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Paragonimiasis In Iowa

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Paragonimiasis
In Iowa


Introduction

The presence of the lung fluke, Paragonimus kelliocotti, was first recorded in the United States in a cat in 1894 (27). It was first recognized in domesticated animals in Iowa in a dog from Blackhawk County in 1948. Subsequently, paragonimiasis has been diagnosed in dogs from Polk and Dallas counties. An additional case was found in a dog from an unrecorded county. Also, one cat from Story County has been found to harbor P. kelliocotti.

The presence of P. kelliocotti previously has been reported in Ontario (12), Iowa (4), and 20 other states (2, 3, 4, 6, 7, 8, 9, 11, 13, 15, 18, 19, 25). The mink is considered to be the normal definitive host (25). In addition to the mink, dog, and cat, this fluke has been recorded in North America from man (1), fox (12), goat (7), wildcat (19), opossum (13), raccoon (13), striped skunk (13), swine (22), and muskrat (3).

Briefly, the life cycle of P. kelliocotti is as follows. Mature flukes in pulmonary abscesses deposit eggs that are coughed up, swallowed, and passed in the feces (Fig. 8). Eggs that drop into water swimming miracidia hatch, penetrate a suitable snail (Pomatiopsis), and therein undergo further development. Free-swimming cercariae escape from the snail and penetrate the exoskeleton of crayfish (Cambarus). In the crayfish the cercariae encyst and await ingestion by a suitable definitive host. In the definitive host, the adolescent flukes migrate to the lungs, mature, and begin the cycle over again.

Case reports

Following are summaries of five cases of paragonimiasis diagnosed in the Department of Veterinary Pathology and Parasitology and in Stange Memorial Clinic at Iowa State University. This report will serve to remind veterinarians of the presence of paragonimiasis in the Midwest.

Case 1 (Accession #14115)

This dog was a male Labrador retriever, 7 years old, that had been discharged from the K-9 Corps, U. S. Army, about five years previous to clinical examination on November 22, 1948. This dog had served in the Orient. Since the date of discharge from service, the dog had lived in Blackhawk County, Iowa. For the past five months, the owner had noticed that the dog had weekly tremulous convulsions, usually at night. Coughing spells, sometimes with hemoptysis, were associated with these convulsions. The dog’s appetite and general condition remained good.

Other clinical results included the de-
tection of cestode segments and eggs of *Ancylostoma caninum* and *P. kellicotti* in the feces, using a sugar flotation method (5). Radiographs of the skull were inconclusive, but foci several millimeters in diameter seemed to exist in the anterior portions of the brain. Results from other examinations were noncontributory.

The dog was treated for the ancylostomosis and sent home with the expectation that further clinical examinations could be conducted on the dog at the time of future visitations. However, contact with the dog was lost, and no additional information is available.

**Case 2 (Accession #14541 and 14544)**

This dog was a male coon hound, 7 years old, from Polk County, Iowa. The dog was admitted to the clinic on July 6, 1951, at which time routine fecal examination, using a sugar flotation technique (5), was performed. Eggs of *Capillaria* sp. (*aerophila*?), *Ancylostoma caninum*, and *P. kellicotti* were found. Euthanasia was performed.

At necropsy, 12 to 15 nodules 1 to 3 cm. in diameter, were found distributed throughout the parenchyma of both lungs. The connective tissue capsules of these nodules were about 1 mm. thick.

Microscopically, adult flukes were observed in the cysts. Each cyst appeared to be composed of a greatly dilated bronchiole. Marked hyperplasia of the bronchiolar epithelium and extensive infiltration of the lamina propria with plasma cells and lymphocytes had occurred (Fig. 1, 2). Bronchiolar exudate surrounding the flukes was composed of erythrocytes, neutrophils, cellular debris, and macrophages (Fig. 3). Fibrosis and atelectasis of the adjacent tissue were present. Marked congestion and edema were seen in neighboring pulmonary lobules. In one lesion from this dog a fluke was free in the pulmonary parenchyma inciting hemorrhage and a marked inflammatory reaction characterized by infiltration with neutrophils and lymphocytes.

**Case 3 (Accession #16178)**

This dog, of unrecorded origin, age, sex, and breed, was examined at the clinic and found to harbor *P. kellicotti*. On August 18, 1956, one apical lobe, containing a discrete abscess thought to contain the flukes, was excised surgically.

Two adult *P. kellicotti* were removed from this abscess. Microscopically, hyperplasia of the bronchiolar epithelium and extensive lymphocytic and plasma cell infiltration were found. Capillary congestion and atelectasis of the adjacent tissue were marked. Similar changes were also observed in the bronchi. Large accumu-
Figure 1. Hyperplasia of the bronchial epithelium from a case of canine paragonimiasis (case 2). Lymphocyte and plasma cell infiltration of the lamina propria. H and E. 52X

Figure 2. Canine paragonimiasis. Hyperplasia of the bronchial epithelium, lymphocyte and plasma cell infiltration of the lamina propria. H and E. 187X.
lations of fluke eggs were seen in the parenchyma (Fig. 4). The shells of the fluke eggs were birefringent under polarized light, a character which made them easily seen. The eggs were surrounded by fibrosis, giant cells, and lymphocytes which had infiltrated into the adjacent tissue. The pneumonic reaction in the surrounding alveoli was characterized by suppuration, septal cell proliferation, and some lymphocytes. Many septal cells contained a pigmented material suggestive of cecal contents of the flukes.

Case 4 (Clinic #62-C-1785).
This dog was a male black and tan hound, 7 years old, from Dallas County, Iowa. The dog had been used to hunt small game and had had several different owners in the past several years. Therefore, the dog probably had traveled over several counties in central Iowa. The dog was admitted to the clinic on February 13, 1963, for treatment of a dog bite wound on the head. It was noticed that the dog had a non-productive cough after moderate exercise. Eggs of *Ancylostoma caninum* and *P. hellicotti* were found upon routine fecal examination, using a sugar flotation technique (5). Other findings were non-contributory.

After satisfactory response of the ancylostomiasis and wound to therapy, the dog was sent home. No therapy was initiated for the paragonimiasis. No further information is currently available on this dog.

Case 5 (Accession #63-P-65)
This cat was a castrated male domestic, 6 years old, from Story County, Iowa. The cat was admitted to the clinic for treatment for urethral calculi. Some coughing was noticed, and it was stated that this had existed for the past six months. The cat died unexpectedly while receiving treatment for the calculi.

At necropsy, there were two raised, dark red, cystic lesions (1-2 cm. in diameter) in the right cardiac lobe of the lung and one similar lesion in the right diaphragmatic lobe. On cross section, one adult *P. hellicotti* was observed in each lesion.

Histopathologically, the lesions were confined to the bronchi, bronchioles, and...
Figure 4. Chronic inflammatory change around a collection of fluke eggs within the alveoli (case 3). H and E. 52X.

Figure 5. Inflammatory exudate of a feline bronchus. Cellular debris, fluke eggs, neutrophils, and macrophages (case 5). H and E. 187X.
adjacent tissue. The surrounding tissue was edematous with mild septal cell proliferation. Each cyst appeared to be composed of a greatly dilated bronchiole containing cellular debris, fluke eggs, and desquamated epithelial cells (Fig. 5). In some areas, metaplasia of the bronchial epithelium to stratified squamous epithelium had occurred. The lamina propria, fibrotic in many bronchi, was infiltrated with lymphocytes and macrophages. Eosinophils were rarely present. Hyperplasia of the bronchial glands was very prominent, especially around the parasitized and adjacent bronchi (Fig. 6). Atelectasis of surrounding alveoli had occurred. An area suggestive of a migratory tract consisted of fibrosis and capillary proliferation. Medial hypertrophy and subintimal fibrosis of variously sized arteries and veins occurred throughout the affected lobe (Fig. 7).

Discussion

The first case of paragonimiasis in a domesticated animal in Iowa was diagnosed in 1948. It is not known whether this dog acquired the fluke while in the K-9 Corps or after discharge. P. kelliocotti was known to have been present in wild animals in Iowa (4) before. It is probable that paragonimiasis regularly occurs in a sylvatic cycle involving such hosts as mink, opossum, and muskrat. Therefore, paragonimiasis occurs only accidentally in an urban cycle, which accounts for the few cases reported in dogs and cats.

The sources of infection for the five cases described are uncertain. Crayfish that harbor kelliocotti metacercariae serve as a source for shellfish-eating animals such as mink. Although a few dogs and cats are known to eat crayfish, these shellfish are not usually their choice of food. It has been demonstrated that dogs may become infected after ingesting an animal in which adolescent flukes are migrating (2). Thus, we may have paragonimiasis in an animal that has not eaten crayfish.

In case #1, it is interesting to speculate on the possible etiologic connection between the lung flukes and the convulsions. Because adolescent flukes migrate, it

Figure 6. Paragonimiasis of the feline bronchus. Note hyperplasia of bronchial glands (A), lumen of the bronchus filled with cellular debris (B). This change was observed in the feline lung and not the canine. H and E, 32X.
seems possible that errant flukes could have migrated into the brain, causing encephalopathy responsible for the convulsions. On the other hand, we recognize that the convulsions in this dog may have been entirely unrelated to the paragonimiasis. In man, cerebral paragonimiasis is a well-known sequela to migration of *P. westermanii* (20, 23, 24). However, there is also the possibility that parasitic embolism (errant eggs) may be the cause of cerebral encephalopathy in these cases (17).

It is interesting to note that at least three of the cases (2, 4, and 5) described above were brought to the clinic for treatment of a condition other than paragonimiasis. The fourth (1) was examined for convulsions (cerebral paragonimiasis?) and the fifth (3) lacks enough clinical history to make a statement. However, the presence of *P. kellicotti* in these cases unquestionably had an effect on the patient and altered the prognosis in each case. This emphasizes the importance of conducting routine fecal examinations. In this regard, we have found that a simple sugar flotation technique (5) was satisfactory in these cases. However, flotation has been claimed to be of little value in diagnosing paragonimiasis, and sedimentation methods were recommended (25). Further work needs to be done on the critical comparison of these two diagnostic techniques in detection of paragonimiasis.

In the cat, Kau and Wu (10) mentioned that eggs remaining for long periods in alveoli incited a granulomatous reaction. Chronic bronchitis and mild proliferation of glandular epithelial cells were also observed. In case 5, chronic inflammation was not associated with fluke eggs, possibly because the course was of relatively shorter duration. Hyperplasia of the bronchial glands was more evident in case 5 than previously reported (10). Hyperplasia of the vascular media is a common finding in pneumonia of the cat; it is not a specific change associated with this parasite.

In the dog cystic pleural elevations, measuring $\frac{1}{2}$ inch in diameter and containing a small amount of brown-colored...
fluid, have been reported (14). Microscopically, edema, congestion, and foci of chronic inflammation were reported. In some areas of the lung, the majority of the alveoli and bronchioles were filled with oval, straw-colored eggs. Slight fibrosis and giant cell proliferation had taken place around the parasite eggs.

This microscopic appearance was similar to that observed in our canine cases, with the notable exception that both of our cases also had proliferation of the bronchial epithelium. The supplicative and hemorrhagic reaction seen in one lesion from case 2 suggested a recent entry into the tissue by this fluke. Whether this fluke was actively migrating or had passively escaped from a nearby nodule was not known.

There appears to be a difference between the dog and cat in their response to P. kelliocotti. In our feline case, there was hyperplasia of the bronchial glands and hypertrophy of the vascular media, neither of which appeared to be prominent in canine cases seen by Nielsen (14) or us. Fluke eggs, when present in the parenchyma seem to incite a granulomatous reaction in both the dog and cat in long-standing cases.

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New Ketosis Test Developed

A test for ketosis that is two to three times more sensitive than any field test on the market today has been developed by Michigan State University scientists.

The new method of detection will be thoroughly studied to determine its effectiveness under actual farm conditions. At present, all ketosis tests require taking urine or milk samples on the farm, but they are not nearly as sensitive as the MSU test. The scientists report that the new test can be made on either urine, blood or milk, and it might possibly be made by the farmer himself under the

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