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What Is Your Neurologic Diagnosis?

An 11-month-old 4.05-kg (8.91-lb) castrated male Bengal cat was evaluated because of weight loss, generalized muscle atrophy, and tetraparesis. One month prior, the cat was limping on the left pelvic limb; within 1 week, the gait abnormality had progressed to both pelvic limbs. During the same period, the cat was reported to have decreases in appetite, water consumption, and overall activity level. Urination and defecation were considered normal, although the cat required assistance to posture in the litter box. Physical examination revealed a plantigrade stance and decreased muscle mass, most prominent in the pelvic limbs. Remaining physical examination findings were normal. The cat could ambulate weakly, but would fatigue with exercise. Results of a CBC, serum biochemical analysis, and survey vertebral column radiography were considered normal.

Neurologic examination

Observation

Mental	Alert	X	Depressed		Disoriented		Stupor		Coma		
Posture	Normal		Head tilt		Tremor		Falling				
Gait	Normal		Ataxia		Pelvic limbs		All 4		Circling		
Paresis	Pelvic limbs		Tetra	X	Hemi		Mono				
Other											

Key: 4 = Exaggerated, clonus; 3 = Exaggerated; 2 = Normal; 1 = Diminished; 0 = None; NE = Not evaluated.

Postural reactions

	LF	RF	LR	RR
Wheelbarrow	1	1		
Hopping	1	1	0	0
Ext postural thrust			0	0
Proprioceptive pos	2	2	0	0
Hemistand/walk	NE	NE	NE	NE
Placing–tactile	2	2		
Placing–visual	2	2		

Spinal reflexes

	LF	RF	LR	RR
Quadriceps			1	1
Extensor carpi	1	1		
Flexion	0	0	0	0
Crossed extensor	0	0	0	0
Perineal			2	2

Cranial nerves

	L	R
II,VII–Vision menace	1	1
II, III–Pupils resting	2	2
Stim L	2	2
Stim R	2	2
II–Fundus	2	2
III, IV,VI–Strabismus, resting	2	2
III, IV,VI, VIII–Strabismus, position	2	2

	L	R
VIII–Nystagmus, resting	2	2
VIII–Nystagmus, change	2	2
V–Sensation	2	2
VII–Facial mm	2	2
V, VII–Palpebral flex	1	1
IX, X–Gag	2	2
XII–Tongue	2	2

Comments CN

The palpebral reflexes fatigued with repeated stimulation

Sensation (Locate and describe abnormal)

Hyperesthesia	2	
Superficial pain	2	
Cutaneous reflex	0	Unable to elicit bilaterally
Deep pain	2	

What is the problem? Where is the lesion? What are the most probable causes of this problem? What is your plan to establish a diagnosis? Please turn the page.

Assessment

Anatomic diagnosis

Problem	Rule out location
Tetraparesis	Brain, C1-C5 or C6-T2 segments of the spinal cord, multiple locations in the spinal cord, or peripheral nervous system
Decreased to absent spinal reflexes in all 4 limbs (lower motor neuron problem)	Peripheral nervous system or multiple locations in the spinal cord (C6-T2 and L4-S2 segments)
Fatigable palpebral reflex bilaterally	Cranial nerve V (CNS or peripheral nervous system lesion) or cranial nerve VII (CNS or peripheral nervous system lesion)
Incomplete menace response bilaterally	Cranial nerve II (CNS lesion) or cranial nerve VII (CNS or peripheral nervous system lesion), forebrain, or cerebellum

Likely location of 1 lesion

Lower motor neuron signs for all 4 limbs, tetraparesis, and plantigrade stance made disease of the peripheral nervous system most likely. Less likely were multifocal spinal or brain disease because no ataxia (just weakness) was observed and mentation appeared normal. The palpebral reflexes and the menace responses were incomplete, likely secondary to skeletal muscle weakness or peripheral cranial nerve involvement.

Etiologic diagnosis—On the basis of the physical and neurologic examination findings, a disease of the peripheral nervous system was considered most likely. Differential diagnoses included storage disease (glycogen or lysosomal), genetic or familial polyneuropathy, electrolyte disturbances, endocrine disease (eg, diabetes mellitus), neoplasia (lymphoma or paraneoplastic neuropathy or myopathy), infectious or inflammatory disease of the peripheral nervous system (infection with *Toxoplasma gondii*, FeLV, or FIV), multifocal infectious or inflammatory disease of the CNS (infection with *Toxoplasma gondii*, *Cryptococcus neoformans*, FeLV, FIV, *Rickettsia rickettsii*, or *Ehrlichia* spp), primary muscle disease (infectious or noninfectious), or toxin (organophosphate or ionophore toxicosis).

Initial diagnostic recommendations for the cat included assessment of serum titer of antibody against *T gondii*, antigen testing for cryptococcosis, evaluation of serum creatine kinase activity, an electrolyte panel, and testing for circulating FeLV antigen and anti–FIV antibody. Additional diagnostic testing included collection and analysis of a CSF sample, electrodiagnostic testing (electromyography and assessment of motor nerve conduction velocity [MNCV]), and histologic examination of biopsy specimens of peripheral muscles and peripheral nerves. A CNS disease was considered less likely, given the examination findings overall; thus, MRI of the cervical and lumbar intumescences was not considered at this time.

Diagnostic test findings—Serum creatine kinase activity was within the reference interval (554 U/L; reference interval, 45 to 695 U/L). The electrolyte panel included assessments of concentrations of sodium, potassium, chloride, and carbon dioxide and the anion gap; all values were within their respective reference intervals. Results of testing for serum anti–*T gondii* antibody, *Cryptococcus neoformans* antigen, FeLV antigen, and anti–FIV antibody were negative. Evaluation of a CSF sample did not reveal any abnormalities.

The cat underwent inhalational anesthesia, and electrodiagnostic testing was performed. Electromyography revealed spontaneous activity (positive sharp wave and fibrillation potentials) in the carpal extensor and flexor, biceps brachii, triceps brachii, cranial tibial, gastrocnemius, quadriceps femoris, and semitendinosus muscles. This spontaneous activity was suggestive of denervation of muscle fibers. The MNCV of the left peroneal nerve was assessed. Conduction velocities measured along 3 regions (hip to stifle, stifle to tarsus, and hip to tarsus) of the peroneal branch of the sciatic nerve were 117, 45, and 63 m/s, respectively. Mean ± SD nerve conduction velocity of the peroneal nerve in clinically normal cats is 120 ± 24.4 m/s.[1] Assessment of the MCNV of the left ulnar nerve was attempted but could not be attained either because of user error or conduction block. The MNCV results indicated that nerve conduction of the proximal (hip-to-stifle) segment of the peroneal branch of the sciatic nerve was normal, whereas nerve conduction of the segment of the nerve located distal to the stifle region was slowed. The slowed MNCV was indicative of disease affecting either the myelin sheaths alone or the myelin sheaths combined with the axons. All recorded compound motor action potentials amplitudes were low; all were 0.4 mV. In clinically normal cats, mean ± SD amplitudes for the peroneal nerve range from 29 ± 6.2 mV to 30 ± 6.6 mV.[1] The decreased amplitudes represented disease affecting the axons. The cat had no evidence of polyphasia as observed on the compound motor action potential recorded during the MNCV testing; this finding made a primary myelin sheath disease less likely. Thus, on consideration of all diagnostic test results, a diagnosis of a disease affecting the distal portion of the peripheral nerves was made.

Biopsy specimens were collected by an open procedure from the triceps brachii, cranial tibial, and vastus lateralis muscles and the peroneal nerve. Biopsy specimens were either unfixed and chilled or immersion fixed in neutral-buffered 10% formalin prior to shipping by an overnight service under refrigeration to the Comparative Neuromuscular Laboratory, University of California-San Diego. Variability in myofiber size was evident in all muscle specimens with atrophic fibers that had an anguloid shape. Intramuscular nerve branches had patchy depletion of myelin and mild mononuclear cell infiltration. Examination of the peroneal nerve biopsy specimen revealed variable changes between nerve fascicles wherein some fascicles had subjectively normal nerve fiber density and other fascicles had nerve fibers widely separated by endoneurial edema. Neither axonal degeneration nor demyelination was found in the peroneal nerve. The histopathologic findings for the muscle and nerve biopsy specimens were consistent with a predominantly distal polyneuropathy.

Comments

Diseases affecting the peripheral nervous system in young cats are relatively uncommon.[2,3] The cat of the present report had polyneuropathy affecting the distal portion of the peripheral nerves. As a general rule, diseases that cause denervation of the distal nerve segments are more common and thought to be related to the fact that nutrients flow from the nerve cell body to the distal aspects of the nerve, making them more easily impacted by disease.[4]

To date, several breed and familial polyneuropathies in cats have been described, including type IV glycogen storage disease in Norwegian Forest Cats,[5] peripheral and central axonopathy in Birmans,[6] alphamannosidosis leading to myelin abnormalities in Persians[7] and in a family of domestic longhair cats,[8] and axonal degeneration in 2 related Snowshoe cats.[9] In 2011, Bensfield et al[2] first described Bengal cat polyneuropathy. Bengal cats with this disease are relatively young; the mean ± SD age of onset was 10.6 ± 7.9 months in that study.[2] The clinical signs at the time of evaluation of those cats included variable weakness of the pelvic and thoracic limbs, weight loss, muscle atrophy, and stunted growth. Apart from neurologic dysfunction and decreased muscle mass, the cats were otherwise clinically normal as determined by physical examination. Electrophysiology testing revealed spontaneous electromyographic activity and slowed MNCV in most cats. Histologically, peripheral muscle biopsy specimens had angular-to-anguloid atrophy of muscle fibers and loss of myelinated fibers in intramuscular nerve branches; in some but not all peripheral nerve biopsy specimens, there was evidence of demyelination and remyelination.[2]

Treatment of reported Bengal cat polyneuropathy cases has varied. Treatments have included administration of a glucocorticoid, antimicrobials, NSAIDs, or no treatment.[2] No standard treatment of affected cats has been accepted to date. Regardless of treatment, the median time to onset of recovery is 1.5 weeks, with a range of 2 days to 52 weeks.[2] Of the 33 affected cats for which outcome data were reported by Bensfield et al,[2] 17 (51%) made a complete recovery and 12 (36%) made a partial recovery with some residual weakness. Nearly 50% of the 33 affected cats for which follow-up information was available had at least 1 relapse of clinical signs.

For the cat of the present report, treatment with prednisolone (0.5 mg/kg [0.23 mg/lb]), orally, every 24 hours was started following diagnosis. After 7 days, that cat's weakness was reportedly much improved. Because no direct studies of treatment efficacy have been performed to date, an attending clinician may choose to prescribe an anti-inflammatory dosage of prednisolone, as described for the cat of the present report. A reasonable goal of treatment is to eventually taper the corticosteroid dosage and monitor for relapse of the condition. Whether long-term or lifelong glucocorticoid administration is indicated for affected cats is not known. The cat of the present report tolerated the medication well. The cat's weakness did increase as the medication dosage was initially tapered. The cat was continued with slow tapering of the prednisone dosage every 4 to 6 weeks; 9 months after diagnosis, that cat was receiving 0.3 mg of prednisolone/kg (0.14 mg/lb) orally every other day. The owner reported that the cat was doing very well and appeared to be back to normal with only intermittent tiring with extreme activity. Prognosis for young Bengal cats with this specific polyneuropathy is good, as most cats historically have gone on to recover either partial or full neurologic function.[2] Polyneuropathy of Bengal cats should be considered as a cause of lower motor neuron tetraparesis in a young Bengal cat.

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This feature is published in coordination with the American College of Veterinary Internal Medicine on behalf of the specialty of neurology. Contributors to this feature should contact Dr. Helen L. Simons (800-248-2862, ext 6692) for case submission forms. Submissions will be sent to Dr. Karen Kline, DVM, DACVIM, for her review, except when Dr. Kline is an author.

New Veterinary Biologic Products

Product name	Species and indications for use	Route of administration	Remarks
Canine Osteosarcoma Vaccine, Live Listeria Vector (Antelope Valley Bios, Inc, Lincoln, Neb, US Vet Lic No. 419)	For use in the postsurgical treatment of dogs with canine osteosarcoma. Efficacy was demonstrated in dogs that were diagnosed with canine osteosarcoma that had previously undergone surgical removal of the appendicular tumor followed by chemotherapeutic treatment with carboplatin. The dogs then received a 3-dose IV series of treatments with the canine osteosarcoma vaccine. An increase in median survival time compared to historical standards was seen in the treated dogs.	IV	USDA licensed 12/19/17