Selected Emerging Diseases in Ferrets

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KEYWORDS

• Ferrets • Cryptococcosis • Hypothyroidism • Influenza • Pure red cell aplasia

KEY POINTS

- Cryptococcosis has been described in 17 ferrets worldwide, with 12 of these cases being reported since 2002, and has only recently been reported in the United States and Europe.
- Influenza is both a zoonotic and anthroponotic disease; therefore, recognition of influenza infection in ferrets by veterinarians can aid in increased surveillance in humans, as was seen in the 2009 pandemic H1N1.
- Although treatment of hypothyroidism in ferrets is simple and similar to that for dogs and cats, the clinical signs are ambiguous and include obesity, lethargy, decreased activity, excessive sleeping, and in some ferrets hind-end weakness.
- Pure red cell aplasia (PRCA) is a nonregenerative anemia that should be considered when presented with an anemic ferret. Prompt and aggressive therapy with long-term immunosuppressive medications and blood transfusions as needed are vital in the successful treatment of this condition.

Several emerging diseases have been recently reviewed, with little to no new information arising since the publication of these comprehensive reviews. The reader is encouraged to seek the following resources for additional information on those emerging conditions in previous editions of *Veterinary Clinics of North America—Exotic Animal Practice*:

- Disseminated idiopathic myofasciitis:
  Ramsell KD, Garner MM. Disseminated idiopathic myofasciitis in ferrets. Vet Clin North Am Exot Anim Pract 2010;13(3):561–75.
- Mycobacteriosis:
  Pollock C. Mycobacterial infection in the ferret. Vet Clin North Am Exot Anim Pract 2012;15(1):121–9.

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- Systemic coronavirus:
  Murray J, Kiupel M, Maes RK. Ferret coronavirus-associated diseases. Vet Clin North Am Exot Anim Pract 2010;13(3):543–60.

CRYPTOCOCCOSIS

Etiology and Epidemiology

Cryptococcus spp are capsulated, dimorphic, basidiomycetous fungi that are found in soil, air, and trees.[1] Although there are 39 recognized species, only a few species are found to cause disease in humans and animals.[2] The most medically relevant species are *Cryptococcus neoformans* and *Cryptococcus gattii*. *C neoformans* is split into 2 distinct variants: var. *neoformans* (previously called serotype D) and var. *grubii* (previously called serotype A).[3] This species is classically identified as causing meningitis and meningoencephalitis in immunosuppressed people, has a worldwide distribution, and is found in pigeon droppings.[1] *C gattii* (previously called *Cryptococcus neoformans* var. *gattii*) is also synonymously called *Cryptococcus bacillisporus* in some texts. It is endemic in tropical and subtropical climates, although it is being found in more areas, and is an emerging pathogen in immunocompetent humans in North America.[2,4] Additional species that can cause disease in immunosuppressed humans include *Cryptococcus albidus* and *Cryptococcus laurentii*, but to date these species have not been documented to cause disease in ferrets.

This fungus has a special life cycle that involves a yeast form and a filamentous form. The most medically relevant form is the basiospore, which is the infectious form in mammals. The natural route of infection is via inhalation of the basiospores or actual yeast cells. In the host, the yeast appears as round-ovoid structures with a polysaccharide capsule.[1] This thick capsule helps prevent desiccation[1] and, in the correct environment, allows the organism to stay viable for up to 2 years.[2] In addition, this capsule in *C neoformans* also functions as its major virulence factor because it helps to evade the host's immune system.[2,5] Because entry is via inhalation, the nasal cavity and lungs can be infected first, followed by hematogenous spread to the central nervous system (CNS).[2]

Cryptococcosis in ferrets

Since it was first reported in the literature in the United Kingdom in 1954,[6] there have been 16 reported cases of cryptococcosis in ferrets. Before 2000 there had been 4 reported cases: 1 in the United Kingdom, 1 in Australia, and 2 in North America. Since 2000 there have been several cases in Australia, 3 in North America, and 1 in Spain.

As with cryptococcosis in humans, cats, and dogs,[2,5,7] the 2 most common species reported in ferrets is *C neoformans* and *C gattii* (**Table 1**). Of the 13 cases that reported the infectious species, 6 ferrets were infected with *C neoformans*[6–11] and 6 were infected with *C gatti*.[7,12–14] In the 3 cases that the variant was listed for *C neoformans*, it was always var. *grubii*.[7,10,11] The infectious species was not explicitly listed in 2 ferrets[15]; they were included in a report of a 2003 outbreak of *Cryptococcus* in Canada, where other animals and humans were infected with both *C neoformans* and *C gattii* (see **Table 1**).

Age and sex

Of the 16 reported cases of cryptococcosis, the sex was reported in 14 cases. There were more cases reported in male ferrets: 12 males[6,7,9–14,16] and only 2 females.[7,16] In addition, there are more cases reported in spayed/castrated ferrets[7,10–14,16] than in intact ferrets.[6–8] The ages of these ferrets were reported in 13 cases and ranged from 17 months to 6 years.[6–11,13,14,16]