## SPIRURIDOSIS

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<th>Animal Group(s) Affected</th>
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<td>Non-human primates, equids, cervids, bovids, camelids, canids, felids, insectivores, birds, and reptiles</td>
<td>Ingestion of intermediate (invertebrate or vertebrate) or paratenic host</td>
<td>Variable, but may include chronic gastritis, vomiting, hemoptysis, anemia, anorexia, weight loss, conjunctivitis, keratitis, and sudden death</td>
<td>Inapparent to severe; many are subclinical</td>
<td>Levamisole, albendazole, mebendazole, ivermectin and other anthelmintics</td>
<td>Control of arthropod intermediate and paratenic hosts; quarantine of shedding animals</td>
<td>Rare, although food-borne infection or vector-borne can occur</td>
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### Fact Sheet compiled by: Inga F. Sidor; updated by Christopher S. Hanley

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**Fact Sheet Reviewed by:** Guilherme G. Verocai; Inga Sidor

**Susceptible animal groups:** Many vertebrates are susceptible to members of this order of nematode parasites, including wild and captive primates, equids, cervids, bovids, camelids, suids, canids, felids, insectivores, marsupials, rodents, birds, amphibians, and reptiles

### Causative organism:
Commonly encountered pathogenic spirurids of zoo and wildlife species include nematodes of the genera *Habronema*, *Draschia* (equids, camelids), *Parabronema* (primates), *Thelazia* (mammals, birds), *Spirocerca* (canids, felids, ruminants), *Gongylonema* (primates, ruminants, equids, suids, birds), *Trichospirura* (primates, reptiles, amphibians), *Tetrameres*, *Oxyspirura* (birds), *Physaloptera* (small carnivores, primates, insectivores, rodents), and *Gnathostoma* (carnivores, suids, primates, marsupials).

### Zoonotic potential:
Most species are not known to cause human disease, although some zoonotic spirurids exist. *Gnathostoma* spp. may be acquired by ingestion of uncooked infected paratenic hosts (fish, frogs, crustaceans), and cause cutaneous, visceral or ocular larva migrans. *Thelazia* spp. Also can affect human eyes and it is transmitted by flies directly into the eyes.

### Distribution:
Global, more common in warm climates

### Incubation period:
Variable, typically weeks to months; the life cycle includes an obligate arthropod intermediate host, including house or stable flies, cockroaches, coprophagous beetles, and crickets. Paratenic hosts (rodents and other small mammals, amphibians, reptiles, small birds) may also be involved. *Gnathostoma* are aquatic, with a secondary fish or amphibian intermediate host.

### Clinical signs:
Most species of spirurids live in the lumen or walls of the upper gastrointestinal tract (oral cavity, esophagus, stomach, proventriculus, or ventriculus); cutaneous or conjunctival infections are also seen (*Habronema* and *Thelazia*, respectively). Signs vary according to site of parasitism and infections are often inapparent, but signs can include esophagitis with aneurysms, chronic gastritis, vomiting, hemoptysis, anemia, anorexia, weight loss, aortic stenosis or aneurysm, or may induce tumors such as sarcoma (*Spirocerca*), acute or chronic pancreatitis (*Trichospirura*), cutaneous ulceration or nodules, ocular discharge, keratitis/conjunctivitis, and/or sudden death.

### Post mortem, gross, or histologic findings:
Superficial epithelial infections (*Gongylonema*) may result in esophageal epithelial hypertrophy and cornification. With more invasive infections (*Spirocerca*, *Habronema*, and *Tetrameres*), granulomatous or ulcerative lesions of organs develop surrounding necrotic nematodes and caseous debris, including gastritis, esophagitis, and aortitis. Granulomas may be large and
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coalescent, appearing neoplastic. Larval migration may cause focal tissue hemorrhage and necrosis. Nodular granulomatous dermatitis can be seen with cutaneous infections due to erratic larval migration when life-cycle is not completed. Conjunctivitis and progressive keratitis are typical of Thelazia.

**Diagnosis:** Morphological identification of larvae, eggs or adult nematodes. Adults may be recovered from ocular conjunctiva (e.g. Thelazia, Oxyspirura), including surgical removal, or during necropsy. Because of encysting or encapsulation, for some species, of the adult nematodes in granulomas, fecal shedding of eggs may be intermittent. Imaging techniques such as endoscopy may assist in some cases (e.g. granulomas by Spirocerca). Eggs of different species may be difficult to separate morphologically (e.g. Spirocerca and Physaloptera) and may require larvae to make a definitively identification. Confirmation of infection in biopsies or necropsy tissues may be desired by histopathology. Oral and lingual scraping has been used to identify Gongylonema in callitrichids, but results are inconsistent. Molecular techniques, including EM are available for identification of some parasites.

**Material required for laboratory analysis:** Feces, vomitus, surgical/postmortem lesions

**Relevant diagnostic laboratories:** Any diagnostic laboratory with routine parasitologic capabilities should be able to diagnose this infection.

**Treatment:** A variety of anthelminthics have been used to treat these infections, with variable efficacy, including mebendazole, albendazole, levamisole, fenbendazole, ivermectin, doramectin, moxidectin, and milbemycin oxime, but controlled studies are uncommon. Surgical removal of nematodes (Thelazia) or granulomas (e.g. Spirocerca) may apply.

**Prevention and control:** Removal of arthropod intermediate hosts (terrestrial and aquatic) or paratenic hosts from enclosures is key to controlling infections. Prophylactic treatment of animals with endectocides or insecticides may prevent contact of arthropod intermediate hosts. In endemic regions, preventative treatment may be possible for some spirurid species. Animals with active fecal shedding or vomiting should be separated from uninfected animals. Quarantine, routine parasitological diagnostics, and prophylactic treatment of new arrivals.

**Suggested disinfectant for housing facilities:** General measures for cleaning and disinfection should reduce environmental parasite contamination. Bleach or ethanol treatment may reduce viability of spirurid eggs, which are believed not to be very resistant in the environment.

**Notification:** None

**Measures required under the Animal Disease Surveillance Plan:** None

**Measures required for introducing animals to infected animal:** Direct infection is not observed; the indirect life cycle of these parasites makes control of intermediate hosts the most important measure.

**Conditions for restoring disease-free status after an outbreak:** Undefined as ante mortem testing may be unreliable (due to the low sensitivity of certain techniques) and return to disease-free status may be difficult to ascertain.

**Experts who may be consulted:**
Guilherme G. Verocai, DVM, MSc
Department of Ecosystem and Public Health
University of Calgary
3330 Hospital Drive NW, HSC 2531
Calgary AB, Canada T2N 4N1
Phone: 403-210-7869
Fax: 403-210-7869
gui.verocai@ucalgary.ca

**References:**
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