

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 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 pet 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; may be due to destruction of the nerve cell bodies or axons, or demyelination; 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 Brittany spaniels—autosomal dominant disorder
- Laryngeal paralysis in Bouvier des Flandres—autosomal dominant

SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs

- Cats

Breed Predilections

Inherited Disorders

- Spinal muscular atrophy (disorder characterized by loss of nerve cell bodies in the brain stem and spinal cord [spinal muscular atrophy])
 - ♦ Brittany spaniels, Swedish Lapland dogs, English pointers, German shepherds, Doberman pinschers, rottweilers, Griffon Briquet, Saluki, Maine coon cats
 - ♦ Progressive neuronopathy—cairn terriers
- Disorders affecting the axons of peripheral nerves (known as “axonopathies”)
 - ♦ Giant axonal neuropathy—German shepherd dogs
 - ♦ Progressive axonopathy—boxers
 - ♦ Laryngeal paralysis—Bouvier des Flandres
 - ♦ Progressive central and peripheral sensorimotor axonopathy—golden retriever
 - ♦ Axonal neuropathy—snowshoe cat
 - ♦ Paralysis of the voice box or larynx (known as “laryngeal paralysis”)—polyneuropathy complex—Dalmatians, Rottweilers, and Great Pyrenees (Pyrenean Mountains dogs)
 - ♦ Central-peripheral distal axonopathy—Birman (cat breed)
 - ♦ Distal sensorimotor polyneuropathy—Rottweilers, Alaskan malamutes, Great Dane, Leonburger and Bouvier des Flandres
- Demyelination (disorder characterized by loss of the white material [known as “myelin”] that covers certain nerve fibers)
 - ♦ Recurrent demyelinating re-myelinating neuropathy—Bengal cat
 - ♦ Congenital hypomyelination neuropathy—golden retrievers
 - ♦ Demyelinating polyneuropathy—miniature
 - ♦ 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 cats
 - ♦ Alpha-L-fucosidosis—English springer spaniels
 - ♦ Mannosidosis—Persian and domestic shorthair cats
 - ♦ GM1 gangliosidosis type II—Siamese and Korat cats
 - ♦ Sphingomyelinosis—Siamese and Balinese
 - ♦ Glycogenesis type IV—Norwegian forest cat
- Sensory neuropathy (disorder involving sensory nerves)
 - ♦ Ganglioradiculitis—Siberian Husky
 - ♦ Longhaired dachshunds, English pointers, German shorthaired pointers, English springer spaniels, French spaniels, Jack Russell terriers, 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 (condition involving many peripheral nerves secondary to diabetes mellitus [“sugar diabetes”])—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—1-8 months of age
- Presence of large amounts of oxalic acid or oxalates in the urine (known as “primary hyperoxaluria”) in cats—5-9 months of age

- Rottweiler, Bouvier, Leonberger distal polyneuropathy—over 1 year of age
- Giant axonal neuropathy in German shepherd dogs—14–16 months
- Intermediate and long-term (chronic) forms of spinal muscular atrophy in heterozygote Brittany spaniels—6–12 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”)— middle-aged to older pets
- *Neospora* inflammation of several nerve roots and nerves (known as “*Neospora* polyradiculoneuritis”)—usually dogs less than 6 months of age
- Ganglioradiculitis—over 1 year of age

SIGNS/OBSERVED CHANGES IN THE PET

Inherited Disorders

- Most—slow, progressive; generalized weakness, muscle tremors, loss of muscle mass (known as “muscle atrophy”), often with an abnormal stance and gait, breathing or voice changes if voice box muscle paralysis
- Sensory neuropathies—self-mutilation or a mild to severe 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; nerve function deficiency leading to weakness (lower motor neuron)
- Sphingomyelinosis in cats—often progressive motor and sensory
- 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 (such as in coonhound paralysis, distal denervating disease)
- Slowly progressive course—generalized weakness and loss of muscle mass (muscle atrophy); in distal polyneuropathies (diabetic neuropathy, especially in cats), an abnormal stance (dropped hocks for example)
- 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”), regurgitation (return of food or other contents from the esophagus or stomach back up through the mouth), poor intestine motility (known as “ileus”), dry mouth (known as “xerostomia”), dry eye (known as “keratoconjunctivitis sicca” or KCS), third eyelid protrusion, vomiting, and lack of control of urination (known as “urinary incontinence”)
- Metabolic causes produce generalized weakness
- Paraneoplastic (cancer-associated) signs
- The veterinarian 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; reduced to absent sensation (hypoesthesia to anesthesia)
- Low thyroid hormone may be associated with general neuropathies, specific cranial nerve paralysis, enlarged flabby esophagus (megaesophagus), signs of being dizzy (vestibular signs)
- Hepatosplenomegaly, meaning a commonly enlarged spleen and liver; seen with storage diseases
- Paraneoplastic—may find first signs of cancer on exam
- Dysautonomia—slow heart (bradycardia), dry nose, dry eyes, loss of reflexes (areflexia)
- Hyperoxaluria in cats—enlarged painful kidneys on palpation
- Primary hyperchylomicronemia—cats may have lipid granuloma, a bumpy skin area

- May have a change in voice (known as “dysphonia”) or loss of voice (known as “aphonia”) if cranial nerves are involved
- Other signs determined by underlying cause of the nerve disorder

CAUSES

Inherited Disorders

- 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 Brittany spaniels—autosomal dominant disorder

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 glomerulonephritis, polyarthritis)
- Metabolic disease—diabetes mellitus (sugar diabetes) in cats; decreased levels of thyroid hormone (known as “hypothyroidism”) and Cushing’s disease (overactive adrenal cortisol)
- Cancer/cancer-associated: insulinoma, carcinoma, malignant melanoma, mast cell tumor, osteosarcoma, multiple myeloma, or lymphosarcoma)
- Infectious disease—*Neospora caninum*; feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV)-related
- Chemotherapy drugs—vincristine; vinblastine; cisplatin
- Poisons—thallium; organophosphates; salinomycin (cats), lasalocid (dogs)
- Unknown cause (so-called “idiopathic” disease)

RISK FACTORS

- Genetics
- 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

- Usually outpatient
- Inpatient—observe sudden (acute) disease 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 pet 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 (hyperchylomicronemia)—low-fat diet alone can resolve the polyneuropathy within 2–3 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; consider feeding tube
- Diabetes mellitus (“sugar diabetes”)—important to carefully monitor food intake; in cats, feed a low-

carbohydrate, high-protein diet; diabetic neuropathy often reversible with diet change and medical control of diabetes

SURGERY

- If the nervous system disorder is secondary to a tumor or cancer, may 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

Inherited conditions –most are untreatable

ACQUIRED (CONDITION THAT DEVELOPS SOMETIME LATER IN LIFE/AFTER BIRTH) DISORDERS

- Goal is to treat underlying cause, not always successful
- 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 pet is variable
- Cancer—steroids administered to decrease the immune response (immunosuppressive steroid therapy) may improve the polyneuropathy, without specific action against the primary tumor; chemotherapy for the cancer
- *Neospora*-associated inflammation of several nerve roots and nerves (polyradiculoneuritis)—clindamycin or trimethoprim/sulfonamide combined with pyrimethamine; effectiveness is questionable
- Abnormal function of the autonomic nervous system (dysautonomia)—treat symptomatically with intravenous fluid therapy, artificial tears, metoclopramide, bethanechol, and pilocarpine eye drops

Follow-Up Care

PATIENT MONITORING

- Repeat nervous system examinations

PREVENTIONS AND AVOIDANCE

- Avoid breeding pets with inherited or *Neospora*-associated (placental transfer of the organism from the bitch) diseases
- Avoid contact with raccoons for dogs
- Avoid future vaccinations if sudden (acute) inflammation of several nerve roots and nerves (polyradiculoneuritis) is suspected to be associated with vaccines; discuss the possible association with your pet's veterinarian
- 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

POSSIBLE COMPLICATIONS

- Inherited disease—continued nervous system deterioration, leading to inability to walk (ambulate)
- Sudden (acute) or long-term (chronic) progressive disease—severe loss of muscle mass (muscle atrophy); pressure sores; urinary tract infection; scarring and contraction of muscles; and aspiration pneumonia (inflammation of the lungs, caused by accidentally inhaling food, vomit, or liquids)

EXPECTED COURSE AND PROGNOSIS

- Conditions in which only myelin (a white material that covers certain nerve fibers) is lost (known as

“demyelinating disease”) have more rapid improvement than those with actual loss of function of the axons (known as “axonal degeneration”)— can take months for partial or complete recovery, if at all

- Inherited disease—most have a poor to hopeless prognosis (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
- 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
- Canine axonal degeneration (deterioration of the part of the nerve that carries impulses away from the nerve cell body and toward other nerves or toward muscles)—relentless, progressive deterioration
- Other acquired (condition that develops sometime later in life/after birth) diseases—most show continued deterioration despite treatment; progression may be slow and insidious over 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”)