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Preliminary Report

OUTBREAK OF TOXOPLASMOSIS ASSOCIATED WITH MUNICIPAL DRINKING WATER — BRITISH COLUMBIA

Between 1 January, 1995 and 6 September, 1995, there have been 110 acute *Toxoplasma gondii* infections identified among individuals in the Greater Victoria area. Of these, 42 infected women and 11 newborns have been identified through a pregnancy-related screening program, which began on 24 April, 1995. Fifty-seven infections have been identified in non-pregnant individuals. This outbreak of toxoplasmosis is the largest ever reported and the first to be linked to municipal drinking water.

On 20 March, 1995, the British Columbia Centre for Disease Control, in conjunction with the Capital Regional District (CRD) Health Department, began an investigation to determine the source of the outbreak. At that time, although the number of requests for toxoplasmosis serology had not increased in the CRD during the preceding months, 15 individuals had been identified with serologic evidence of acute toxoplasmosis (IgG and IgM positive) since 1 January, 1995. One to four cases per year had been identified in the CRD in the preceding 4-year period. Concurrently, a Victoria retinal specialist advised the Provincial Laboratory that he was concerned about the sudden appearance of seven cases of acquired toxoplasmosis retinitis. He could not remember one case in his Victoria practice in the preceding 5 years.

The initial cluster included seven persons with retino-choroiditis and eight with lymphadenopathy. A preliminary questionnaire failed to identify any common food or beverage sources or purchase sites. This was followed by a case-control study involving symptomatic, non-pregnant residents of the CRD,

two geographic mapping exercises, and a second case-control study involving pregnancy-related cases.

The epidemiologic evidence gathered to date supports the hypothesis that drinking water from the Humpback Reservoir (HBR) (one of two main reservoirs serving the Greater Victoria area), and no other exposure, was the most likely source of this outbreak.

The geographic distribution of *Toxoplasma* infections largely matches the distribution of water from the HBR. There is no other variable that we have been able to identify which is unique to the Greater Victoria area that would account for this distribution of cases. The relative risk (RR) of being a case of toxoplasmosis if living in that water distribution area was 3.23 (95% CI: 1.57-6.89).

A population-based pregnancy screening program was instituted following recognition of the outbreak. Women living in the area served by the HBR were more than four times as likely to have acute *Toxoplasma* infection than women living in other areas of the CRD (RR = 4.57, 95% CI: 1.41-14.84). However, the HBR was not associated with past infection (IgG positive, IgM negative) (RR = 1.02, 95% CI: 0.77-1.35).

Results from the first case-control study involving non-pregnant, symptomatic cases indicate that cases were more likely than controls to be living in the area served by the HBR (OR = 8.27, 95% CI:1.16-142.75). Cases were more likely than controls to have lived or worked in the area served by the HBR (OR = ∞ , 95% CI:2.49-∞). Illness was not associated with cats or cat litter exposure, foreign travel or consumption of unpasteurized milk, game meat, raw meat, hamburger or lamb. The exposure period examined in this study was 6 weeks preceding the onset of symptoms in systemic cases and 3 months preceding the onset of symptoms in eye cases.

Finally, a case-control study involving women screened during the pregnancy screening program supports the results of the first case-control study. Living in an area served by the HBR at any time between 1 October, 1994 and 30 April, 1995, and drinking water at that location was associated with illness (OR = 3.16, 95% CI: 1.02-11.40). Living in an area served by the HBR (without consideration of whether tap water was consumed at that location) was of borderline significance (OR = 3.11, 95% CI: 0.91-14.27). Living or working in an area served by the HBR (and drinking tap water at that location) was of borderline significance (OR = 3.31, 95% CI: 0.94-14.81). Other variables (cat ownership, raw/rare/ game meat consumption, unpasteurized milk, goats' milk) that have been associated with epidemic toxoplasmosis were also examined and none were associated with acute infection. The exposure period examined in this study was the entire period of elevated risk from 1 October, 1994 to 30 April, 1995, as the cases were mostly asymptomatic.

The Greater Victoria Water District serves approximately 292,000 residents of the CRD. The distribution system is supplied with unfiltered, disinfected water from two chloramination plants operated by the District, the Japan Gulch Chloramination Plant (serving 73,000 people) and the HBR Chloramination Plant (serving 219,000 people).

Although the chain of events may never be fully elucidated, we suspect that the feces of infected domestic, feral or wild cats entered the HBR or its feeder streams, resulting in *Toxoplasma* oocyst contamination of the water supply. Four of seven domestic/feral cats captured in the watershed and tested have shown serologic evidence of *Toxoplasma* infection. Wild cats (cougars), which are also known to frequent the watershed area, have not been captured or tested; however, five of five cougars captured from the Nanaimo area (approximately 100 kilometres north of the watershed area) have shown serologic evidence of *Toxoplasma* infection. The operating conditions of the HBR and Treatment plant, including water temperature and disinfection with chloramine without filtration, would have supported survival, sporulation and distribution of oocysts. Although the evidence is not definitive, it is suspected that primary chloramination would not be reliably effective against *Toxoplasma* oocysts.

Studies are in progress to isolate *Toxoplasma gondii* from the HBR. However, these studies may not provide additional evidence because oocysts have never been isolated from water and specimens were not collected until water was strongly considered as a possibility, at which time the outbreak was over.

The outbreak appears to be over. On 17 July, 1995, in an effort to identify new infections in the pregnant population, and to assist in determining if the outbreak was over, the British Columbia Ministry of Health issued an advisory recommending *Toxoplasma* screening of pregnant women living in the CRD until 31 December, 1995. A screening schedule has been developed that involves testing in the first trimester, late second trimester and at the time of delivery.

Source: *The British Columbia Toxoplasmosis Team (A Bell, MD, R Gill, J Isaac-Renton, MD, A King, MD, L Martinez, MD, D Roscoe, MD, D Werker, MD, British Columbia Centre for Disease Control; S Eng, T Johnstone, MD, R Stanwick, MD, CRD Health Department; WR Bowie, MD (Team Leader), S Marion, MD, C Stephen, MD, University of British Columbia; A Burnett, MD, J Cadham, F Jagdis, MD, P Macleod, MD, Victoria; K Barnard, MD, J Millar, MD, S Peck, MD, BC Ministry of Health; J Hull, S Irwin, Greater Victoria Water District; J Hockin, MD, LCDC, Ottawa; K Kain, MD, University of Toronto; J Remington, MD, Stanford University, California; JP Dubey, MD, US Department of Agriculture, Maryland).*

Editorial Comment: This is the first report of an outbreak of toxoplasmosis associated with a municipal water supply. One other waterborne outbreak has been reported, among U.S. army personnel who drank untreated water from a stream in Panama[(1)]. As in the Victoria outbreak, the association was made on the basis of epidemiologic studies. There is no accepted method, at present, for the identification of *Toxoplasma gondii* oocysts in water. Given the delay to detection of clinical cases and the presumably episodic nature of distribution of oocysts through a large water distribution system, it is very unlikely that water sampling will be successful in confirming water as the source in this outbreak.

This outbreak indicates the potential for waterborne transmission of *Toxoplasma*. There are approximately 900 Canadian municipal water systems of varying size that provide unfiltered water (unpublished data). *T. gondii* oocysts survive well in a temperate environment and could easily be washed into surface water. At 10-12 μm in diameter, they are larger than oocysts of *Cryptosporidium* (4-6 μm), but slightly smaller than *Giardia lamblia* (11-12 μm). It should be no surprise, therefore, that *T. gondii* could be transmitted via unfiltered surface water,

when such systems have been implicated in large outbreaks of both other organisms.

The prevalence of postnatally acquired toxoplasmosis is unknown in Canada. Many serologic studies of adults have been done around the world, with the prevalence of *T. gondii* antibodies ranging from 0 to 100%[2]. A study carried out in Victoria, B.C., during the 1970s found that 28% of 596 adults had antibodies by the dye test[3]. The current pregnancy screening program in Victoria has detected approximately 10% of women with IgG antibodies only, which is indicative of past infection. However, there is an age bias in this group, being considerably younger than the average age in Victoria.

Primary ocular toxoplasmosis is uncommon in immuno-competent hosts, yet was a common feature of this outbreak. One possible explanation is a bias towards detection of retinochoroiditis by interested ophthalmologists in Victoria, with the great majority of infections being asymptomatic or causing only undiagnosed mild illness. It is also possible that the mode of transmission or characteristics of the strain of the infecting organism favoured clinically significant eye disease. Results of the continuing pregnancy screening program may enable us to better estimate the true extent of infection and the clinical spectrum of disease in this outbreak.

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International Notes

THE EBOLA FEVER EPIDEMIC OFFICIALLY DECLARED OVER IN ZAIRE

The International Scientific and Technical Committee, established by the World Health Organization (WHO) in Zaire, officially announced, on 24 August, 1995, the end of the recent outbreak of Ebola hemorrhagic fever in this country.

The last identified case was admitted to hospital in Kikwit on 24 June, 1995 and was discharged on 14 July, 1995. Since two maximum incubation periods, that is 42 days, have elapsed without any new reported cases, the conditions allowing the outbreak to be officially declared over are now met.

Active surveillance and tracing of cases and deaths retrospectively have shown that the first identified case related to the outbreak had onset of illness on 6 January, 1995.

The final total of confirmed cases is 315, including 244 deaths, which represents a mortality rate of 77%. One hundred and sixty-six of the 315 cases were females and 149 males. Mortality is slightly higher among males (81%) than among females (74%).

The cases ranged in age from 3 days to 71 years, with a median of 35 years. Twenty-six cases were < 17 years old and 13 were > 60. The median age among survivors was 29 years, among fatal cases 35 years.

Of the 286 cases with known occupation, 75 (26%) were nurses or students and 61 (21%) were housewives. Retrospective case-finding is going on to assess the full magnitude of this outbreak.

The cases have occurred in three Sub-Regions of Bandundu Region, with one case in the Kwango Sub-Region and the rest in Sub-Regions Kikwit and Kwilu. Two hundred and sixty-six cases have been reported in Kikwit, the remaining in Bulungu (13 cases), Fashi (1), Gungu (4), Idiofa (1), Mosango (23), Mokala (1), and Vanga (6).

Since the reservoir of the virus is not known, during the outbreak and subsequent studies, field teams captured more than 3,000 birds and mammals, including small rodents, and several thousand possible insect vectors. Samples from these animals are now being processed for virus isolation.

Blood samples from patients, patient contacts and health care workers potentially exposed are being investigated in the WHO Collaborating Centre for Reference and Research on Special Pathogens at the Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, and in the WHO Collaborating Centre for Reference and Research on Haemorrhagic Fevers and Arboviruses at the National Institute of Virology, Johannesburg, South Africa.

Source: *Press Release WHO/62, 24 August, 1995.*

AFRICAN PYGMY HEDGEHOG-ASSOCIATED SALMONELLOSIS — WASHINGTON, 1994

During 1994, the Washington Department of Health Public Health Laboratory reported the isolation from a human of a rare *Salmonella* serotype, *Salmonella* serotype Tilene. This report summarizes the epidemiologic investigation of the case by the Seattle-King County Department of Public Health, which suggested the infection was related to exposure to African pygmy hedgehogs.

Of 9 April, 1994, a 10-month old girl was evaluated in a hospital emergency department in King County for an acute febrile, non-bloody diarrheal illness; the fever resolved without treatment but the diarrhea persisted for three weeks. On 28 April, she was evaluated in an outpatient clinic; a stool sample yielded *Salmonella* Tilene. The infant had been breast-fed and received supplemental solid foods; she did not attend a child care centre. Her parents were asymptomatic, and cultures of stool samples from both were negative. The family owned a dog and a breeding herd of 80 apparently healthy African pygmy hedgehogs; a stool sample from one of three hedgehogs cultured yielded *Salmonella* Tilene. Although the infant had not had direct contact with the hedgehogs,

the hedgehogs were handled frequently by one member of the family. The infant's illness resolved after treatment for an upper respiratory infection with trimethoprim-sulfamethoxazole.

MMWR Editorial Note: *Salmonella* Tilene is an uncommon cause of human illness; the organism was first isolated in 1960 from a child in Senegal[1]. Although the patient in Washington had the first documented human infection with this serotype in the United States*, since January 1991 the U.S. Department of Agriculture (USDA) has identified two isolates from animals at the National Veterinary Services Laboratory — both were from African pygmy hedgehogs (K. Ferris, USDA: personal communication, April 1995). Although the African pygmy hedgehog is an unusual pet, ownership of these animals is reportedly increasing in the United States[2]. African pygmy hedgehogs are bred domestically in the United States; importation from Africa has been prohibited since 1991 because they can carry foot-and-mouth disease, a disease of livestock that is not found in the United States (R. Perkins, USDA: personal communication, May 1995).

* On June 21, the Texas Department of Health reported to CDC the second human infection with *Salmonella* Tilene in the United States; the patient's family owned a hedgehog.

Salmonella spp. are found worldwide in domestic and wild animals, including mammals, reptiles, and birds. Although ingestion of contaminated food is the most important source of salmonellosis in humans[3], pets are another potential source of infection[4,5]. The overall risk for acquiring salmonellosis from pets is low; however, the risk is increased with exposure to animals with high fecal carriage rates of *Salmonella*. In general, carriage rates are higher in animals that are young, have diarrhea, or live in overcrowded conditions[4]. Reported carriage rates are highest in reptiles (as high as 90%), and lowest in dogs and cats[4]. Carriage rates have not been reported for African pygmy hedgehogs.

The investigation of this case and a recent report involving reptile-associated transmission of *Salmonella*[5] underscore the potential risk for transmission of *Salmonella* from an infected pet to members of the household who do not have direct contact with the pet. This risk can be reduced by handwashing after handling of pets, especially before eating or handling food, and by avoiding contact with pets' feces[6].

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Source: *Morbidity and Mortality Weekly Report, Vol 44, No 24, 1995.*

Notifiable Diseases Summary

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Notifiable Diseases Summaries published to date in this new format (FAX) can be found in the index under the same name.

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