

CATS ARE NOT SMALL DOGS! FELINE NEUROLOGY IN A NUTSHELL

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Overview and Objectives

As most of us were taught were taught early in veterinary school, cats are not small dogs; this is as true for neurologic patients as it is in other veterinary fields. This talk will review how cats are unique in terms of the diseases that affect their nervous systems with a focus on practical aspects of the neurologic examination, generation of a differential diagnosis, diagnostic evaluation and therapeutic interventions.

Presentation and Neurologic Examination

Veterinarians generally see fewer purebred cats than dogs and therefore breed-specific feline diseases are often less familiar to us. However, it is important to realize that certain signalments may be quite informative in arriving at a final diagnosis. For example, paraparesis and urinary and/or fecal incontinence in a Manx cat should alert the clinician to the possibility of a spinal cord anomaly (e.g., meningomyelocele). Progressive neurologic dysfunction in a young (< 1 year-old), purebred cat may increase the suspicion for a neurodegenerative disorder (e.g., storage disorder), although these are rare diseases.

Although cats are certainly highly variable in their receptiveness to examination, in general cats will tolerate fewer of the examination procedures routinely used in dogs. As a result, observation of a patient's gait and behavior, which is important in dogs, becomes even more crucial in cats. Such observation is important to assess the cat's mentation and interaction with its environment, as well as to look for evidence of gait abnormalities such as ataxia, paresis or lameness. Most of the cranial nerve testing performed in dogs can be completed in cats. However, postural reaction testing is more challenging. Some cats will allow assessment of proprioceptive placing ("conscious proprioception") although many will simply lift up their feet when touched or resent handling of their feet. Similarly, hopping can be performed in many cats, although a cat will often drop to their side or roll after a few hops. Wheelbarrowing and extensor postural thrust are usually reliable and can be used to detect discrepancies in one side versus the other. Segmental spinal reflexes can be assessed in most cats, and the most reliable are the patellar and withdrawal reflexes. In dogs the cutaneous trunci reflex is best elicited using a pair of mosquito hemostats to pinch the skin but this seldom works in cats (other than to really irritate them!). A better technique is to pull on/pluck the hair over the back to produce the desired twitch of the cutaneous trunci muscle. Finally, palpation of the spine to detect discomfort can be accomplished in some cats although many normal cats will resent this test, particularly over the thoracolumbar region.

The principles of localization of neurologic lesions remain the same in cats as in dogs and other species. One point to note is that the spinal cord terminates further caudally in the cat than in the dog, usually extending down to L7 or even to the sacrum in some individuals.

Differential Diagnoses by Presenting Signs

Seizures

The list of differential diagnoses for seizures is relatively similar in the cat when compared to dogs with one large exception; the prevalence of genetic (“idiopathic”) epilepsy appears to be very low in this species. Therefore, any cat with seizures would ideally receive a complete diagnostic workup including brain imaging and potentially cerebrospinal fluid (CSF) analysis. The main differentials for cats with seizures are metabolic disorders and inflammatory conditions (i.e., meningoencephalitis) although neoplastic, anomalous, traumatic and vascular etiologies must also be considered. Cats with hepatic encephalopathy can have intermittent seizures without other associated neurologic signs, a scenario that is very uncommon in dogs; these cats often have a striking, copper colored iris. Despite the concern for underlying metabolic or structural diseases, some cats with seizures do not have an identifiable cause, and are best classified as unknown (cryptogenic) epileptics.

Altered Mentation

Mentation changes usually indicate forebrain dysfunction, although a primary brainstem lesion is possible. Differential diagnoses to consider include metabolic disease (e.g., hypoglycemia, electrolyte disorders, hepatic encephalopathy), meningoencephalitis, neoplastic disease, cerebrovascular disease, trauma and toxins. Meningiomas are the most common primary brain tumor in older cats and typically lead to altered mentation as the primary clinical sign, often without seizures or other obvious neurologic signs.

Vestibular Dysfunction

Vestibular dysfunction is common in cats and can be caused by a variety of etiologies. Diseases leading to peripheral vestibular dysfunction (i.e., affecting the vestibular nerve or semicircular canals) include otitis media-interna, inflammatory polyps, neoplastic disease, trauma and toxins (e.g., chlorhexadine, aminoglycosides). An idiopathic peripheral vestibular syndrome has also been described. Central vestibular disease (i.e., brainstem lesion) can arise from inflammatory, neoplastic or vascular etiologies. Thiamine deficiency is rarely seen with the well-supplemented diets currently fed to most cats, but can cause brainstem dysfunction including vestibular signs.

Cerebellar Dysfunction

A classic lesion is cerebellar hypoplasia secondary to *in utero* infection with feline panleukopenia virus. This disorder manifests itself from the time of birth as profound ataxia, intention tremors and dysmetria without obvious paresis. Other causes of cerebellar

dysfunction include meningoencephalitis, cerebrovascular accidents, neoplastic disease and neurodegenerative disorders.

Ataxia, Tetraparesis & Paraparesis (Spinal Cord Dysfunction)

Spinal cord lesions are relatively less common in cats when compared with dogs. The main reason for this discrepancy is the paucity of intervertebral disk disease (IVDD) in feline patients. When it occurs, IVDD typically presents as a chronic paresis in cats and acute disk extrusions are quite rare. Important differentials for cats with spinal cord lesions include meningomyelitis, neoplastic disease and less commonly vascular accidents involving the spinal cord. Of course, thromboembolic events affecting the vasculature of the limbs (e.g., distal aorta or “saddle” thrombus) must be kept in mind and appropriately ruled out.

Spinal Pain

Spinal pain is harder to appreciate in cats than in dogs as their signs are often nonspecific and include behaviors such as avoiding contact with owners or other pets, inappetence and lethargy or general malaise. Disorders that can cause cervical or thoracolumbar pain in cats include meningomyelitis, diskospondylitis, intervertebral disk disease, trauma and neoplastic disease involving the vertebrae, spinal nerve roots or meninges.

Neuromuscular Disease

As in dogs, neuromuscular disorders are uncommonly diagnosed, but are underappreciated. These disorders encompass peripheral neuropathies, neuromuscular junction disorders and myopathies. One classic presentation is pelvic limb paresis characterized by a plantigrade stance, which is highly suggestive (but not pathognomonic) of poorly controlled diabetes mellitus. Most neuropathies present as chronic paraparesis or tetraparesis and may be first recognized by a reluctance of the cat to jump or vigorously play. There is typically no ataxia and segmental spinal reflexes may or may not be appreciably depressed. Differential diagnosis includes metabolic disorders, paraneoplastic polyneuropathy, infectious disease (e.g., Toxoplasmosis) and immune-mediated polyneuropathy. Acute onset of severe, progressive (ascending) tetraparesis can be seen with several disorders including acute polyradiculoneuritis (“Coonhound paralysis”), tick paralysis and coral snake envenomation. Myasthenia gravis can also occur in cats and causes weakness that typically worsens with activity. In cats this disorder is frequently associated with a cranial mediastinal mass (typically a thymoma) and has also been associated with methimazole therapy for hyperthyroidism.

Diagnostic Considerations

A complete blood count, serum biochemistry and urinalysis are often the first tests to consider in cats with neurologic disorders. These tests can help to identify metabolic disorders, certain infectious diseases and occasionally neoplastic conditions and are also useful as a preanesthetic workup if advanced diagnostic testing is pursued. Bloodwork also serves as an important initial baseline in animals receiving anticonvulsant therapy (particularly phenobarbital). Radiographs of the spine are an important diagnostic test for cats presenting

with signs of spinal cord disease or spinal pain, and may show lytic or occasionally proliferative changes in patients with neoplastic or infectious conditions (e.g., diskospondylitis) affecting the vertebrae. Imaging of the thoracic and abdominal cavities (radiographs and/or ultrasonography) can be useful to further define systemic diseases or to detect metastases or primary neoplasms. Additional tests available to the general practitioner include specific metabolic tests (e.g., T4, serum bile acids, fructosamine), infectious disease tests (e.g., *Toxoplasma gondii* titers, coronavirus [FIP] assays), coagulation testing, blood pressure evaluation and assays for specific toxins (e.g., ethylene glycol, THC, lead).

Despite the utility of the tests discussed above, advanced diagnostic testing is frequently required in order to arrive at a diagnosis in cats with neurologic dysfunction, and such testing often requires referral to a specialty hospital. As in other species, the main neurodiagnostic testing modalities are imaging, CSF analysis and electrodiagnostic testing. Magnetic resonance imaging (MRI) is almost always the preferred imaging test to evaluate the brain, spinal cord and associated structures, although computed tomography (CT) also has some utility. Myelography can identify spinal cord compression, and can be used in conjunction with CT. Cerebrospinal fluid analysis is primarily used to document inflammatory CNS conditions, although there are nonspecific changes seen with compressive diseases and on rare occasions neoplastic cells can be identified (e.g., lymphoma). Electrodiagnostic tests include electromyography (EMG), assessment of nerve conduction velocity and repetitive nerve stimulation and are primarily used to investigate neuromuscular diseases although electroencephalography (EEG) is occasionally helpful in defining seizure disorders. Finally, biopsy of muscle and/or nerve tissue for histopathological analysis can be very helpful in documenting peripheral neuropathies or myopathic disease.

Therapeutic Considerations

When considering traditional anticonvulsant medications, phenobarbital is the most frequently used medication, is relatively well tolerated and is effective in controlling seizures in most cats. Although an effective anticonvulsant, bromide causes inflammatory lung disease in a large proportion of cats and is not recommended for feline patients. Oral diazepam can also be effective as a maintenance anticonvulsant in cats but is not recommended due to a rare but devastating adverse effect (idiosyncratic hepatic necrosis). Several newer generation anticonvulsants can be utilized for seizure control in cats including levetiracetam, pregabalin, gabapentin and zonisamide.

If infection of the CNS is a potential concern, the antibiotics chosen would ideally achieve high concentrations within the CNS as well as show efficacy against documented or suspected organisms. Sulfa medications (trimethoprim-sulfa and related drugs) are a good option, as they have good CNS penetration, a broad spectrum of activity and activity against protozoal organisms (e.g., *Toxoplasma gondii*). Clindamycin can also be used effectively although it has relatively poor CNS penetration. Doxycycline is another good choice with a broad antibacterial spectrum as well as activity against rickettsial organisms. When treating infections involving bony structures (e.g., diskospondylitis or otitis media-interna) antibiotic therapy should be continued for at least 2 weeks past the clinical resolution of signs and for a minimum of 8 weeks.

Glucocorticoid therapy is helpful to control inflammation in patients with inflammatory CNS disease or to reduce peritumoral edema in patients with brain or spinal cord tumors. Nonsteroidal anti-inflammatory drugs (NSAIDs) can be effective in some cats to control pain associated with vertebral or nerve root lesions; NSAIDs and glucocorticoids should never be used together in these patients. Gabapentin or pregabalin can be quite helpful as adjunctive analgesic therapy for cats with painful conditions.

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