Enteric Coccidiosis in Ferrets: An Unexpected Course

Between 2005 and 2009, there were 3 outbreaks of *Eimeria furonis* in ferret populations, with high morbidity and mortality rates. The current study describes the analysis of samples and relevant information from each outbreak.

The 3 outbreaks occurred in large, densely populated ferret shelters in Detroit, Michigan, and western and eastern Pennsylvania. Overall, at least half of the animals in the 3 shelters showed clinical signs, and approximately 25% of affected animals died. In each case, the animals demonstrated similar clinical signs: acute foul-smelling diarrhea (sometimes with melena or frank blood), dehydration, lethargy, and weight loss. Coccidial oocysts were found in the pooled feces of 1 group, but this was sporadic and inconsistent. Oocysts were not found in the samples from the other 2 groups.

Morphologic examination and DNA sequence analysis later identified the organism as *E. furonis*. Examination of infected animals at necropsy revealed erosion of the mucosal epithelium, blunting of the intestinal villi, and hemorrhage into the intestinal mucosa. Supportive care and treatment with sulfadimethoxine were palliative during these outbreaks, but long-term treatment was required and did not completely eradicate infection.

**Commentary**
These 3 outbreaks represent a departure from the expected course of enteric coccidiosis in ferrets. Typically, *Eimeria* infection is asymptomatic in otherwise healthy ferrets. Although no evidence of other pathogens was observed in the tissues examined, it is possible that the animals in these outbreaks were coinfected with a second enteric pathogen, perhaps one with a shorter time course of infection. Regardless, it is clear that *E. furonis* was at least a major contributor to the intestinal disease seen in these cases and should be considered in the differential diagnosis of diarrhea in ferrets.—Carly Jordan, PhD

**Source**

Predicting Recovery from Spinal Cord Injury

Matrix metalloproteinases, including metalloprotease-9 (MMP-9), are associated with injury and disease states in the CNS. They are implicated in secondary injury through disruption of the blood–brain/ blood–spinal cord barrier and promotion of inflammation, oxidative stress, and demyelination. As such, they may be useful biomarkers for the severity of spinal cord degeneration following compressive injury.

A study to determine the relationship between MMP-9 levels in the CSF and the severity of clinical presentation was conducted using 34 dogs with clinical signs and MRI evidence of thoracolumbar intervertebral disk herniation (IVDH). All dogs were nonambulatory at admission; 13 lacked deep noiception. CSF was collected on all dogs and MMP-9 activity levels were measured via gelatin zymography.

All dogs subsequently underwent hemilaminectomy. Results showed MMP-9 activity in the CSF of 6 dogs. Outcome was considered successful if the dog was not urinary incontinent and could ambulate without support. Of the 6 dogs that were MMP-9 positive, 4 were classified as grade V (ie, paraplegic, urinary incontinent, and lacking deep pain perception). These dogs were nonambulatory 6 months after treatment. The remaining 2 dogs had grade III and IV injuries and showed good recovery. The authors concluded that the presence of MMP-9, along with severe (grade V) clinical signs, appears to indicate severe spinal injury with poor prognosis in dogs.

**Commentary**
Lack of nociception following IVDH is the most common negative prognostic indicator used in clinical neurology. Patients with intact nociception have a 90% to 95% chance for recovery following surgery. This decreases to 50% if patients lack nociception and surgery is performed within 24 to 48 hours of loss of nociception (if performed later, this changes to 10%). In this study, all 4 dogs that lacked nociception and had detectable MMP-9 expression failed to recover. However, 2 of 6 dogs with detectable MMP-9 expression presented with nociception and both recovered. This makes use of MMP-9 expression to accurately predict recovery less certain. Additional large-scale studies with quantitative analysis of MMP-9 levels or other biomarkers are needed before being used to successfully predict prognosis. From a practical standpoint, a rapid, accurate on-site test would be needed because decisions on whether to perform surgery in patients that lack nociception must be made quickly.—Mark Troxel, DVM, DACVIM (Neurology)

**Source**