Diagnostic Exercise: Sudden Behavior Change in a Cat

H. B. Gelberg

Abstract
A 5-year-old, spayed female, domestic short-haired cat had a 10-day history of sudden behavioral changes followed by seizures. Blood parameters were in the reference ranges, and radiographs failed to detect a mass lesion in the brain. Euthanasia was followed by rabies testing, which was negative. Gross lesions were absent. Histologic changes were present only in the brain and consisted of foci of hippocampal pyramidal cell loss, mild gliosis, pallor of the associated neuropil, and neovascularization.

Keywords
encephalopathy, feline, hippocampus

History, Clinical Findings, Gross Findings, and Laboratory Results
A 5-year-old, spayed female, domestic short-haired cat developed sudden behavioral changes, including aggression followed by seizures. Over a 10-day period, the seizures became more frequent, occurring at approximately 30-minute intervals. A complete blood count, blood chemistry analyses including T4, and plain radiographs of the head failed to help identify a cause for the neurologic signs. The cat was unresponsive to antiseizure medication and was euthanized and necropsied. There were no significant gross lesions detected at necropsy. A fluorescent antibody test on frozen brainstem, hippocampus, and cerebellum was negative for rabies virus antigen. Formalin-fixed, hematoxylin and eosin–stained, 5-μm-thick sections were prepared of all major organs using standard methodology.

Differential Diagnoses
Behavioral changes and/or seizure activity in cats may be caused by neoplasia, hydrocephalus, liver failure, renal failure, thyroid disease, rabies, feline infectious peritonitis, toxoplasmosis, migrating parasites, thiamine deficiency, hypoglycemia, hypertension, amyloid angiopathy, coagulopathies, anoxia, water intoxication, vascular accidents/malformations, diabetes mellitus, trauma, lysosomal storage diseases, heavy metal toxicity, and ischemia with infarction. Many cases are idiopathic.

Microscopic Findings
Histologic lesions were limited to the central nervous system. Multiple sections of brain, including cerebrum, thalamus, cerebellum, and brainstem, were examined. Lesions were present only in the hippocampus overlying the pyriform lobe. They consisted of several sharply delineated, linear foci of pyramidal cell loss accompanied by a modest number of glial cells, a few pigment-laden phagocytes, and moderate neovascularization within a mildly rarified stroma (Figs. 1, 2). Histochemical staining with Prussian blue indicated that some of the phagocytes contained iron.

Diagnosis
Subacute multifocal hippocampal necrosis

Discussion
Feline hippocampal necrosis is a well-recognized but poorly understood entity and may result from several different pathologic processes. Felids of all breeds, ages, and sexes are at risk. Cats may live indoors and/or outdoors. Varying reports call this condition hippocampal necrosis or complex partial cluster seizures with orofacial involvement. Onset in all cases is sudden, and the lesions are generally asymmetrical and nonprogressive. However, in some cases, the lesions are bilaterally symmetric and believed to be associated with an excitotoxin.

The pathogenesis of neural necrosis is most likely multifactorial and includes sequelae of vasospasms of the (middle)

1 Department of Biomedical Sciences and the Veterinary Diagnostic Laboratory, College of Veterinary Medicine, Oregon State University, Corvallis, OR, USA

Corresponding Author:
H. Gelberg, Department of Biomedical Sciences and the Veterinary Diagnostic Laboratory, College of Veterinary Medicine, 233 Magruder Hall, Oregon State University, Corvallis, OR 97331, USA.
Email: howard.gelberg@oregonstate.edu
cerebral arteries with resultant ischemia and neural infarction. The arterial supply to the feline brain is unique in that the circle of Willis is supplied by anastomoses with the maxillary and pharyngeal arteries that arise from the external carotid artery. It is not a closed ring and lacks a rostral communicating artery, and blood flow is away from the arterial circle so that the external carotid artery distributes to the entire brain except for the caudal brainstem.

Hippocampal necrosis may result from a variety of insults ranging from anesthetic accidents to toxins. Oxyhemoglobin release, secondary to hemorrhage, has also been shown to cause vasospasm. Conversely, it has been suggested that hippocampal necrosis is a result of seizure activity and not the cause. In the current case, the sharp demarcation of the hippocampal lesions without ongoing neuronal degeneration along with phagocytized iron is consistent with an ischemic episode. Like stroke in humans, variable degrees of functional recovery may occur depending on the location and degree of the damage. It appears worthwhile for veterinary pathologists to carefully examine the hippocampus in cases of unexplained seizures in cats.

Acknowledgements
The author thanks Kay Fischer and the personnel of the histopathology section of the Veterinary Diagnostic Laboratory for their excellent technical assistance.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) received no financial support for the research, authorship, and/or publication of this article.

References