppressed and immunodeficient people, acute infection or reactivation of parasites in latent tissue cysts from previously acquired infection can result in severe or life-threatening disease. Laboratory diagnosis relies primarily on immunoglobulin G (IgG), IgM and, in some cases, IgA testing to assess infection status. IgG avidity testing can provide a more accurate estimate of duration of infection in the pregnant mother. Detection of active infection relies most commonly on nucleic acid amplification testing, while enhanced immunohistostaining can discriminate between latent and active forms of the parasite in affected tissues.

Keywords Diagnosis; laboratory investigation; MRCP; *Toxoplasma* infection; *Toxoplasma gondii*

Key points

- Foodborne and environmentally acquired routes are likely to be important for acquisition of *Toxoplasma* infection in the UK
- Freezing meat before cooking is a simple step to reduce risk of foodborne infection
- Cerebrospinal fluid and amniotic fluid sent for detection of *Toxoplasma* by nucleic acid amplification testing should not undergo prior centrifugation for other investigations as this potentially removes the parasites from suspension
- Where an apparent low-level immunoglobulin G (IgG) seroconversion is subsequently observed in a previously seronegative patient who has been given blood products, the potential for passive acquisition of IgG from the donor population should be considered

Introduction

Toxoplasmosis results from infection with the protozoan parasite *Toxoplasma gondii*. *Toxoplasma* infects all mammalian and avian species and is widely prevalent, with an estimated 1–3 billion humans infected worldwide.[1] In the UK, there appears to be a geographical variation in rates of infection, with higher levels in the west; seroprevalence ranges from 11% to 40% among blood donors (mean age 40 years) across the UK, and the estimated UK incidence is 0.2–0.8% per annum.

Sources of infection

Figure 1 describes the routes of transmission of *Toxoplasma* to humans. The sexual reproductive cycle occurs only in the intestinal epithelium of the cat family (Felidae), and this species, termed the *definitive host*, is the only one in which *Toxoplasma* oocysts are produced. These oocysts are subsequently shed in the cat's faeces. The three key life stages of *Toxoplasma* are the tachyzoite (associated with active infection), the bradyzoite (contained in quiescent tissue cysts) and the oocyst, which can persist in the environment for many months.

Human infection occurs by ingestion either of oocysts contaminating soil (which can be present on some unwashed fruit and vegetables) or of tissue cysts in meat that has not been thoroughly cooked. Outbreaks associated with transmission of *Toxoplasma* oocysts in potable drinking water have occurred, and there is emerging evidence that shellfish filter-feeding in contaminated marine environments can also represent a viable source of infection.

Clinical disease

Infection can result in a range of outcomes from asymptomatic through to severe or life-threatening disease. The clinical course depends principally on the immune status of the patient.

Acute infection occurs from either ingestion of the parasite in its oocyst or bradyzoite form, passage of circulating tachyzoites through the placenta from an acutely infected mother to the fetus, or introduction of tissue cysts in donated tissues from an infected donor to an uninfected recipient.

Reactivated infection occurs when the host's immune system is no longer able to prevent bradyzoites within tissue cysts from reverting to the active tachyzoite form. Reactivated infection typically occurs following significant immunosuppression or as a result of acquired immunodeficiency.

Key patient groups

A list of helpful laboratory tests and the specimens required, and a summarized interpretation of findings, are shown in Table 1.

Immunocompetent individuals

Acute infection in immunocompetent people results in noticeable symptoms in only 10–20% of cases, but mild symptoms can go

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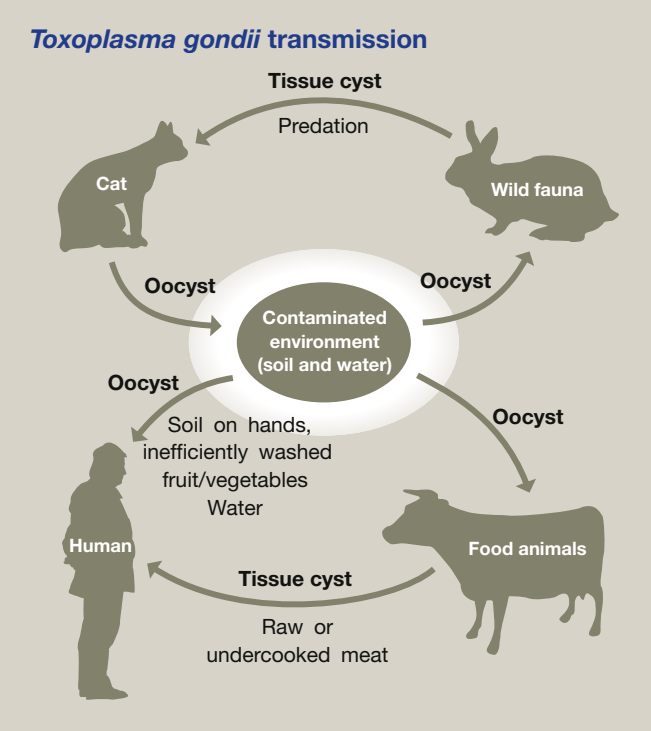

Figure 1

unnoticed in a significant proportion of the remaining 80–90%. Symptoms are self-limiting and typically resemble a mild to moderate flu- or glandular fever-like illness. The incidence of ocular toxoplasmosis associated with acute infection has been estimated at approximately 0.4 per 100,000 in the UK. Reactivation of infection in previously infected immunocompetent individuals is extremely rare.

Laboratory diagnosis: acute infection is confirmed by the presence of immunoglobulin M (IgM) and IgG specific for *Toxoplasma*. Anti-*Toxoplasma* treatment is generally not indicated unless symptoms are severe or prolonged. The laboratory diagnosis of ocular toxoplasmosis relies primarily on direct detection of the parasite in ocular fluids using nucleic acid amplification testing (NAAT).

Pregnant women

Acute infection presents the same risk to the immunocompetent mother as to the non-pregnant woman. However, if circulating tachyzoites cross the placenta, the resulting congenital infection can have severe or fatal consequences for the unborn child, depending upon the stage of pregnancy at which this occurs.[2] Maternal infection acquired early in pregnancy presents a lower risk of transplacental transmission (12–15% in the mid-first trimester) but usually results in severe fetal abnormality or

Laboratory investigation and interpretation of findings

Patient group	Specimen-type(s)	Investigation	Interpretation
Immunocompetent	Serum	IgG, IgM detection	Presence of IgG confirms infection Presence of IgM indicates acute infection
Ocular toxoplasmosis	Serum	IgG, IgM detection	Absence of IgG excludes ocular toxoplasmosis
	Ocular fluids	NAAT	Detection of parasite indicates active intraocular infection
Pregnant mother	Serum	IgG, IgM detection IgG avidity (if IgM-positive)	Presence of IgG confirms infection Presence of IgM indicates acute infection Estimate duration of infection by IgG avidity compared with date of conception
Fetus	Amniotic fluid	NAAT	Detection of parasite confirms congenital infection
Neonate	Serum	IgG, IgM, IgA detection	Presence of IgM or IgA confirms congenital infection[a] Exclusion of congenital infection is by demonstrating clearance of maternally acquired IgG by around 1 year of age
	EDTA blood	NAAT	Detection of parasite in any neonatal specimen confirms congenital infection
	CSF (if available)	NAAT	
Immunosuppressed and immunodeficient individuals	Serum	IgM, IgG detection	Presence of IgM suggests acute or active infection
	EDTA blood	NAAT	Detection of parasite indicates active infection
	CSF (if appropriate)	NAAT	Detection of parasite indicates active infection
	Solid tissue biopsies	Histological examination	Detection of tachyzoites confirms active infection

CSF, cerebrospinal fluid; IgM, immunoglobulin M; NAAT, nucleic acid amplification testing.
[a] If the mother has high concentrations of IgM or IgA at birth, demonstrating the persistence of these in the child for >1–2 weeks after birth is helpful in excluding maternal contamination.

Table 1

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