International Journal of Science, Environment and Technology, Vol. 6, No 5, 2017, 2752 – 2758
ISSN 2278-3687 (O)
2277-663X (P)

TOXOPLASMOSIS-THE PUBLIC HEALTH SIGNIFICANCE

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Abstract: Toxoplasmosis or Crazy cat lady syndrome is a worldwide neglected zoonotic infection. The sexual cycle occurs only in species belonging to *Felidae* family. Infection is mainly acquired by ingestion of food or water that is contaminated with oocysts shed by cats or by eating undercooked or raw meat containing tissue cysts. Acquired acute toxoplasma infection can be asymptomatic or have nonspecific flu-like symptoms Infection acquired during pregnancy may cause severe damage to the foetus. In immunocompromised patients, reactivation of latent disease can cause life-threatening encephalitis. Retinochoroiditis is usually a result of reactivated congenital infection. Toxoplasma status should also be determined before transplantation. Current infection is diagnosed by a high or four-fold rise in specific IgG, low IgG avidity, and the presence of specific IgM or IgA. Diagnosis may require western blotting or the polymerase chain reaction. First-line treatment is with pyrimethamine, sulfadiazine and folinic acid. Other drugs (clindamycin, clarithromycin, azithromycin or atovaquone) can be helpful.

Keywords: Toxoplasmosis, Crazy cat lady syndrome, Retinochorditis, Pyrimethamine.

INTRODUCTION

Toxoplasmosis is one of the most common parasitic zoonosis world-wide. Caused by the protozoan intracellular parasite *Toxoplasma gondii*. The diseaseis prevalent in most areas of the world affecting millions of people and is of veterinary and medical importance because of the fatal conditions like abortion and congenital diseases inflicted in its intermediate hosts mainly humans.*T. gondii* infects a large proportion of the world's population (perhaps one third) but uncommonly causes clinically significant disease. However, certain individuals are at high risk for severe or life-threatening toxoplasmosis. Individuals at risk for toxoplasmosis include foetuses, newborns, and immunologically impaired patients.

ETIOLOGY

The causative agent of Toxoplasmosis is a protozoan named *Toxoplasma gondii*, belonging to the class Sporozoa, subclass Coccidia and order Eucoccidia. It is the only representative of

*Received Aug 3, 2017 * Published Oct 2, 2017 * www.ijset.net*

the genus Toxoplasma where toxon means arc and plasma means creature in Greek. There are 3 major genotypes (type I, type II, and type III) of *T. gondii*.These genotypes differ in their pathogenicity and prevalence in people. In Europe and the United States, type II genotype is responsible for most cases of congenital toxoplasmosis.

EPIDEMIOLOGY

This protozoan is a globally prevalent parasite in wild and domestic animals which is being transmitted in food chain by carnivorous feeding and scavenging nature. The sero-prevalence varies widely in different regions and depends on socio-economic status, environmental factors and meat-cooking habits. It is generally assumed that approximately 25 to 30% of the World's human population is infected by Toxoplasma. Seroprevalence are higher in several Latin-American countries, including Argentina, Brazil, Cuba, Jamaica, and Venezuela (51-72%) and in West African countries on the Gulf of Guinea, i.e. Benin, Cameroon, Congo, Gabon and Togo (54-77%). Lower seroprevalence has been reported for women of child bearing age in Southeast Asia, China and Korea (4-39%). Seroprevalenceis also low in areas with a cold climate, such as the Scandinavian countries (11-28%). Indian studies for the prevalence of toxoplasmosis reveal a wide variation and one study reported prevalence, as high as 77% in women of reproductive age group with an average prevalence rate of 7.7% among Indian pregnant women. In a pan-India seroprevalence study conducted by Singh *et al*.,(2014) the seroprevalence of toxoplasmosis in Indian women of reproductive age representing four distinct geographical regions of India was reported. According to the study prevalence in India is 22.4% with highest prevalence in South India (73.3%) followed by East India (21.2%) and North India (19.7) whereas West Indian women had the lowest seroprevalence (8.8%).

HOSTS AFFECTED

The life cycle of *T.gondii* involves both definitive and intermediate hosts. Definitive hosts are members of the family *Felidae*, especially the domestic cats, along with other species like Mountain lion, Leopard cat and Bob cat. As the parasite is of ubiquitous distribution, it is capable of infecting an unusually wide range of hosts and many different host cells. Intermediate hosts include a range of warm-blooded animal's*viz.,* man, birds, rodents, marsupials, and other domestic and wild mammals. Toxoplasma normally divides asexually to yield a haploid form that can infect virtually any vertebrate host but it also has a well-defined sexual cycle that occurs exclusively in cats (Dubey, 1998; Dubey *et al.,* 2003).

LIFE CYCLE OF *TOXOPLASMA GONDII*

The life cycle of *T. gondii* is facultatively heteroxenous, with three infectious stages:

1. Tachyzoites, also called trophozoite is the rapidly multiplying form and can infect any cell in the body.
2. Bradyzoites or tissue cyst is a stage encysted in the tissue.
3. Oocyst is a cyst surrounded by a thick resistant wall

Trophozoites and tissue cysts represent stages in asexual reproduction while oocyst is seen in definitive hosts formed by sexual reproduction.

ROUTES OF TRANSMISSION

All three stages are infectious for both intermediate and definitive hosts which may acquire *T. gondii* infection by any of the following routes:

- Horizontally by oral ingestion of infectious oocysts from the environment.
- Horizontally by oral ingestion of tissue cysts contained in raw or undercooked meat or viscera of intermediate hosts
- Vertically by transplacental transmission of tachyozites
- Tachyzoites may also be transmitted in the milk from the mother to the offspring

CLINICAL DISEASE IN MAN

Humans acquire infection by eating undercooked or raw meat infected with tissue cysts, or via ingestion of food or water contaminated with infected cat faeces carrying sporulated oocysts. Maternal to fetus transmission can also occur. Rare cases of individuals becoming infected through bloodtransfusions or organ transplantation have also been reported. Sporozoites fromoocysts and bradyzoites spread to mesenteric lymph nodes and then through blood steam and lymphatic's reach organs such as brain, eye, liver, spleen, hearty, skeletal muscle, lymph nodes and placenta of pregnant mother. Focal areas of necrosis develop in these organs. With the development of immunity tachyzoites are destroyed and acute infection resolves. Some of the tachyzoites may still persist and develop into tissuecysts containing bradyzoites, which remain viable for years. When there is suppression of immune system, infection is reactivated.

Postnatal Toxoplasmosis: Postnatal infection can be either localized or generalized. In immune competent non-pregnant individuals, infection with T. gondii is usually asymptomatic whereas in immune suppressed patients the condition can be severe. Lymphadenitis is the most frequently observed clinical form of human toxoplasmosis. Neurologic disease is the most common sign in reactivated infections and may lead to coma

and death. In patients with HIV or AIDS, toxoplasmosis is often a reactivated rather than a new infection. Ocular toxoplasmosis has been recognized as an important cause of human retinochoroiditis since the early 1950s. Ocular toxoplasmosis with unilateral uveitis can be seen in adolescents and young adults that may be a result of prenatal infection that was acquired postnatally.

Congenital Toxoplasmosis: Infections acquired during pregnancy can lead to congenital toxoplasmosis of the infant, affecting the development of brain and retina. The risk of intrauterine infection of the foetus, the risk of manifestation of congenital toxoplasmosis, and the severity of the disease depend on the time of maternal infection during pregnancy, the immunological competence of the mother during parasitaemia, the number and virulence of the parasites transmitted to the foetus, and the age of the foetus at the time of transmission. In immuno-competent hosts, infection with T. gondii usually results in life-long immunity against toxoplasmosis. Therefore if a primary T. gondii infection is acquired 4-6 months before conception or earlier, protective immunity will usually prevent vertical transmission to the foetus on subsequent exposures.

CLINICAL DISEASE IN ANIMALS

Members of the *Felidae*, including domestic cats, are the definitive host and the disease is communicable only in *Felidae.* Among the intermediate hosts, infection is severe in cats, sheep, goats and swine. Lower infection rates are seen in dogs and horses whereas cattle seem to be relatively resistant. Virtually all forms of clinical disease seen in man can occur in cats, dogs and several other wildlife. Among the wild animals New world monkeys and Marsupials are highly susceptible to the infection and most of these infected animals die due to overwhelming toxoplasmosis (Dubey and Lindsey, 2006; Gangneux and Darde,2012).

Most of the felids infected with Toxoplasmosis are asymptomatic, but generalized acute, sub-acute and chronic infections have been reported, particularly common in older cats, vary with the site of the lesion. Most infected dogs are asymptomatic but clinical toxoplasmosis is common in puppies and immunosuppressed older dogs. Toxoplasma encephalitis is most severe in dogs aged younger than six months. Ocular involvement has been reported in dogs and the sign may include retinitis uveitis and iridocyclitis (Etheredge *et al*., 2004).

In other animal species although the infections are generally subclinical and asymptomatic abortion serves as the most important clinical manifestation of Toxoplasmosis. Clinical toxoplasmosis is seen most often in sheep and goats when infected during pregnancy and are manifested by abortions, stillbirths, or mummification or resorption of the foetus.

Congenitally infected lambs may be uncoordinated, weak and unable to nurse. Ewes generally abort only once due to toxoplasmosis and diseased lambs or kids do not recur during subsequent pregnancies. Outbreaks with generalized infections, abortions, stillbirths and neonatal mortality are occasionally reported in swine. Fever, encephalitis, ataxia and retinal degeneration have been reported in horses.

DIAGNOSIS

Diagnosis can be done by the conventional technique of isolation of toxoplasma from blood, body fluids or demonstration of parasite in tissues. Several serological procedures which are available for the detection of T.gondii antibody in patients include the Sabin-Feldman dye test (DT), Indirect hemagglutination assay, Indirect florescent antibody assay (IFA), Latex agglutination (LAT), Enzyme-linked immunosorbent assay (ELISA), and Immunosorbent agglutination assay test (IAAT). Sabin-Feldman dye test is considered as the gold standard test for toxoplasma detection and is based on the presence of certain antibodies that prevent methylene blue dye from entering the cytoplasm of Toxoplasma organisms.

Serological detection IgM level demonstrates acute infection while 1gG levels are assayed for diagnosing past infection. Many tests for avidity of Toxoplasma IgG antibodies have been introduced to differentiate between recently acquired and distant infection. Advanced molecular techniques like detection of specific nucleic acid sequence with DNA probes, or detection of toxoplasma specific immunoglobulins can be done. Polymerase chain reaction (PCR) amplification is used to detect the DNA in body fluids and tissues. Prenatal diagnosis can be done by the PCR detection of parasitic DNA on amniotic fluid (Montoya, 2002). Samples from brain tissue, BAL fluid, cerebrospinal fluid, vitreous and aqueous fluid and peripheral blood can be used for PCR.

PREVENTION& CONTROL

Transmission of Toxoplasma can be effectively reduced by strict hygienic measures such as thorough washing of fruits and vegetables, avoiding consumption of raw and undercooked meat, and by keeping hands sanitized after gardening or handling cats. Although these measures are cost-effective and easily implemented, in some areas water used for washing may be contaminated with toxoplasmosis. Educative campaigns should be devised to make the public aware of this highly prevalent parasitic zoonosis and thereby preventing its transmission (Jones *et al.*, 2009). The following steps are recommended for the prevention and control of Toxoplasmosis to a great extent.

SUGGESTION AS A PUBLIC HEALTH VETERINARIAN

- Direct or indirect contact with cat faeces and infected cats should be avoided
- Keep away from stray cats.
- Thorough cooking of meat and vegetables should be ensured
- Meat should be cooked to a temperature of at least 160^{o} C for 20 minutes.
- Drinking water should be from a clean source.
- Ensure the quality of animal origin feaces given to food animals
- Pregnant women, and persons with suppressed immune systems, should be conscious in keeping themselves away from cat faeces.
- Control rodent populations and other potential intermediate hosts
- Do not drink unpasteurized milk.
- Wash hands and food preparation surfaces with warm soapy water after handling raw meat.

CONCLUSION

Toxoplasmosis raises the threat of a persistent zoonotic pathogen in our country nowadays. The parasite being a category B biodefense pathogen can be regarded as a potent candidate for bioterrorism due to the extreme environmental stability of infective oocysts that could contaminate water or food supplies. Since the screening for toxoplasmosis is not a routine activity in our country, advanced researches on its zoonotic importance, diagnosis, treatment and prevention are still awaiting.

REFERENCES

[1] Carme, B., 2009. Severe Acquired Toxoplasmosis Caused by Wild Cycle of Toxoplasma gondii, French Guiana-Volume 15, Number 4—April 2009-Emerging Infectious Disease journal-CDC.

[2] Chong LH, Singh M, Chua SB, Fong WE. Feline toxoplasmosis in Singapore. *Singapore Vet J.* 1993; **17**:79–87.

[3] Dubey JP, Lindsay DS, Speer CA. Structures of Toxoplasma gondii tachyzoites, bradyzoites, and sporozoites and biology and development of tissue cysts. *Clin Microbiol Rev.* 1998; **11**:267–99.

[4] Dubey, J.P. and Lindsay, D.S., 2006. Neosporosis, toxoplasmosis, and sarcocystosis in ruminants. *Veterinary Clinics of North America*: Food Animal Practice, **22**(3), pp.645-671.

[5] Horion M, Thoumsin H, Senterre J, Lambotte R. 20 years of screening for toxoplasmosis in pregnant women: the Liege experience in 20,000 pregnancies. *Rev Med Liege*. 1990; **45**:492–7

[6] J.L. Jones, V. Dargelas, J. Roberts, C. Press, J.S. Remington, et al. Risk factors for Toxoplasma gondii infection in the United States Clinical Infectious Diseases, **49** (2009), pp. 878–884

[7] López-Pérez, I.C., Risco-Castillo, V., Collantes-Fernández, E. and Ortega-Mora, L.M., 2006. Comparative effect of *Neospora caninum* infection in BALB/c mice at three different gestation periods. *Journal of Parasitology*, **92**(6), pp.1286-1291.

[8] Montoya, J.G. 2002. Laboratory diagnosis of Toxoplasma gondii infection and toxoplasmosis. *J. Infect. Dis*. **185**:S73-82

[9] Nicolle C, Manceaux L. Sur un protozoaire nouveau du Gondi. C R Hebd Séances Acad Sci. 1909; *148*:369–72.

[10] Pereira KS, Franco RM, Leal DA (2010) Transmission of toxoplasmosis (Toxoplasma gondii) by foods. *Advances in Food and Nutrition Research***60**:1–19

[11] Pernas, L., Adomako-Ankomah, Y., Shastri, A.J., Ewald, S.E., Treeck, M., Boyle, J.P. and Boothroyd, J.C., 2014. Toxoplasma effector MAF1 mediates recruitment of host mitochondria and impacts the host response. PLoS Biol, **12**(4).

[12] Remington JS, Thulliez P, Montoya JG 2004. Recent developments for diagnosis of toxoplasmosis. *J Clin Microbiol* **42**: 941-945.

[13] Sabin AB. Biological and immunological identity of Toxoplasma of animal and human origin. Proc Soc Exp Biol. 1939; **41**:75–80.

[14] Singh, S., Munawwar, A., Rao, S., Mehta, S. and Hazarika, N.K., 2014. Serologic prevalence of *Toxoplasma gondii* in Indian women of child bearing age and effects of social and environmental factors. *PLoS Negl Trop Dis*, **8**(3), p.e2737.