

# PERIPHERAL NEUROPATHIES (POLYNEUROPATHIES)

## (DISORDERS OF THE PERIPHERAL NERVES)

### BASICS

#### OVERVIEW

- “Neuropathy” is the medical term for any disorder affecting the nervous system; “peripheral neuropathy” is a general term for disorders affecting the peripheral nerves; the “peripheral nerves” are the nerves outside of the central nervous system (that is, outside of the brain and spinal cord)—these nerves extend to the head, body, and legs; “polyneuropathy” is a disease or disorder that involves several peripheral nerves
- “Peripheral neuropathies” are diseases or disorders that affect many peripheral motor, sensory, autonomic, and/or cranial nerves, in any combination; “motor nerves” control muscles; “sensory nerves” carry impulses to the central nervous system, so the animal is “aware” of a particular sensation, such as taste or feeling touch or pain; the “autonomic nerves” are involved in the control of muscles in the heart, blood vessels, gastrointestinal tract, and other organs; the “cranial nerves” are nerves that originate in the brain and go to various structures of the head (such as the eye, face, and tongue)
- “Axonopathy” is a disorder affecting the axons of peripheral nerves; the “axon” is the part of the nerve that carries impulses away from the nerve cell body and toward other nerves or toward muscles

#### GENETICS

- Most inherited as autosomal recessive disorders
- Disorder characterized by loss of nerve cell bodies in the brain stem and spinal cord (known as “spinal muscular atrophy”) in Brittanys—autosomal dominant disorder

#### SIGNALMENT/DESCRIPTION of ANIMAL

##### **Species**

- Dogs and cats

##### **Breed Predispositions**

##### **Inherited Disorders**

*Spinal Muscular Atrophy (disorder characterized by loss of nerve cell bodies in the brain stem and spinal cord [spinal muscular atrophy])*

- Brittanys, Swedish Lapland dogs, English pointers, German shepherds, rottweilers
- Progressive neuronopathy—cairn terriers

*Disorders Affecting the Axons of Peripheral Nerves (Known as “Axonopathies”)*

- Giant axonal neuropathy—German shepherd dogs
- Progressive axonopathy—boxers, Leonbergers
- Presence of large amounts of oxalic acid or oxalates in the urine (known as “primary hyperoxaluria”)—domestic shorthairs (cat breed)
- Paralysis of the voice box or larynx (known as “laryngeal paralysis”)—polyneuropathy complex—Dalmatians, rottweilers and Great Pyrenees (Pyrenean Mountain dogs)
- Distal polyneuropathy—Birman (cat breed)
- Distal sensorimotor polyneuropathy—rottweilers, Alaskan malamutes

*Demyelination (disorder characterized by loss of the white material [known as “myelin”] that covers certain nerve fibers)*

- Hypertrophic neuropathy—Tibetan mastiffs

*Lysosomal Storage Diseases (inherited metabolic diseases in which harmful levels of materials accumulate in the body’s cells and tissues)*

- Globoid cell leukodystrophy—West Highland white terriers, cairn terriers, domestic shorthair kittens
- a-L-fucosidosis—English springer spaniels
- G<sub>M1</sub> gangliosidosis type II—Siamese and mixed-breed cats
- Sphingomyelinosis—Siamese (cat breed)
- Ceroid lipofuscinosis—English setters, Chihuahuas, and Siamese

*Sensory Neuropathy (disorder involving sensory nerves)*

- Long-haired dachshunds, English pointers, German shorthaired pointers, English springer spaniels, French spaniels and border collies

##### **Acquired (condition that develops sometime later in life/after birth) Disorders**

- Coonhound paralysis—because of their use, coonhounds have a higher incidence than other breeds
- Clinical diabetic polyneuropathy—more common in cats than dogs
- Tumor of the pancreas involving the cells that secrete insulin (known as an “insulinoma”)—German shepherd dogs, boxers, Irish setters, standard poodles, and collies

##### **Mean Age and Range**

##### **Inherited Disorders**

- Usually begin at less than 6 months of age
- High levels of chylomicrons (lipid droplets containing cholesterol esters and triglycerides) in the blood (known as “hyperchylomicronemia”) in cats—usually over 8 months of age
- Presence of large amounts of oxalic acid or oxalates in the urine (known as “primary hyperoxaluria”) in cats—5 to 9 months of age
- Rottweiler distal polyneuropathy—over 1 year of age
- Giant axonal neuropathy in German shepherd dogs—14 to 16 months
- Intermediate and long-term (chronic) forms of spinal muscular atrophy in heterozygote Brittanys—6 to 12 months of age

#### **Acquired (condition that develops sometime later in life/after birth) Disorders**

- Secondary to cancer and pancreatic tumors secreting insulin (insulinoma)-associated low blood glucose (known as “hypoglycemia”)—tend to occur in middle-aged and old animals
- *Neospora* inflammation of several nerve roots and nerves (known as “*Neospora* polyradiculoneuritis”)—most commonly seen in dogs less than 6 months of age; highest incidence, 2 to 4 months of age

### **SIGNS/OBSERVED CHANGES in the ANIMAL**

#### **Inherited Disorders**

- Most—slow, progressive; generalized weakness, muscle tremors, loss of muscle mass (known as “muscle atrophy”), often with an abnormal stance and gait
- Sensory neuropathies—may see self-mutilation or a wobbly, incoordinated or “drunken” appearing gait or movement (known as “ataxia”)
- Lysosomal storage diseases (inherited metabolic diseases in which harmful levels of materials accumulate in the body’s cells and tissues)—evidence of slowly progressive central nervous system involvement is common; head tremors, wobbly, incoordinated or “drunken” appearing gait or movement (ataxia), seizures, blindness, dementia, and depression
- Giant axonal neuropathy of German shepherd dogs—rapidly progressive (less than 3 weeks) generalized weakness

#### **Acquired (condition that develops sometime later in life/after birth) Disorders**

- Rapid or slow progression
- Rapidly progressive course—an initial stiff, stilted gait, leading to progressive generalized weakness or partial paralysis (known as “paresis”) or paralysis (coonhound paralysis, distal denervating disease)
- Slowly progressive course—generalized weakness and loss of muscle mass (muscle atrophy); in the distal polyneuropathies (diabetic cat), an abnormal stance
- Abnormal function of the autonomic nervous system (known as “dysautonomia”)—primarily a sudden (acute) onset (less than 48 hours) of depression, lack of appetite (known as “anorexia”), constipation, third eyelid protrusion, vomiting, and lack of control of urination (known as “urinary incontinence”)
- May see weakness of all four legs (known as “tetraparesis”) to paralysis of all four legs (known as “tetraplegia”); may see decreased reflexes (known as “hyporeflexia”) to lack of reflexes (known as “areflexia”); may see decreased muscle tone (known as “hypotonia”) to lack of muscle tone (known as “atonia”); loss of muscle mass (muscle atrophy); muscle tremors are common
- May see proprioceptive abnormalities, in which the normal subconscious awareness of the location of the limbs and movement is altered
- May have a change in voice (known as “dysphonia”) or loss of voice (known as “aphonia”)
- Other signs determined by underlying cause of the nerve disorder

### **CAUSES**

#### **Acquired (condition that develops sometime later in life/after birth) Disorders**

- Immune-mediated disease—primary or secondary; may be seen with systemic lupus erythematosus or other immune-mediated diseases (such as polymyositis, glomerulonephritis, polyarthritis, and pemphigus)
- Metabolic disease—diabetes mellitus (sugar diabetes) in cats; decreased levels of thyroid hormone (known as “hypothyroidism”); and insulinoma; may be associated with various cancers (such as carcinomas, malignant melanoma, mast cell tumor, osteosarcoma, multiple myeloma, or lymphoma)
- Infectious disease—*Neospora caninum*; feline leukemia virus (FeLV)-related disease
- Chemotherapeutic drugs—vincristine; vinblastine; cisplatin; colchicine
- Poisons—thallium; organophosphates; carbon tetrachloride; lindane
- Unknown cause (so called “idiopathic” disease)

### **RISK FACTORS**

- Development of associated specific diseases (metabolic, immune-mediated, cancer) or exposure to associated specific drugs/poisons or causal factors (such as raccoon saliva)

## **TREATMENT**

### **HEALTH CARE**

- Inherited disease—most are untreatable

- Acquired (condition that develops sometime later in life/after birth) disease—principal goal usually is to treat the primary cause, if identified, with the hope that the secondary polyneuropathy will improve or resolve after appropriate therapy; not always successful
- Usually outpatient
- Inpatient—observe sudden (acute) disease of several nerve roots and nerves (polyradiculoneuropathies) closely for breathing failure in the early progressive phase of disease
- Physical therapy—excellent ancillary treatment
- Systemic lupus erythematosus-related disease—treat as for long-term (chronic) progressive or relapsing polyneuropathy
- Abnormal function of the autonomic nervous system (dysautonomia)—may require intensive intravenous fluid therapy and/or feeding

#### **ACTIVITY**

- No restrictions, if able to walk (known as being “ambulatory”)

#### **DIET**

- Generally no special management, unless the animal has an enlarged esophagus (the tube running from the throat to the stomach; condition known as “megaesophagus”) or difficulty swallowing (known as “dysphagia”)
- High levels of chylomicrons (lipid droplets containing cholesterol esters and triglycerides) in the blood (known as “hyperchylomicronemia”)—low-fat diet alone can resolve the polyneuropathy within 2 to 3 months
- Inability to move (paralysis)—make sure the pet can reach food and water
- Regurgitation (passive, backward movement or return of food or other contents from the esophagus) and/or vomiting (forceful ejection of stomach contents up through the esophagus and mouth), such as in cases with abnormal function of the autonomic nervous system (dysautonomia)—temporarily halt intake of food and/or water
- Diabetes mellitus (“sugar diabetes”)—important to carefully monitor food intake

#### **SURGERY**

- If the nervous system disorder is secondary to a tumor or cancer, treat the primary tumor via surgery, chemotherapy, or radiation

### **MEDICATIONS**

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Long-term (chronic) progressive or relapsing disease—most likely immune-mediated; may improve with long-term steroid treatment, designed to decrease the immune response (known as “immunosuppressive steroid therapy”), prednisone may be administered at doses to decrease the immune response; chemotherapeutic drugs may be used to decrease the immune response, examples include azathioprine or cyclophosphamide; response of individual patient is variable
- Cancer—steroids administered to decrease the immune response (immunosuppressive steroid therapy) may improve the polyneuropathy, without specific action against the primary tumor
- *Neospora*-associated inflammation of several nerve roots and nerves (polyradiculoneuritis)—best treated with clindamycin; effectiveness is questionable
- Abnormal function of the autonomic nervous system (dysautonomia)—treat symptomatically with intravenous fluid therapy, artificial tears, metoclopramide, bethanechol, and physostigmine eye drops

### **FOLLOW-UP CARE**

#### **PATIENT MONITORING**

- Repeat nervous system examinations

#### **PREVENTIONS AND AVOIDANCE**

- Avoid breeding animals with inherited or *Neospora*-associated (placental transfer of the organism from the bitch) diseases
- Avoid contact with raccoons for dogs with a previous history of coonhound paralysis

#### **POSSIBLE COMPLICATIONS**

- Inherited disease—continued nervous system deterioration, eventually leading to inability to walk (ambulate) successfully
- Sudden (acute) or long-term (chronic) progressive disease—severe loss of muscle mass (muscle atrophy) and resultant pressure sores; urinary tract infection; scarring and contraction of muscles; aspiration pneumonia

#### **EXPECTED COURSE AND PROGNOSIS**

- Conditions in which only myelin (a white material that covers certain nerve fibers) is lost (known as “demyelinating disease”) have a more rapid course of improvement than those involving actual loss of function of the axons (known as “axonal degeneration”)—the majority of cases, which can take months for partial or complete recovery, if at all

- Inherited disease—most have a poor to hopeless prognosis for any recovery of peripheral nerve function (except for cats with high levels of chylomicrons [lipid droplets containing cholesterol esters and triglycerides] in the blood [hyperchylomicronemia])
- Sudden (acute) inflammation of several nerve roots and nerves (polyradiculoneuritis orcoonhound paralysis)—good long-term prognosis; may take weeks to months to recover ability to walk (ambulation)
- Metabolic disease—fair to good prognosis with successful treatment of the primary metabolic abnormality; tumors of the pancreas involving the cells that secrete insulin (insulinomas) have a high recurrence rate
- Other acquired (condition that develops sometime later in life/after birth) diseases—most show continued deterioration despite treatment; guarded to poor prognosis; sometimes progression is slow and insidious over many months or years

## KEY POINTS

- Treatment of the primary cause may not lead to reversal of the peripheral nerve signs, and, in some cases, deterioration will continue
- Many polyneuropathies are of unknown cause (so called “idiopathic disease”)

