CLINICAL DECISION MAKING IN NEUROLOGY – PETER EARLY

The Neurological Examination

The goals of the neurological examination are to detect the presence of a neurologic disease and to determine the location of the lesion within the nervous system. The neurologic examination should be performed in a systematic manner in order to assure that the animal's neurologic status is completely evaluated. The parts of a customary neurologic examination include evaluation of the head (mentation and cranial nerves), gait, limbs (postural reactions and spinal reflexes) and pain/nociception (normal and abnormal pain responses).

Gait Evaluation

I find gait evaluation the most useful and important part of the neurologic exam. Clinical evaluation of gait usually involves observation of the animal's movements while walking. This is best accomplished by having a handler walk the animal over a flat, non-slippery area. I typically evaluate gait by having a handler walk the animal approximately 100 feet, away and back, as well as circling clockwise and counterclockwise. I have the animal short on the leash and under good control and have the dog typically walk slowly. I may have them walk on and off the curb. Overall, evaluation is made by watching for paresis, ataxia, stride length, lameness, stiffness, spasticity, dysmetria and shuffling or scuffing of limbs or digits. I also note position of head and tail during gait evaluation.

Gait analysis is broken down between the axial and appendicular skeleton. The axial vertebral column is made up of many joints and is divided into anatomical segments. The axial portion includes the head, neck, thoracic, lumbar, lumbar/pelvic and tail. When I evaluate the appendicular skeleton, the categories are more generalized by thoracic limbs and pelvic limbs. They may be subdivided into smaller segments by each joint of the legs: shoulder, elbow, carpus in the thoracic limb and hip, stifle, tarsus in the pelvic limbs. Locomotion as a whole is a result of the individual movements of these segments. Gait analysis is used to assess the movement of each of the individual joints and how they affect locomotion.

Ataxia, in one word, can be described as incoordination. Ataxia can result from a variety of anatomic lesions within the nervous system, most commonly of the spinal cord sensory pathways, cerebellum and vestibular system. Sensory ataxia is due to loss of proprioception, sense of relative position of limbs(s). Clinical signs associated with cerebellar ataxia may include intension tremors or hypermetria. Vestibular ataxia involves disequilibrium. Clinical signs may include head tilt, nystagmus, strabismus, falling and nausea.

Paresis, in one word, can be defined as weakness. Varying degrees of paresis can occur with some animals retaining the ability to walk (ambulatory) while others are unable to support their own weight or stand (non-ambulatory). Paresis may be observed as gait as dragging of the toes or feet, scuffing or scuffling. Abnormal toenail wear may suggest underlying paresis. Mono-, para-, hemi or tetraparesis may be used to describe limb(s) involved.

Refractory Epilepsy and Anti-Epileptic Drug (AED) Therapy

Veterinarians generally diagnose idiopathic epilepsy (IE) based primarily upon signalment and history. Since there is no diagnostic test for IE, the arrival at a diagnosis is done by excluding other disorders that may have caused the seizures. The minimum database for any animal presenting for evaluation of seizures should consist of: CBC, serum chemistry profile, urinalysis, pre/post bile acid levels. Most dogs with IE will begin their seizure histories between 1 and 5 years of age. Be aware that you will encounter dogs with IE that are younger and older epilepsy, so the 6 months to 6 years should only be used as a guideline. Excluding pre-ictal and post-ictal behavior, dogs with IE are normal between seizures. A subset of dogs appear to have behavioral disorders. These dogs are typically described by their owners as being anxious, but this perceived behavioral abnormality is constant rather than episodic.

Seizures are one of the most common neurological problems facing canine companion animal patients. The term epilepsy is used for seizures that are recurrent. Various etiologies exist, and among those, idiopathic and genetic epilepsy are most common. Refractory epileptics are generally defined as patients on two or more anticonvulsant therapies and experiencing breakthrough seizures, of variable frequency. Roughly 30% of all (presumed) genetic and idiopathic epileptics are considered refractory, which is also a common finding in human medicine. Refractory epileptics are commonly given anywhere from two to five different pharmaceutical agents daily, with additional agents and doses administered during cluster (repetitive) events.

Phenobarbital is the most frequently used antiepileptic and is well suited for seizure control in dogs and cats. Initial oral dosing is 2-3mg/kg twice a day. The half-life in dogs is about 2 days and time to steady state is 10-14 days. Therapeutic serum concentrations are typically between 15-30µg/ml, with a recommended maximum of 35µg/ml because of an increased risk of hepatotoxicity at higher concentrations. Phenobarbital induces hepatic enzyme activity, which can result in increased blood levels of these enzymes and increased metabolism of many drugs, including itself. Common side effects of phenobarbital include polyuria and polydipsia, polyphagia, hepatotoxicity, bone marrow dyscrasias and sedation.

Potassium bromide is not metabolized and is excreted unchanged by the kidneys. Daily maintenance dose is 40-50mg/kg as monotherapy or 30-40mg/kg in combination with other AEDs. The half-life in dogs is typically 25 days and time to steady state levels is 3-4 months. Typically, a loading dose is given to accelerate the time to steady state. Standard loading is achieved with 100-120mg/kg/day for 5 days, or for an extremely quick load, 500-600mg/kg can be given divided over one day. Once-daily administration is effective, although the dose may be divided to reduce gastric irritation and given with small amount of wet food or bread. Common side effects include polyuria, polydipsea and polyphagia, and hind limb weakness and sedative.

Zonisamide represents a viable first choice or add-on therapy for dogs with primary epilepsy. Canine studies have shown that 5mg/kg twice a day is an appropriate starting dose. For animals on phenobarbital a starting dose of 7-10mg/kg twice a day may be needed. Reference blood levels have been taken from the human literature and are 10-40ug/ml. I typically measure blood levels when seizures are poorly controlled and the dose is at the higher end of the dosing range ($\geq$10mg/kg BID). Zonisamide is metabolized by the liver and has a reasonably long half-life of 15 hours. Side effects in dogs include ataxia, lethargy and vomiting. There have been three case reports of an idiosyncratic hepatotoxicity that resolved with discontinuation of the drug.

Levetiracetam is another viable first choice or add-on therapy. It is primarily excreted renally with little to no hepatic metabolism, making it an ideal choice for any animal with compromise of hepatic function. The half-life in dogs is about 3 hours and dosing typically starts at or above 20mg/kg three times a day. Plasma reference ranges are 10-45ug/ml. Higher doses may be necessary for dogs on phenobarbital. The only side effect typically reported is sedation. Levetiracetam is also available in an intravenous form making it a functional complement to phenobarbital and benzodiazepines in managing patients with status epilepticus or cluster seizures. In patients with cluster seizures I may administer pulse therapy with two initial doses of 40-60mg/kg followed by subsequent doses of 25-40mg/kg every 6-8 hours over the next 48 to 72 hours. Levetiracetam has also been used in cats with similar half-life and dosing. Side effects noted in cats included lethargy and inappetance. Dogs and cats should be evaluated every 12 months with a physical and neurological examination, plasma AED levels, and minimum database.

Cervical Spondylomyelopathy (CSM)

CSM encompasses a number of cervical abnormalities. These include, but are not limited to, vertebral malarticulation, malformation, disc protrusion, articular facet hypertrophy, spondylolisthesis and ligamentous hypertrophy. CSM is a multi-factorial disease with generally three types of CSM being diagnosed clinically. One is exemplified by middle-aged to older Doberman Pinschers and is characterized by ventral compressive lesions of the caudal cervical area from IVDD type II (annular protrusion) and ligamentous hypertrophy, these are commonly refered to as Disc Associated Wobblers Syndrome (DAWS). Young, giant breed dogs such as the Great Danes, Mastiffs and Bernese Mountain Dogs, have a differing pathophysiology. In these instances, disease of the dorsal articular facets, lamina and pedicles abnormalities may be predisposes to hypertrophy of the associated joint capsule and ligaments, resulting in predominantly dorsal and lateral spinal cord compression. Another variation of CSM may be similar to the DAWS the older large breed dog that presents with true cervical spinal canal stenosis. Diagnostics should include survey radiographs, CT scan/myelogram or MRI with dynamic and traction views and potentially, CSF analysis. Conservative therapy includes exercise restriction, analgesics, rehabilitation therapy and NSAID or corticosteroids with a fair to good outcome for minimally affected patients and for short-term control of clinical signs.

There are many successful surgical techniques described for treating cervical spinal lesions with the decision in individual cases dependent upon the location and type of pathology and surgeon preference. The goal of surgery is most often to decompress the spinal cord and nerve roots, but stabilization may be indicated in some cases. Surgical procedures may be broadly categorized as decompression (dorsal laminectomy and ventral slot) and/or distraction/fusion techniques. Each approach has advantages and disadvantages and surgical decisions are made on a case by case basis.