



NEW YORK CITY DEPARTMENT OF
HEALTH AND MENTAL HYGIENE
Thomas R. Frieden, MD, MPH
Commissioner

Health Advisory #08: Baylisascariasis (Raccoon Roundworm) Infection with Severe Outcome Identified in Two New York City Children

- Two cases of *Baylisascaris procyonis* (*B. procyonis* or raccoon roundworm) infection have been identified in children from Brooklyn, both with serious sequelae:
 - An infant with eosinophilic meningoencephalitis from neural larva migrans resulting in severe permanent brain damage, and
 - A teenager with ocular larva migrans resulting in loss of vision in one eye.
- The New York City (NYC) Health Department asks providers to consider and test for baylisascariasis in patients presenting with encephalopathy with peripheral eosinophilia or a CSF eosinophilic pleocytosis, ocular larva migrans, diffuse unilateral subacute neuroretinitis (DUSN) or eosinophilic pseudotumor;
- Suspected cases should be reported immediately to the NYC Health Department for consultation and diagnostic assistance at 212-788-9830 during business hours or the Poison Control Center at 212-764-7667 after hours and on weekends.

Please distribute to staff in the Departments of Internal Medicine, Pediatrics, Ophthalmology, Family Medicine, Infection Control, Infectious Disease, Emergency Medicine, Critical Care, Neurology, Rehabilitation and Laboratory Medicine.

Dear Colleagues,

April 9, 2009

On March 30th, 2009 two cases of baylisascariasis among children from Brooklyn were reported to the Health Department. The first case was identified in a previously healthy infant who presented with an acute onset of developmental regression, irritability, postural deficits and seizures in October of 2008 resulting in a diagnosis of eosinophilic meningoencephalitis. The patient had a history of geophagia and travel to upstate New York. Serologic testing for *B. procyonis* was positive and anthelmintic and steroid therapy were initiated but did not result in improvement. The child remains hospitalized with permanent brain damage. The second child, a teenager, developed an acute onset of blindness of the right eye in January of 2009. This patient had not traveled outside NYC during the incubation period. Visual inspection of the eye revealed a larva and lesions consistent with ocular larva migrans (OLM). The large dimensions and morphological characteristics of the larva were consistent with *B. procyonis* rather than *Toxocara canis*, the more common cause of OLM in the United States. Serologic testing is pending. Laser photocoagulation was conducted to successfully destroy the larva, along with steroidal therapy, but the child remains blind in the right eye. The Health Department is conducting an investigation to attempt to determine when and how these children became infected and to assess any risk to others.

Baylisascariasis is an uncommon disease caused by the raccoon roundworm *B. procyonis*. Fewer than 30 cases have been reported in the medical literature although unpublished cases are known. While most were infants or young children, adults have also been reported. Infection occurs following ingestion of *B. procyonis* eggs which are shed in the feces of infected raccoons. Upon ingestion the eggs hatch and the larvae migrate through the body. The larvae cause particular damage to the eyes and central nervous system due to OLM or neural larva migrans (NLM), although viscera and various somatic tissues are commonly affected. The incubation period is not well defined but estimated to be 2 to 4 weeks for NLM and 1 to 2 weeks for OLM. Asymptomatic and mild and covert infections have been reported. Onset and severity of illness is often associated with the number of eggs ingested, the extent of larval migration, and the degree of inflammation and necrosis. Young children, persons with pica and/or developmental disabilities and those who have an exposure to raccoon habitats are at greatest risk for severe, overwhelming, irreversible neurologic disease or death. Of 14 cases of NLM summarized recently, ten were under

20 months of age and 3 had a history of developmental delay.^{i,ii} Outcomes included death (5), severe/persistent residual deficits (9) along with visual impairment, blindness and epilepsy.

Studies suggest that the parasite is very common among raccoons, with carriage rate estimates as high as 90% among juvenile and 60-70% of adult raccoons sampled.ⁱⁱⁱ The eggs are extremely resilient, can overwinter and persist in the environment for months to years. Raccoons are the definitive host and humans are not capable of shedding eggs. This alert asks providers to consider baylisascariasis in the differential diagnosis for patients presenting with encephalopathy and peripheral or CSF eosinophilia, diffuse unilateral subacute neuroretinitis (DUSN) or eosinophilic pseudotumor, especially if there is a history of exposure to raccoons or raccoon habitat.

DIAGNOSIS: Diagnosis of baylisascariasis is based on clinical illness, exposure history and laboratory findings including a CSF eosinophilic pleocytosis, a peripheral eosinophilia and deep white matter abnormalities on MRI.^{i,ii} For OLM, peripheral eosinophilia is not always present, but ocular examinations may reveal a migrating larva, larval tracks, or lesions consistent with a nematode larva. *B. procyonis* larvae grow relatively large in size, measuring up to 1,500 to 1,900 µm in length. This helps to distinguish them from *Toxocara* larvae which measure 350 to 445 µm in length. Identification of larva in tissue biopsies is diagnostic, but the chances of a biopsy containing a larva are relatively low. Immunodiagnostic tests of serum or cerebrospinal fluid (CSF) are helpful in suspected cases but are not widely available. Please contact the Bureau of Communicable Disease (BCD) to discuss suspect cases and obtain assistance with diagnostic testing. Call BCD at 212-788-9830 during business hours and the Poison Control Center at 212-764-7667 after hours and weekends.

TREATMENT: Anthelmintic treatment has had limited effectiveness in preventing death or severe outcome, except in cases with low infections and early aggressive therapy. While data from animal models show that preventive treatment is effective before *B. procyonis* larvae enter the brain, most human cases are not recognized until well after CNS damage has already occurred. Theoretically if started within 1-3 days of possible infection, anthelmintics should prevent clinical disease by killing larvae before they enter the CNS and should be considered for anyone with a recent history of ingestion of raccoon feces.^{ii,iii} Time is of the essence in the treatment of this infection. Albendazole is the treatment of choice because of its CNS penetration, minimal toxicity and larvicidal activity. In addition, systemic corticosteroids should be administered to reduce the damage associated with the inflammatory response. Summaries of treatments administered to published NLM cases are cited below.^{i,ii,iv,v} Laser photocoagulation along with the administration of systemic corticosteroids is the treatment of choice for patients with OLM and diffuse unilateral subacute neuroretinitis (DUSN).

RESOURCES: For more information on baylisascariasis visit <http://www.cdc.gov/ncidod/dpd/parasites/baylisascaris/default.htm> or <http://www.avma.org/reference/zoonosis/znbaylis.asp>.

Please call the Bureau of Communicable Disease at 212-788-9830 with questions regarding testing, diagnosis, or management of suspected cases of baylisascariasis. As always, we greatly appreciate your cooperation and collaboration in our efforts to detect, investigate and prevent infectious diseases in New York City. Sincerely,

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i Gavin et. al. 2005. Baylisascariasis. Clinical Microbiology Reviews, Oct 2005, p. 703-718.

ii Murray and Kazacos 2004. Raccoon roundworm encephalitis. CID 2004;39(10)1484-92.

iii Roussere et. al. 2003 Raccoon Roundworm Eggs near Homes and Risk for Larva Migrans Disease, California Communities. EID:9;December 2003 1516-22.

iv Gavin et. al. 2002 Neural larva migrans caused by the raccoon roundworm *Baylisascaris procyonis*. Pediatr Infect Dis J. 2002;21:971-5.

v Park et. al. 2000. Raccoon Roundworm (*Baylisascaris procyonis*) Encephalitis: Case Report and Field Investigation. Pediatrics 2000;106 <http://www.pediatrics.org/cgi/content/full/106/4/e56>.