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NEUROLOGIC DISEASE IN A WHITE-TAILED DEER MASSIVELY INFECTED WITH MENINGEAL WORM

(Pneumostrongylus tenuis)*

Pneumostrongylus tenuis generally is not regarded as an important cause of central nervous disease in its natural host, the white-tailed deer *(Odocoileus virginianus)*. The parasite develops in the neural parenchyma of the central nervous system and matures in the subdural space and venous sinuses primarily within the cranium. Infected deer usually are not infected with large numbers of worms and rarely display neurologic signs. This report indicates, however, that abnormally heavy infections of *P. tenuis* in the subdural space and the venous sinuses of the cranium of white-tailed deer occur and can result in severe neurologic signs and death.

Materials and Methods

The deer under consideration was a pregnant three-year old doe (65 lbs. and in poor condition) from the Lake Russell Wildlife Management Area, Habersham County, Georgia. This animal was brought to the laboratory for clinical and pathological study because of her poor condition and obvious locomotor difficulties.

Results

Clinical observations

The doe was circling to the right when found. Her gait was unsteady and she tended to fall. The animal's head was held to the right, and she demonstrated a moderate nystagmus. The deer was killed for necropsy by giving an intramuscular injection of 50 mg succinylcholine chloride.

Necropsy findings

The most significant findings were in the cranium. Masses of adult *Pneumostrongylus tenuis* were found in the subdural space near the posterior choroid plexus and immediately behind the pituitary. Fewer worms were found elsewhere in the subdural space. Worms also were extremely numerous in the intercavernous and dorsal sagittal sinuses. Eighty adult *P. tenuis* were recovered from the subdural space and an estimated 20-40 worms were entangled within the sinuses. The dura mater was dark brown in color. A salient feature was the orange-brown color of the leptomeninges extending posteriorly as far as the medulla oblongata.

Histological findings

The findings in the dura mater were similar to those reported by Alibasoglu et al. (1961. Cornell Vet. *51:* 431-441) and Anderson (1963. Can. J. Zool. *41:* 775-792). The dura mater was thickened and in many areas eggs and larvae of *P. tenuis* were found surrounded by connective tissue and frequently by giant cells. Focal accumulations of lymphocytes as well as numerous eosinophils were found throughout the dura.

Dr. T. J. Hulland, Department of Pathology, Ontario Veterinary College, kindly provided the following notes on

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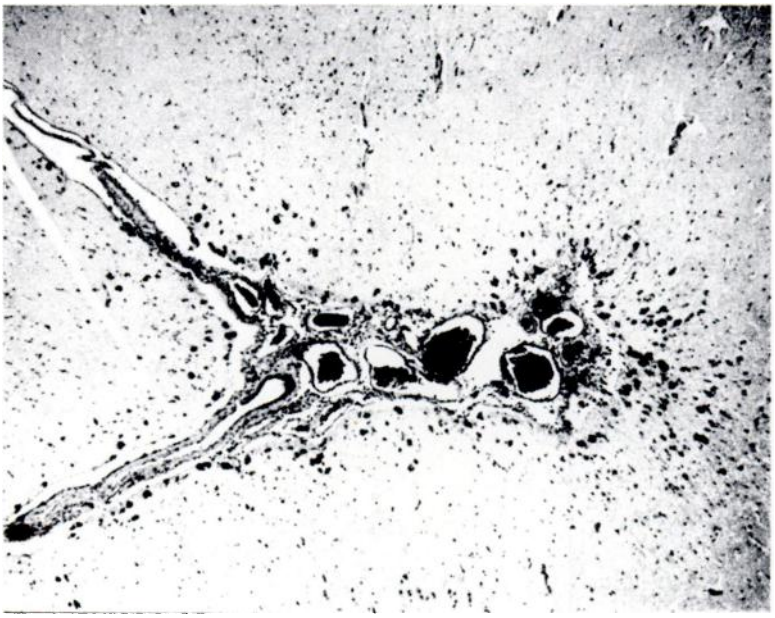


FIGURE 1. *Pigment deposition adjacent to vessels within the cerebral cortex. H & E x 100.*

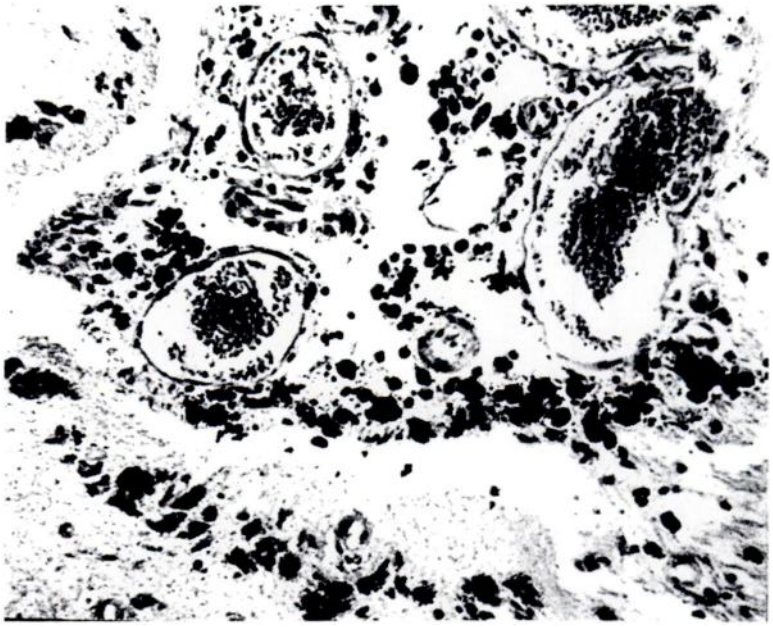


FIGURE 2. *Detail of pigment deposition associated with vessels of cerebral cortex. H & E x 450.*

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the leptomeninges and the brain. "The cerebral meningeal surfaces show evidence of intracellular and extracellular pigment granules in the leptomeninges and also in the outer zone of the cortex. In hematoxylin and eosin preparations, most of the pigment, both in the meninges and the brain parenchyma, appears to be in histiccytes which have small, eccentric nuclei. The pigment is golden-brown but in concentration appears almost black. Some collections of free pigment appear to have been extruded by degenerating macrophages. Granule diameter varies up to 2 μ An unusual location for the pigment is the elastica and collagen of medium sized meningeal vessels. In this location it is present in relatively large quantities in some vessels. The pigment is Periodic Acid Schiff-negative, Aldehyde fuchsin-negative, Phloxine-negative, but strongly iron-positive as determined by Perle's Prussian blue reaction. One can only conclude that the pigment is a product of red blood cell breakdown by macrophages, although no erythrocyte extravasation or intermediate stages of breakdown are visible" (Fig. 1, 2).

"A separate lesion is visible adjacent to the median sagittal sinus of the cerebral meninges. In this tissue is a focal area containing several larvae and many multinucleate giant cells. Several larvae are ensheathed by two or more giant cells and some giant cells contain remnants of dead larvae. Giant cells contain up to two hundred nuclei and are mixed with a few pigment-laden mononuclear cells. The pigment present here is similar to that described earlier."

Discussion

On the basis of the material available for study, there is little evidence to suggest that the abnormal neurologic signs displayed by the deer were due directly to trauma of the neural parenchyma by wandering *P. tenuis*. This is in contrast to damage produced by *P. tenuis* in moose (*Alces a. americana*), which consists of extensive trauma to the spinal cord (Anderson, 1964. Path. Vet. *1:* 289-322; Anderson, 1965. Can. J. Zool. *43:* 635-639). The presence of pigment in the meninges and cerebral cortex suggests, however, that the massive infection of worms in the cranium had induced some circulatory abnormality. Possibly large masses of worms in the venous sinuses and the reaction they provoked had interfered mechanically with the blood flow.

It is worth mentioning that of approximately 2500 deer examined for *P. tenuis* (Prestwood and Smith, 1969. J. Parasit. *55:* 720-725), this was the only animal with signs of neurologic disturbance attributed to meningeal worms. The orange-brown discoloration of the leptomeninges and cerebral cortex also has been noted in other deer with large numbers of *P. tenuis*. Possibly circulatory disturbances are not uncommon in heavy infections of meningeal worm in deer.

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