Bacterial and Parasitic Diseases of Ferrets

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KEYWORDS

• *Mustela putorius furo* • Bacterial • *Heliobacter mustela*
• Parasitic • Heartworm Disease
• Mycobacteriosis • Ferrets

The domestic ferret, *Mustela putorius furo*, is a popular companion animal and is used in biomedical research. As a member of the family *Mustelidae*, it is closely related to mink, weasels, and otters. The European polecat (*M putorius*), the North American black-footed ferret (*M nigripes*), and the Russian polecat (*M eversmanni*) are among its closest free-ranging relatives.[1,2] When compared with other companion mammals, primary bacterial and parasitic infections are less common in domestic ferrets.[3] In countries such as the United States, pet ferrets are generally kept indoors, and the risk for exposure to primary bacterial and parasitic infectious agents is low. Companion, breeding, and working ferrets are commonly kept outdoors in other parts of the world, placing them at comparatively greater risk for exposure to infectious diseases.

HELICOBACTER MUSTELAE

Helicobacter mustelae is a small, microaerophilic, gram-negative, slightly curved, urease-positive bacterial rod with four to eight sheathed flagella.[4–6] An excellent review of *H mustelae* infection in ferrets has recently been published.[7] Clinical disease caused by *H mustelae* is one of the more common bacterial diseases seen in the domestic ferret.[8] It is believed that close to 100% of domestic ferrets are infected.[6,7,9–11] Ferrets are believed to be infected at or shortly after weaning.[5] Transmission is likely fecal to oral and may be made easier through hypochlorhydria, which can be induced by oral administration of omeprazole.[5,7] An increased gastric pH may allow the bacteria to pass into the intestines and be shed into the feces.[7] *H mustelae* colonizes the gastric antrum and pyloric portion of the duodenum and can cause ulcerative gastritis and duodenitis.[6,8] Because *H mustelae* is antigenically related to *Helicobacter pylori*, the domestic ferret is used as a research model for human gastritis caused by *H pylori*.[6,8]

Ferrets infected with *H mustelae* may be at increased risk for gastric neoplasia. Gastric adenocarcinoma and mucosa-associated lymphoma tissue have been

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Vet Clin Exot Anim 12 (2009) 531–561
doi:10.1016/j.cvex.2009.06.001 **vetexotic.theclinics.com**
1094-9194/09/$ – see front matter

observed in infected ferrets, but a direct causal relationship between infection and neoplasia has not been fully established.[5–9,12–14] Colonized ferrets produce antibodies to gastric parietal cells.[15] Persistent gastritis, lymphoproliferation, and focal glandular atrophy of the proximal antrum are seen in infected animals.[5,16] Uncolonized stomachs are devoid of lymphoid follicles.[5,7] Hepatobiliary inflammation and hepatic hemangiosarcoma were seen in ferrets that were infected with *H mustelae*.[13] Lesions included chronic cholangiohepatitis with proliferative changes ranging from hyperplasia to carcinoma. Further investigation is needed to fully elucidate the role of *H mustelae* in cases of hepatitis or hepatic neoplasia.[7,13]

Clinical Signs

Clinical disease is not altogether common, but may occur more frequently in stressed ferrets or those that have concurrent illness.[5,6,8,10] Clinical signs are related to the presence of ulcerative gastritis and duodenitis, and include lethargy, anorexia, ptyalism, abdominal pain, rapid weight loss, nausea, dehydration, anemia, and melena (**Fig. 1**).[5,6,8]

Diagnosis

A tentative diagnosis can be made based on history, physical examination, and diagnostic testing to exclude similar diseases.[6,8] Fecal occult blood testing to evaluate for gastric bleeding can be performed (Hemoccult; Beckman Coulter, Fullerton, California) after dietary exclusion of heme. A convalescent care diet (Carnivore Care; Oxbow Pet Products, Murdock, Nebraska) has been evaluated and found to be free of heme.[10] Samples of gastric mucosa can be collected by endoscopy or laparotomy. Exploratory surgery can also be useful to evaluate for other causes of clinical disease, such as gastric foreign bodies.[6] Biopsy samples can be evaluated for inflammation with routine hematoxylin-eosin stain, and for the presence of *Helicobacter* sp using Warthin-Starry 4.0, silver, and immunohistologic stains.[5–8] Samples can also be tested using commercially available polymerase chain reaction (PCR) assays.[7,10] Appropriate samples for PCR testing include gastric biopsies and gastric or fecal swabs.[7,10] Feces and gastric biopsy samples can also be submitted for microbiologic culture.[5,7] Culture methods are not routinely used in the diagnosis of helicobacteriosis in ferrets because *H mustelae* requires selective media for growth.[5,6,10] Because nearly all ferrets are likely colonized,

Fig. 1. Melena adhered to the tail and perineum of a ferret that has helicobacteriosis.