History

In early fall 2012, a 48-kg (106-lb) sexually intact male Dahl ram in fair body condition was found dead; the owner observed no clinical signs prior to death. The ram was part of a flock of 50 game animals used for high-fence hunting that was moved among pastures in Idaho, Utah, and Montana. The ram was housed primarily on flood-irrigated pasture in common with approximately 170 captive Rocky Mountain elk (Cervus canadensis). The owner reported that 12 other sheep had died over the past year without observed clinical signs, but none were submitted for postmortem examination. Both sheep and elk were orally dewormed each February with 11.3% albendazole at a dose of 10 mg/kg (4.5 mg/lb; labeled cattle dose).

Gross Findings

At necropsy, numerous mesothelial defects were found in the parietal peritoneum, many of which were associated with black pigment or hemorrhage (Figure 1). Multiple winding hemorrhagic tracks lay under the splenic capsule. Throughout the liver, bile ducts were dilated and thickened and often contained green to black viscous fluid. Multiple subpleural nodules, some associated with peripheral hemorrhage, were in the lung lobes. Small linear foci of hemorrhage were in the serosa of the rumen, reticulum, omasum, abomasum, both ventricles of the heart, left testis, and both kidneys.

Formulate differential diagnoses from the history, clinical findings, and Figure 1—then turn the page →

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Additional Gross Findings and Histopathologic Findings

On closer examination of the surface of the liver, flukes were visible, apparently displaced from an incised bile duct (Figure 2). In sections of the liver, numerous flukes were seen in fibrous-thickened bile ducts. Flukes have a thin tegument underlain by smooth muscle fibers and a digestive tract (paired ceca) but lack a body cavity. Severe bridging perportal fibrosis replaced either portions of or entire lobules of the liver. Bile ducts were mildly duplicated, and mixed leukocytes infiltrated between collagen fibers. Hemorrhagic tracks bordered by fibrous tissue infiltrated with numerous hemosiderin-laden macrophages disrupted random lobules. Multiple hemorrhagic tracks, bordered by immature fibrous tissue or pleocellular leukocyte infiltrates, were identified in the serosa of the rumen, reticulum, omasum, and abomasum. Hemosiderin-containing macrophages infiltrated bordering collagen fibers. Similar tracks were identified in the lungs, heart, spleen (Figure 3), kidneys, and testes.

Morphologic Diagnosis and Case Summary

Morphologic diagnosis: extrahepatic fluke attachment sites and intrahepatic migratory tracks, consistent with *Fasciola hepatica*, in the rumen, reticulum, omasum, abomasum, liver, lung, heart, kidneys, testes, and spleen.

Case summary: distomiasis (fascioliasis) in a New Mexico Dahl sheep.

Comments

In the sheep of the present report, observed lesions were due to heavy infection of liver flukes (*F. hepatica*). Speciation of the flukes was based on size, observed migratory patterns, and intrabiliary location. Temporary attachment sites of migrating flukes accounted for parietal peritoneal defects and fibrinohemorrhagic tracks in abdominal tissues. Moreover, immature flukes had accessed hepatic veins and subsequently the systemic circulation to lodge in lung lobes, with secondary migration through the visceral pleura, pericardium, and myocardium. In cattle, aberrant migration of flukes is common in the lungs and other unusual body sites. In sheep, fluke infestations in the peritoneum, lungs, lymph nodes, uterus, spleen, pancreas, and subcutis have been described. As in the case described in this report, acute fascioliasis is often not recognized clinically in affected animals, which are frequently found dead but in good body condition.

In sheep, distomiasis is reported to develop primarily during autumn months or early winter (the sheep of this report died in September). First reported in 1379, *F. hepatica* is the major trematode that infects sheep in temperate and subtropical parts of the world. In addition to sheep, *F. hepatica* infects goats, cattle, pigs, equids, cameldids, rab-
bits, deer, and otters. Mild winters or increased rainfall is associated with increased numbers of cases of fascioliasis in many parts of the world. Fascioliasis is described as an emerging zoonotic disease as well.

Adult flukes live in bile ducts, where they lay as many as 2,500 eggs/d, which are excreted in feces. One animal infected with *F. hepatica* can shed as many as 3 million eggs/d. Even though greater infectivity is reported in spring and fall, eggs are laid year-round and an adult fluke can live as long as 11 years. Eggs develop into miracidia, which penetrate a snail intermediate host (mainly *Lymnaea trunculata*); multiply as sporocysts, rediae, and cercariae; exit the snail; and encyst on grass to become metacercariae. If these metacercariae are ingested by grazing animals, they excyst in the small intestine and immature flukes migrate through the bowel wall, across the peritoneum, and into the liver where they access bile ducts and develop into adults. In sheep, fluke infection results in diminished growth and reproduction rates and poor quality and quantity of fleece and milk, causing major financial loss to the sheep industry. In the sheep of the present report, lesions attributable to extrahepatic fluke attachment sites or migratory tracks were uncommonly extensive.

With regard to husbandry of the remaining flock, recommendations to irrigate the sheep pastures differently, reduce amounts of standing water and snail habitat on those pastures, and administer a flukicide more frequently were made by one of the authors (KAR) and implemented by the owner. At last follow-up, 2 years after the death of this sheep, no additional cases of fascioliasis in this flock had been reported.

References