# GRANULOMATOUS FILARIAL ENCEPHALOMYELITIS CAUSED BY *CHANDLERELLA QUISCALI* IN A NORTHERN CRESTED CARACARA (*CARACARA CHERIWAY*)

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# GRANULOMATOUS FILARIAL ENCEPHALOMYELITIS CAUSED BY *CHANDLERELLA QUISCALI* IN A NORTHERN CRESTED CARACARA (*CARACARA CHERIWAY*)

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*Abstract:* A northern crested caracara (*Caracara cheriway*) was presented after being found nonambulatory in a field. On physical examination, the bird had severe hind-limb paresis. The bird did not improve after 10 days of hospitalization and was euthanized. Histologic examination of the cerebrum and spinal cord revealed multiple adult filarial nematodes surrounded by granulomatous inflammation with several multinucleated giant cells. These parasites were confirmed to be *Chandlerella quiscali* with polymerase chain reaction. This is the first report of *C. quiscali* in a bird of prey.

*Key words:* Avian, *Caracara cheriway*, *Chandlerella quiscali*, encephalomyelitis, northern crested caracara.

## BRIEF COMMUNICATION

In June 2015, a male juvenile northern crested caracara (*Caracara cheriway*) was admitted to the Zoological Medicine Service at Texas A&M University after being found down in a nearby field. On physical examination, the bird had significant hind-limb paresis and was unable to stand or ambulate. Other physical exam findings included lethargy, mild dehydration, and mild scaling on the face, ventrum, and around the vent. The bird was in fair body condition. Radiographs did not reveal fractures or other evidence of trauma. A complete blood count showed a mild anemia (packed cell volume 26%), and numerous *Haemoproteus* spp. organisms were seen on blood smear evaluation. Over the course of 10 days the bird was given supportive treatment including enrofloxacin (Baytril®, Bayer Healthcare LLC, Shawnee Mission, Kansas 66216, USA; 20 mg/kg intramuscular [IM[ q.i.d.), meloxicam (Metacam®, Boehringer Ingelheim Vetmedica, Inc., St. Joseph, Missouri 64506, USA; 0.5 mg/kg IM b.i.d.), subcutaneous fluids (NORMOSOL®-R, Abbott Animal Health, Abbott Park, Illinois 60064, USA), and physical therapy consisting of passive range of motion in the legs. Although mentation and appetite improved, the paresis continued and the bird was euthanized.

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There were no abnormalities seen in the nervous system or limbs on postmortem examination. Tissue samples were fixed in 10% neutral buffered formalin and routinely stained with hematoxylin and eosin. Histologic examination revealed several sections of filarial nematodes throughout the cerebrum (Fig. 1), cerebral meninges, and spinal cord (Fig. 2). The filarids were ~100 μm in diameter and were characterized by a thin cuticle, prominent lateral chords, coelomyarian musculature, a small digestive tract, and a reproductive tract. Parasites in the spinal cord were surrounded by dense clusters of lymphocytes, plasma cells, epithelioid macrophages, and occasional multinucleated giant cells (Fig. 2). Nearby vessels were occasionally surrounded by a variable number of lymphocytes. There was a mild local gliosis near parasite cross-sections and occasional axon degeneration scattered throughout all sections. In the cerebrum, several filarid sections were surrounded and sometimes replaced by large clusters of multinucleated giant cells (Fig. 1B); however, other inflammatory cells were less frequent than in the spinal cord, and multiple filarids completely lacked surrounding inflammation (Fig. 1A).

Evidence of additional parasitic infections was seen in multiple organs. The myocardium contained a few trematode metacercariae that were presumed to be *Strigea* spp. These parasites were visible grossly as white nodules and were surrounded by a small amount of granulomatous inflammation histologically. *Haemoproteus* spp. megaloschizonts were found in the cerebellum, pulmonary pleura, and muscularis of the small intestine, and multiple *Haemoproteus* spp. gametocytes were identified on postmortem blood

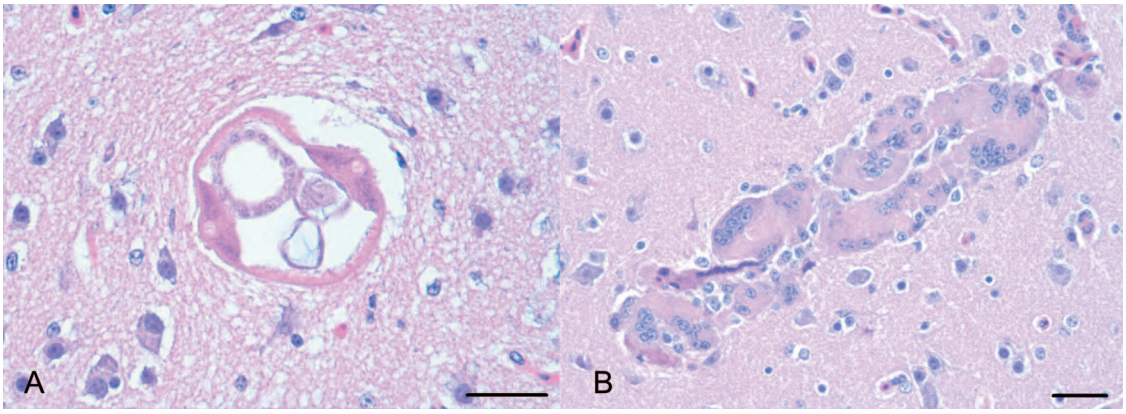


**Figure 1.** **A.** Cross-section of a filarial nematode consistent with *Chandlerella quiscali* in the cerebrum of a northern crested caracara (*Caracara cheriway*) without surrounding inflammation. **B.** A discrete aggregate of multinucleated giant cells in the cerebrum presumably surrounding a filarial parasite. Hematoxylin and eosin; bar = 20 μm.

smears. Scattered protozoal schizonts consistent with *Sarcocystis* spp. were within the skeletal muscle of the leg.

Despite the presence of parasites within the central nervous system, additional diagnostic tests were performed to exclude other differential diagnoses for avian neurologic disease. A fresh sample of cerebrum was sent to the Texas A&M Veterinary Medical Diagnostic Laboratory for West Nile virus polymerase chain reaction (PCR) and was negative. Additionally, formalin-fixed paraffin-embedded sections of cerebrum and spinal cord were sent to the Michigan State University Diagnostic Center for Population and Animal Health for eastern equine encephalitis PCR and were also negative.

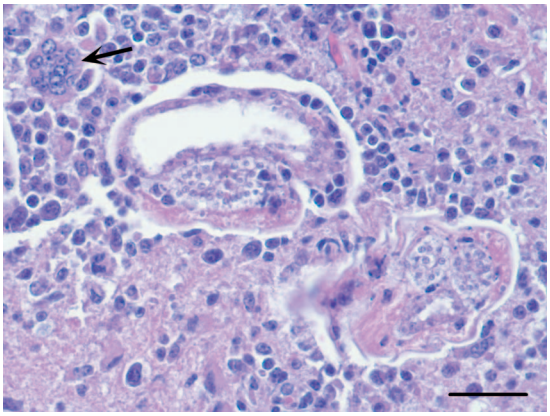

**Figure 2.** Cross-sections of a nematode suspected to be *Chandlerella quiscali* in the spinal cord of a northern crested caracara (*Caracara cheriway*) surrounded by granulomatous inflammation including a multinucleated giant cell (arrow). Hematoxylin and eosin; bar = 20 μm.

To identify the filarial parasite, genomic deoxyribonucleic acid (DNA) was extracted from formalin-fixed paraffin-embedded cerebrum and spinal cord sections with histologic evidence of nematodes (Mo Bio Laboratories, Carlsbad, California 92010, USA). Previously published generic primer sequences targeting the 12S ribosomal DNA gene (12SF: 5′-GTTCCAGAA-TAATCGGCTA-3′and 12SR: 5′-ATTGACG-GATGTTTGTACC-3′) in the mitochondrial genome of nematodes were used.[3] Conventional PCR using Phusion high-fidelity polymerase (New England Biolabs, Ipswich, Massachusetts 01938, USA) was performed on a T100 thermal cycler (Bio-Rad Laboratories, Hercules, California 94547, USA) with negative PCR controls. A 450-base pair product was successfully amplified from genomic DNA isolated from both cerebrum and spinal cord. The PCR products were sequenced and deposited into the GenBank National Center for Biotechnology Information database (accession # KX768276). A basic local alignment search tool search of both sequences indicated that the nematode was consistent with *Chandlerella quiscali*.

*Chandlerella quiscali* is a filarial parasite found commonly in the brain of the common grackle, *Quiscalus quiscula versicolor*.[1–4,6,8,10] In grackles, *C. quiscali* typically resides in the lateral ventricles and does not cause neurologic disease. In addition to common grackles, *C. quiscali* has been described in other passerine species such as Amer-

ican robins (*Turdus migratorius*), blue jays (*Cyanocitta cristata bromia*), brown-headed cowbirds (*Molothrus ater ater*), and starlings (*Sturnus vulgarus*), in which it is also usually nonpathogenic.[4,5] To the authors' knowledge, this is the first report of *Chandlerella quiscali* in a raptor species, and the first report of *C. quiscali* causing clinical signs in a bird other than emus.[7]

Encephalitis due to *C. quiscali* infection has been described in a flock of emus from Louisiana with torticollis and ataxia.[7] Filarids morphologically consistent with *C. quiscali* were recovered from the brain of one emu on postmortem examination, and filarid cross-sections were histologically identified in both the lateral ventricles and the cerebral parenchyma. Parasites were infrequently surrounded by a small amount of mononuclear inflammation, but granulomatous inflammation was not described. Small perivascular cuffs of lymphocytes and plasma cells were described in the brain and spinal cord. A similar filarial infection presumed to be *C. quiscali* was observed in an emu from Texas around the same time (T. M. Craig, pers. com.). There are no reports of *C. quiscali* associated with inflammation in other avian species. In this case, inflammation in the cerebrum was mild, confined to small clusters of multinucleated giant cells around degenerate parasites, and therefore presumably did not contribute greatly to the clinical signs. Additionally, several cerebral filarid sections were not surrounded by any inflammation (Fig. 1A). The inflammation in the spinal cord, however, was much more severe, including a mixed population, perivascular cuffing, and areas of necrosis (Fig. 2). Furthermore, the clinical signs in this bird manifested primarily as the inability to walk, which is more consistent with a spinal cord rather than cerebral lesion. Therefore, we believe the spinal cord lesions were responsible for the clinical signs and ultimate euthanasia of the bird.

Although common grackles are found in large numbers throughout the eastern and midwestern United States, northern crested caracaras are primarily found in northern South America, Central America, and Mexico, with southern Texas being the northern edge of their recognized territory range. The common grackles in the overlapping range of southern Texas presumably provide a reservoir of *C. quiscali*, which is transmitted by *Culicoides* vectors.[1,9] The caracara in this report had a shared environment with both the reservoir and vector of *Chandlerella quiscali*, ultimately leading to infection. Interestingly, the area of Texas in which this bird was found is primarily populated by great-tailed grackles (*Quiscalus mexicana*), with a much smaller population of common grackles. *Chandlerella quiscali* has not been described in great-tailed grackles, but this species may represent an additional reservoir.

In summary, this report describes *C. quiscali* infection in a northern crested caracara with a clinical manifestation of hind-limb paresis. Though typically nonpathogenic, *C. quiscali* can cause clinical disease because of aberrant migration and should be considered as a differential for any bird with neurologic signs, particularly those whose range overlaps with the common grackle.

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