**ANGIOSTRONGYLOS**

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<th>Animal Group(s) Affected</th>
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<td><em>A. cantonensis</em> – non-human primates, marsupials, horses, dogs.</td>
<td>Ingestion of intermediate (snails and slugs) or paratenic (shellfish, frogs, lizards) hosts.</td>
<td><em>A. cantonensis</em> - variety of neurologic signs, including ascending paresis, hyperesthesia, seizure, muscle wasting, coma, +/- gastrointestinal signs.</td>
<td><em>A. cantonensis</em> causes severe progressive neurologic disease in nonhuman primates, often resulting in death or euthanasia.</td>
<td>Primary supportive care for both. Treatment with anthelmintics (fenbendazole, milbemycin, topical moxidectin) may shorten clinical course of <em>A. vasorum</em> infections.</td>
<td>Avoidance and removal of intermediate/paratenic hosts. Monthly topical moxidectin has been recommended.</td>
<td><em>A. cantonensis</em> has been reported in humans.</td>
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<td><em>A. vasorum</em> – canids, red pandas, stoats, badgers.</td>
<td><em>A. vasorum</em> – cough, dyspnea, exercise intolerance, hemorrhage, anorexia, weight loss, occasional CNS signs.</td>
<td><em>A. vasorum</em> can be asymptomatic to fatal in canids. It appears fatal in red pandas. Recovery for both is dependent of severity of presenting signs.</td>
<td><em>A. vasorum</em> can be asymptomatic to fatal in canids. It appears fatal in red pandas. Recovery for both is dependent of severity of presenting signs.</td>
<td>Anthelmintics are contraindicated in <em>A. cantonensis</em> infections.</td>
<td>Monthly prophylactic anthelmintics have been used in red pandas.</td>
<td><em>A. cantonensis</em> has been reported in humans.</td>
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**Fact Sheet compiled by:** Kristina M. Delaski  
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**Susceptible animal groups:**
- *A. cantonensis* – Rats are the definitive hosts. aberrant hosts include several species of non-human primates, Australian marsupials (wallaby, bettong), Tawny frogmouths, horses, and dogs.
- *A. vasorum* – Dogs and red foxes are the definitive hosts. Other canids (coyote, wolf, jackal), European otter, ferrets, badgers and red pandas have also been infected, and red pandas have been reported to shed infective larvae.

**Causative organism:** *Angiostrongylus cantonensis*–neurologic disease; *A. vasorum*–cardiopulmonary disease

**Zoonotic potential:** *A. cantonensis* has been extensively studied in humans, and is considered a zoonotic disease. Transmission is through ingestion of an intermediate or paratenic host, usually raw or undercooked seafood in endemic areas.

**Distribution:** *A. cantonensis* is endemic in the Pacific Islands and Southeast Asia, but has spread to the Americas, including the US, the Caribbean islands and Brazil. *A. vasorum* is endemic to Europe, Africa and South America. It has recently been documented in Newfoundland, Canada.
**ANGIOSTRONGYLUS**

**Incubation period:** *A. cantonensis* larvae can be seen in the CNS hours to days following ingestion, although typical incubation is 2-3 weeks in humans. The prepatent period for *A. vasorum* ranges from 28 to 108 days.

**Clinical signs:**
- *A. cantonensis* – Due to migration of the L3 larvae in central nervous tissue and subsequent eosinophilic inflammation, infection can result in a variety of neurologic signs. Most common signs include ascending bilateral paresis and muscle wasting, urinary bladder paresis, hyperesthesia, and occasional gastrointestinal signs. Seizures, cranial nerve palsies, and coma have also been reported. In humans, ocular *larva migrans* can occur.
- *A. vasorum* – Signs can vary, and may be absent early in infection or with low parasite burdens. Interstitial pneumonia and hemorrhage is most common, leading to fibrosis. This results in tussis, dyspnea, exercise intolerance, anorexia and weight loss. Vascular lesions associated with adult worms can lead to pulmonary hypertension and congestive heart failure. Coagulopathy of unknown etiology has been documented, and can be the presenting clinical sign. This results in anemia, melena, subcutaneous hematomas, and other sequelae depending on location of hemorrhage. Central nervous system signs are often related to intracranial hemorrhage, but can also be the result of aberrant larval migration. Signs vary depending on location of lesions. Red pandas were reported with cough, dyspnea and exercise intolerance, although apparent asymptomatic infections can occur.

**Post mortem, gross, or histologic findings:**
- *A. cantonensis* – Cerebral and cerebellar meningitis, with varying degrees of malacia. Nematodes are often found near the cerebral blood vessels or free in the white matter of the central nervous system with mild to moderate inflammation. Similar lesions may occur in the spinal cord. Hemorrhage in the central canal of the spinal cord has been reported.
- *A. vasorum* – Adult worms present in the lumen of the pulmonary artery and right ventricle. They can be differentiated from *Dirofilaria immitis* by the small size of *A. vasorum*. Interstitial pneumonia with hemorrhage, granulomas around eggs/larvae, and fibrosis. Adult worms cause thromboarteritis and intimal proliferation in affected vessels. Cases with coagulopathy may have intracranial, intrathoracic, or intra-abdominal hemorrhage. Due to larval migration, L1 larvae may be found in a large variety of tissues at necropsy. The presence of undifferentiated eggs and larvae is characteristic. Necropsies of infected red pandas have found mineralized fibrous tissue in the lungs, with nodules centered on nematode eggs and coiled larvae. Granulomas around larvae have also been reported in pulmonary lymph nodes.

**Diagnosis:**
- *A. cantonensis* – Definitive diagnosis is difficult. Fecal analysis is of no value, as the infection is only patent in rats. Hematology shows eosinophilia, and CSF often shows an eosinophilic pleocytosis. Occasionally, larvae may be seen in CSF samples. High field MRI has been able to detect cavitations caused by larval migration in humans, but has yet to be useful in canine cases. ELISA tests on serum were not very sensitive, but those performed on CSF were reported as promising. PCR testing is under development. Neither ELISA nor PCR testing is available commercially.
- *A. vasorum* – Definitive diagnosis is by detection of L1 larvae in feces through Baerman examinations or bronchoalveolar samples. The larvae have a characteristic tail morphology (kinked tail and dorsal spine). Radiographs may show an alveolar pattern, but are often non-specific. Possible hematologic changes include anemia and eosinophilia. Decreased serum fructosamine has been reported in infected dogs. Antigen ELISA and PCR testing are currently under development.

**Material required for laboratory analysis:**
- *A. cantonensis* – CSF for cytology. ELISA tests for serum were not very sensitive, but those for CSF
were reported as promising. ELISA is not available commercially.

- *A. vasorum* – Fecal samples, collected over 3 consecutive days, for Baermann examination. ELISA and quantitative PCR tests have been in development for use on serum (both) or fecal material (PCR), and a canine patient-side antigen test for serum is available through the UK branch of IDEXX.

**Relevant diagnostic laboratories:** As no serologic or PCR testing is available commercially, no reference laboratories are available at this time. IDEXX has developed a rapid, patient-side antigen test for serum, available in the UK. It has not been used in any non-domestic species. More information is available here: http://www.idexx.co.uk/html/en_gb/smallanimal/inhouse/snap/angio-detect.html

**Treatment:** Supportive care for both. Treatment with anthelmintics (fenbendazole, milbemycin, topical moxidectin) may shorten clinical course of *A. vasorum* infections by reducing the parasite burden. Caution is urged, as rapid die-off of adult worms may cause severe secondary reactions (ascites, dyspnea) in the patient. All treated animals are monitored with multiple post-treatment fecal Baermann exams. Anthelmintics are contraindicated in *A. cantonensis* infections, due to risk of increased damage sustained due to inflammatory reactions in the central nervous system. Supportive care for *A. cantonensis* consists of fluid support, analgesics and sedatives, and glucocorticoids if necessary.

**Prevention and control:** Prevention is centered on restricting access to intermediate and paratenic hosts. *A. cantonensis* is carried by rats, so pest control is an important component of prevention. Both nematodes can infect a wide range of gastropod intermediate hosts, which can then in turn infect paratenic hosts when frogs, lizards, or shellfish consume the gastropods. Collection animals should have limited access to these sources of infection. Monthly topical moxidectin has been recommended for prevention of *A. vasorum* in dogs. Monthly doses of milbemycin have been used as prophylaxis in red pandas in endemic areas, but as no trial studies have been conducted, these reports are anecdotal.

**Suggested disinfectant for housing facilities:** 1% bleach, 1-5% glutaraldehyde and cresol-based products are effective disinfectants.

**Notification:** None

**Measures required under the Animal Disease Surveillance Plan:** N/A

**Measures required for introducing animals to infected animal:** As neither nematode is transmitted directly, no special measures are necessary, as long as the enclosure has been cleared of intermediate hosts.

**Conditions for restoring disease-free status after an outbreak:** Adult *A. vasorum* worms can live in vasculature for up to five years, and ova shedding can be intermittent. Repeated negative fecal exams would likely indicate lack of infection.

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**References:**