

Wildlife Pathology Unit

New York State Department of Environmental Conservation

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CASE REPORT

Species: **moose**

WPU Case #: **100812**

Date received: 10/20/2010

Necropsy date: 10/21/2010

Prosecutor: K. Hynes

HISTORY

This moose was exhibiting neurologic signs and was found down in an active cow pasture on October 20, 2010 off of Fuller Road between SR 274 and Jones Road in the Town of Steuben, Oneida County. It was not quite in sternal recumbency; lying more on its side than its sternum. It appeared to be blind, and when prodded, it attempted to get up but could not. The moose was shot on October 20 and the carcass was delivered to the Wildlife Pathology Unit on October 21, 2010 by Steve Heerkens NYSDEC Region 6 Utica. Chuck Dente (NYSDEC Central Office Moose Biologist) assisted with the gross necropsy.

GROSS NECROPSY FINDINGS

This is the carcass of a 2 ½ year old male (bull) moose in good flesh with moderate fat reserves and a gross mass of ~247kg (543.5 lbs). There is unusual antler growth with a single spike on one side and double spikes on the other; possibly the result of a previous injury. There is gunshot trauma to the thorax and lungs. There are no gross signs of *echinococcus* hydatid cysts, abscesses, or lungworm infection. The liver is dark gray and the capsule is bloated with gas; the liver tissue appears more autolytic/decomposed than the other organs (including the kidneys). There are small areas of adhesion between the liver and the diaphragm; there are no signs of liver flukes. There is a small adhesion between the omentum and the right lateral abdominal wall. There is a small adhesion between the left lung and the wall of the thorax; there are two underlying, healed rib fractures with small bony callus formation. There is an area of seral clotting over the lateral spleen. The remainder of the viscera are without gross lesions. The rumen contains a moderate volume of well-chewed leafy plant fibers and hemlock needles and twigs; the odor of conifer is obvious. One adult *Parelaphostrongylus tenuis* was found in the caudal portion of the cervical spinal cord under the pia mater; no nematodes were observed in the brain, although there are areas of black pigment in the ventral cerebellum, dorsal medulla, and pineal body.

HISTOPATHOLOGICAL FINDINGS

Fixed tissues were submitted to Cornell AHDC; the following significant findings were reported: Multifocal axonal degeneration and swelling consistent with Wallerian degeneration in the spinal cord, lymphofollicular hyperplasia in both the meninges and a lymph node section, mild multifocal granulomatous alveolitis in the lung. "The presence of Wallerian degeneration within the submitted sections of spinal cord is considered consistent with the reported history of neurologic disease and the *P. tenuis* noted on

necropsy. No additional histologic changes were present within the examined tissues to indicate an alternate cause of disease.”

MICROBIOLOGY

A rabies test at the NYSDOH Rabies lab was negative. Culture swabs from the liver submitted to Cornell ADHC for bacteriology identified *Escherichia coli*, many Group D, non-*Enterococcus*, and moderate *Clostridium Spp.* closely resembling *Clostridium sordellii*.

DIAGNOSIS: Cerebrospinal nematodiasis (aka “brain worm” or meningeal worm infection).

COMMENT: The *P. tenuis* found in the cervical spinal cord is likely responsible for the neurologic behavior exhibited by this moose. *P. tenuis* is a nematode commonly found in the subdural space of white-tailed deer (the definitive host). The adult worms lay eggs on the duramater that hatch into first stage larvae, the larvae enter the bloodstream, travel to the lungs, up the trachea, are swallowed, then travel through alimentary canal and are excreted with the fecal pellets. The first stage larvae are found in the mucoid coating on the outside of the fecal pellets, the larvae penetrate the foot of a gastropod (slug or snail) where they transform into second and third stage larvae. The infected gastropod is inadvertently consumed by a deer and the third stage larvae travel along the nerves of the deer until they reach the spinal cord and brain where they mature and the cycle repeats. In a moose (or elk, llama, sheep) the larvae from an ingested gastropod travel to the spinal cord and brain but they enter the leptomeninges and can disrupt the nervous tissue with mechanical destruction/manipulation and/or inflammation, resulting in neurologic signs and aberrant behavior. *P. tenuis* infection of the brain or spinal cord of moose is often fatal, although there may be periods where the moose seems to recover (as the worm or worms move through different portions of the brain or cord), they typically are showing signs again in several days. Death can be the result of paralysis, lack of fear/inappropriate behavior (motor vehicle strike, shot by police or Conservation Officer), inability to feed (starvation) or feeding on inappropriate food items (malnutrition). The abnormal antler growth, previously fractured ribs, and adhesions suggest prior impact trauma. The *Clostridium Spp.* isolated from the liver may account for its accelerated rate of autolysis.



Necropsy photograph of *P. tenuis* on cervical spinal cord.

Kevin Hynes
November 19, 2010