

Deer Hunters: Beware of Toxoplasmosis!

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(See the Major Article by Schumacher et al on pages 1557–65.)

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In this issue of *Clinical Infectious Diseases*, Schumacher and colleagues [1] describe an outbreak of acute toxoplasmosis in 9 men who participated in a weekend retreat with barbecue. Of 11 men (out of 12) who participated in the barbecue and ate undercooked venison meat, 9 developed clinical symptoms in the form of fever and muscular pain. All the sick men sought medical care and were treated with doxycycline. An infection with *Anaplasma* or *Ehrlichia* was initially suspected, but panel tests were negative. The time from eating the venison until clinical symptoms was a median of 7 days. The disease lasted for a median of 12 days.

After discussion with an expert team at the Wisconsin Department of Health services, extensive microbiological analyses were performed and other infectious diseases, such as trichinellosis, leptospirosis, brucellosis, and influenzae, were excluded.

Finally, serological tests for toxoplasmosis were performed, and *Toxoplasma gondii* Ig M was positive. An investigation of the outbreak was initiated, and interviews of the participants of the barbecue were performed.

Multiple laboratory tests were performed at toxoplasma reference laboratories in the United States and France. Supplemental serological tests analyzed in humans confirmed the diagnosis of toxoplasmosis. *Toxoplasma gondii* oocysts were found in the venison. The toxoplasma strain from the venison was identified as closely related to an atypical genotype—haplogroup 12, polymerase chain reaction–restriction fragment length polymorphism genotype 5—that is common in North American wild animals. Atypical strains of toxoplasmosis have been found in earlier studies in humans in the United States [2]. The seroprevalence of toxoplasmosis in the United States among white-tailed deer has been reported to be 23–74%.

The clinical symptoms and laboratory signs were different from those previously described in toxoplasmosis: only one-third had lymphadenopathy, one-third had ocular symptoms, and a majority had lymphopenia and elevated transaminases. There were 2 men who ate the venison but did not develop any clinical signs of infection: 1 had serological signs of an earlier toxoplasmosis infection, and the other was seronegative. Another man

participating in the barbecue did not eat the meat and did not get sick. All of the men were immunocompetent (at the time for the study), and all seemed to be cured, but the authors did not present a follow-up of the clinical symptoms.

There have been a few publications concerning toxoplasmosis in hunters who had eaten undercooked venison [3]. In a recently published paper from *Emerging Infectious Diseases*, Gaulin and colleagues [4] describe 9 Canadian deer hunters who had eaten undercooked venison: 6 of them developed fever, myalgia, and joint pain, and toxoplasma was identified by serological tests (immunoglobulin M and a low-avidity test). In the study by Gaulin et al [4], 1 patient was hospitalized, and there was no report of antibiotic treatment. An epidemiological investigation was made, and other infections were excluded. In 3 hunters who ate the venison without any clinical symptoms, 2 were immune and 1 was nonimmune. The frozen deer meat was analyzed, but no toxoplasma parasites were detected.

The seroprevalence of toxoplasma antibodies in humans in the United States has been reported to be 13.2% [5]. There have been a few studies performed in the seroprevalences of toxoplasmosis among hunters. In a study from Poland, in the Lublin Province, 42% of the hunters had antibodies against *Toxoplasma gondii* [6]. In Estonia, the toxoplasma antibody prevalence among hunters was 65.3% [7].

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Acute toxoplasmosis seldom causes symptoms in immunocompetent patients. The signs are unspecific and include fever, myalgia, and lymphadenopathy. Toxoplasmosis is transmitted either by cysts from undercooked meat or from food and water contaminated with oocysts from infected cat feces. Cats are the definitive hosts of the parasite. Mother-to-child transmission of toxoplasmosis is important and can cause congenital disease. The infection is lifelong and could be reactivated after many years. It is an important opportunistic pathogen in immunocompromised patients (including patients with AIDS), for whom a reactivation of *Toxoplasma gondii* can cause severe symptoms, such as chorioretinitis and encephalopathy.

Doxycycline, which was administered to the patients in the study, has been shown to have activity against toxoplasmosis (in vitro and in vivo) [8] but is not the drug of choice for treating toxoplasmosis. The standard treatment is pyrimethamine-sulfadiazine. The question is whether the disease was self-limited.

A shortcoming of the study is the lack of long-term follow-up of the patients. A third of the men reported ocular symptoms, and we do not know whether they healed or whether the patients had any sequelae.

The results from the present study—of patients with atypical clinical symptoms of toxoplasmosis and a high attack rate—highlights the importance of investigating the presence of toxoplasma among hunters (and their families and friends) with an acute infection. Interestingly, none of the health care providers initially suspected toxoplasmosis.

Patients seeking medical care due to fever and an infection of unknown origin should also be asked about their hunting habits and whether they have ingested game.

It is also of importance to inform hunters (and their families) to not eat undercooked meat and to wash their hands after handling raw meat.

Note

Potential conflicts of interest. The author: No reported conflicts of interest. The author has

submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

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