

## Pathology in Practice

In collaboration with the American College of Veterinary Pathologists

# Diarrhea, lethargy, weight loss, and mortality in a flock of peafowls

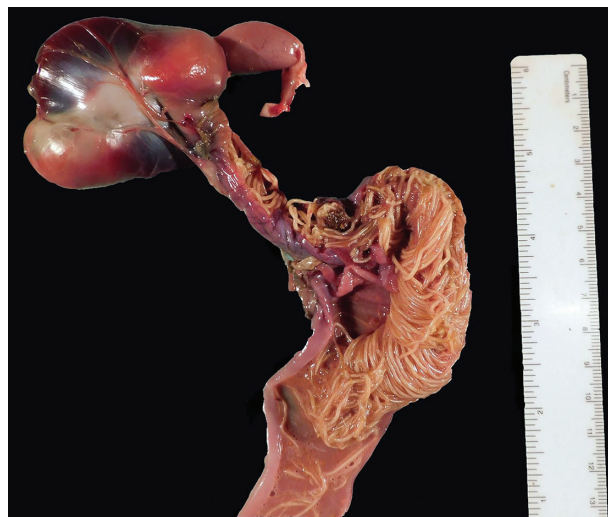
### History

A flock of 6 peafowls that ranged in age from 5 months to 1 year began showing clinical signs of black-stained tar-like diarrhea, lethargy, decreased weight, and 50% flock mortality over a few weeks. The peafowls that were 5 months of age within the flock showed the aforementioned clinical signs while the older peafowls within the flock did not exhibit any clinical signs. The owner reported similar mortality (50% mortality) and clinical signs in the younger peafowl the previous spring. The flock was treated with CORID (amprolium) for 5 days with no signs of improvement. One 5-month-old peahen was submitted for necropsy.

### Gross Findings

On gross examination, the feathers surrounding the cloaca were stained with dark-green to black-colored feces. Body condition scores (BCSs) adapted for chickens were used that range from a BCS of 1 to 5. A BCS of 1 is a poor body condition with a concave curvature of the pectoral muscles and prominent keel bone, 3 is the ideal condition with a slight convex curvature and palpable keel bone, and 5 is overweight with a well-developed muscle mass and nonpalpable keel bone.<sup>1</sup> The BCS was 1/5 with severe atrophy of the superficial and deep pectoral muscles. The left and right caudal edges of the liver contained a 5-cm-long and 0.3-cm-wide, well-demarcated strip of pale tan discoloration, which, on cut section, revealed an adult nematode. On cut section of the left ventral liver lobe, a white to tan, 3-cm-long, ovoid nematode was visualized dissecting through the center of the liver's parenchyma. The hepatic parenchyma was within normal limits outside of the foci containing adult

nematodes. A single nematode was visualized within the lumen of the left celomic air sac. The duodenum was markedly distended, and the jejunum was mildly distended to the level of Meckel's diverticulum. Numerous adult nematodes could be visualized through the intestinal wall distending the duodenum's and jejunum's lumen. On cut section of the duodenum and jejunum, the lumen was distended with numerous 8-cm-long, pale to tan ovoid adult nematodes (**Figure 1**). The nematodes completely occluded the duodenum and the proximal jejunum. The adult nematodes were also visualized within the proventriculus, ventriculus, ileum, and cloaca.



**Figure 1**—Photograph of the proventriculus, ventriculus, and duodenum. The duodenum has been incised to reveal numerous adult nematodes that were 8 cm in length, round in cross sections and ovoid in shape, and too numerous to count.

**Formulate differential diagnoses, then continue reading.**

### Histologic Findings

The hepatic parenchyma contained numerous foci of necrosis and multiple granulomas, which effaced the underlying parenchyma. The central

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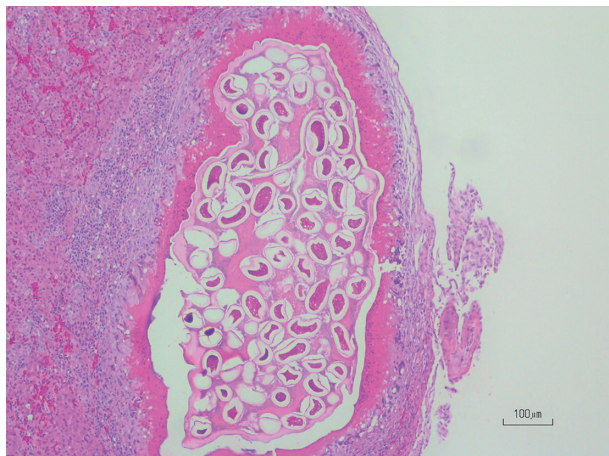
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aspects of the granulomas were characterized by an encased single adult degenerate nematode surrounded by amorphous eosinophilic material and necrotic cellular debris (**Figure 2**). The nematodes had



**Figure 2**—Cross section of a female ascarid containing a mature uterus with numerous eggs. The ascarid is walled off by a granulomatous inflammation consisting of a rim of multinucleated giant cells, macrophages, fibrin, and lymphocytes. H&E stain; 400X.

a prominent cuticle, coelomyarian musculature, and mature uteri with numerous eggs. The granulomas were rimmed with numerous multinucleated giant cells, macrophages, fibrin, and low numbers of lymphocytes and granulocytes. Areas of necrosis were characterized by individualization of hepatocytes, cytoplasmic clearing, and pyknotic, karyorrhectic, or absent nuclei. Multiple periportal tracts were surrounded and expanded by lymphocytic infiltrates and low numbers of macrophages. The pancreas contained multiple granulomas that included degenerate adult nematodes, which were surrounded by multinucleated giant cells, fibrin, and lymphocytes. Various nematode life cycles ranging from eggs to degenerate adults were seen within the lumen of the duodenum and jejunum. The eggs were ellipsoidal with a thick, smooth outer shell and ranged in size from 75 to 80  $\mu\text{m}$  along the longest axis.

## Morphologic Diagnosis and Case Summary

Morphologic diagnosis: multifocal, marked necrotizing granulomatous hepatitis with intralesional adult nematodes; multifocal, mild lymphocytic and histiocytic perivascular hepatitis; and multifocal, moderate granulomatous pancreatitis with intralesional adult nematodes.

Case summary: ascariasis, confirmed with parasite identification and fecal flotation.

## Comments

Ascariasis, an infestation of an organism with roundworms, has recently increased in prevalence in

poultry due to more commercial and backyard flocks being reared with access to soil.<sup>2</sup> Turkeys, chickens, ducks, geese, and quail are some of the species that are most commonly affected by various *Ascaridia* spp.<sup>3</sup> *Ascaridia* spp have a direct life cycle, meaning that there is no intermediate host in the developmental life stages, though it is common for flies to act as mechanical vectors and earthworms to act as paratenic hosts for infective eggs.<sup>3,4</sup> Eggs are shed in the feces of the infected hosts and develop in the environment for up to 14 to 30 days before becoming infective.<sup>3</sup> Infective eggs are ingested by the host species, which release the second-stage larvae within the gastrointestinal tract within the proventriculus or the small intestines.<sup>3</sup> Once hatched, the second-stage larvae invade the small intestinal mucosa.<sup>3</sup> Larvae reside in the mucosa of the small intestines for a few weeks before going through another molt to become third-stage larvae. The third-stage larvae reside within the lumen of the small intestines for 18 to 30 days before a final molt is completed with the larvae becoming adults, which then begin reproducing.<sup>3</sup> *Ascaridia* sp eggs are ellipsoidal in shape with a thick, smooth outer shell.<sup>3</sup> Eggs of *Ascaridia galli* (a common ascarid of poultry) have been shown to remain viable for up to 2 years in a pasture.<sup>4</sup>

Clinical signs in poultry typically present as a loss of appetite, decreased body weight, ruffled feathers, stunted growth, depression, and increased mortality.<sup>4</sup> When high worm burdens are present, mortality rates tend to increase due to intestinal obstruction from adult ascarids and damage to the intestinal tract from L2 to L3 larvae.<sup>4</sup> Infestations are typically greater in birds under 3 months of age due to a lack of resistance from an immature immune system.<sup>3</sup> Larval migration is more likely to occur with certain species of ascarids like *Ascaridia dissimilis* (an ascarid primarily affecting turkeys) or when there is a high worm burden within the intestines, as there was in this case.<sup>3</sup> Adult ascarids, in rare cases, may migrate into the oviduct when high worm burdens are present and worms are passed through the intestines into the cloaca or due to certain medications like piperazine.<sup>3</sup> Nematodes that migrate into the oviduct can become incorporated within an egg before the shell is formed.<sup>3</sup> The incidence of ascarids within eggs is highly uncommon, but with the increase in free-range eggs, the prevalence may start to increase over time.<sup>3,5</sup> *Ascaridia* spp that affect poultry are not zoonotic and do not pose a threat to public health.<sup>3</sup>

Diagnosis of an *Ascaridia* sp infestation can be made through fecal examination including routine fecal flotation or through the identification of adult nematodes during necropsy.<sup>3,4</sup> Various treatment options are available to treat ascariasis in birds. Fenbendazole, albendazole, and levamisole have all been shown to be highly effective in the removal of adult and larval stages of ascarids.<sup>2,3</sup> Piperazine is an older dewormer that paralyzes adult worms instead of killing them. Adult worms may recover within the cloaca and migrate into the oviduct where they can become incorporated within eggs.<sup>3</sup>

Preventative measures can be taken to reduce the risk of infestation.<sup>3,4</sup> When possible, pasture rotation has been shown to reduce the risk of infection from heavily contaminated pastures. Due to the nature of *Ascaridia* eggs being able to survive in the environment for up to 2 years, there is still a risk of infection with this preventative measure.<sup>3,4</sup> Feeding birds on raised feeders instead of feeding on the ground can reduce fecal-oral transmission. Frequent monitoring of the flock by routine fecal flotation followed by targeted anthelmintics can help reduce fecal egg counts and reduce the risk of developing anthelmintic resistance within a flock.<sup>2</sup>

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