Saturday 6 April
Hall 4

Neurology

108 08:30–09:15
How to get the most from your neurological examination
Steven De Decker

109 09:25–10:10
Cerebrovascular diseases: do dogs have strokes?
Richard LeCouteur

110 11:05–11:50
Poorly puppies: neurological disease in the young animal
Steven De Decker

111 12:00–12:45
Cervical spondylomyelopathy ('Wobblers'): diagnosis and treatment options
Steven De Decker

112 14:05–14:50
Spinal cord disorders on a budget
Richard LeCouteur

113 15:00–15:45
Cranial nerve disorders: figuring out the floppy faces
Richard LeCouteur

114 16:50–17:35
A logical approach to vestibular disease
Steven De Decker

How to get the most from your neurological examination

Steven De Decker

After performing a neurological examination, you can answer the following questions: Does the animal have a neurological disease? Which part of the nervous system is affected? And sometimes you can determine the prognosis. This Information is crucial for obtaining a reliable list of differential diagnoses.

BASIC COMPONENTS OF THE NEUROLOGICAL EXAMINATION

The neurological examination can be divided in the *hands-off* and *hands-on* examinations. The hands-off examination is of great importance and often reveals key findings. The neurological examination is further divided into seven components.

- Mentation and behaviour: progressively decreasing levels of mentation are obtundation, stupor and coma. Mentation can be decreased in forebrain and brainstem disorders. Examples of abnormal behaviour include circling, compulsive pacing and head pressing. Abnormal behaviour is suggestive of forebrain disease
- Posture and gait: abnormalities in posture include low head carriage, kyphosis, head tilt. Abnormalities in gait include paresis, ataxia and lameness
- Proprioception: proprioceptive deficits are a reliable indicator for the presence of neurological disease. Proprioceptive deficits can occur in forebrain, brainstem and spinal disease
- Cranial nerves: isolated cranial nerve deficits can be associated with specific idiopathic conditions. Certain combinations of cranial nerve deficits can be suggestive for inner ear localizations, while multiple cranial nerve deficits can occur in brainstem or generalized lower motor neuron disorders
- Spinal reflexes: evaluation of spinal reflexes is indicated to recognize lower motor neuron disease, and to evaluate which spinal cord segment is affected in animals with spinal disease
- Spinal palpation: it is important to start with gentle palpation when you suspect the presence of spinal pain
- Nociception: because this part of the examination is unpleasant, evaluation of nociception or 'pain sensation' should only be performed in paraplegic and comatose animals

DETERMINING THE NEUROANATOMICAL LOCALIZATION

The combination of clinical signs and findings of the neurological examination is used to determine the neuroanatomical localization. This will consist of one of the following: forebrain, cerebellum, brainstem, spinal cord and neuromuscular.

- Forebrain: clinical signs include seizures, decreased mentation, abnormal behaviour and central blindness. Additional neurological deficits include decreased menace response, decreased response after stimulation of the nasal mucosa and proprioceptive deficits
- Cerebellum: clinical signs include ataxia without paresis, hypermetria, central vestibular disease and intention tremors. Additional neurological deficits include a decreased menace response
- Brainstem: clinical signs include decreased mentation, generalized ataxia, hemiparesis, tetraparesis and vestibular disease. Additional neurological deficits include proprioceptive deficits and cranial nerve deficits
- Spinal cord: clinical signs include a combination of ataxia and paresis, spinal hyperaesthesia, and bladder dysfunction. Additional neurological deficits include proprioceptive deficits and alterations in spinal reflexes
- Neuromuscular: the hallmark of neuromuscular disease is paresis without ataxia. Other clinical signs include changes in voice and regurgitation. Additional neurological deficits can include decreased spinal reflexes and cranial nerve deficits

KEY LEARNING OBJECTIVES

- Learn the basic components of a practical neurological examination
- Understand how a neuroanatomical localization is obtained by using a combination of clinical signs and neurological examination findings
- Learn how a reliable list of differential diagnoses is constructed

MULTIPLE CHOICE QUESTIONS

1. Which statement is CORRECT about evaluating spinal reflexes?
   - **(A)** Spinal reflexes are evaluated to determine prognosis
   - **(B)** Spinal reflexes are evaluated to determine the neuroanatomical localization
   - **(C)** Spinal reflexes are unaffected in generalized lower motor neuron disease
   - **(D)** Spinal reflexes are decreased in brainstem disease
2. Which statement is TRUE about proprioceptive deficits?
   - **(A)** Proprioception is typically decreased in cerebellar disease
   - **(B)** Proprioception is typically intact in forebrain disease
   - **(C)** Proprioception is typically decreased in spinal disease

(D) Proprioception is typically decreased in animals with neuromuscular disease

3. Which statement is TRUE about forebrain disease?
   (A) Forebrain disease is the only neuroanatomical localization associated with abnormal behaviour
   (B) Forebrain disease is the only neuroanatomical localization associated with decreased mentation
   (C) Forebrain disease is often associated with ataxia
   (D) Forebrain disease does not result in proprioceptive deficits

Cerebrovascular diseases: do dogs have strokes?

Richard LeCouteur

The term 'cerebrovascular disease' is defined as any abnormality of the brain resulting from a pathological process compromising its blood supply. Pathological processes of the blood vessel include occlusion of the lumen by a thrombus or embolus, rupture of a blood vessel wall, lesion or altered permeability of the vessel wall and increased viscosity or other changes in the quality of the blood. A cerebrovascular accident (CVA), also known as stroke, is the most common clinical presentation of cerebrovascular disease, defined as a sudden onset of non-convulsive and non-progressive focal brain signs secondary to cerebrovascular disease.

CAUSES

From a pathological point of view, the lesions affecting the cerebral blood vessels are divided into two broad categories:

- Ischaemic stroke, resulting from occlusion of a cerebral blood vessel by a thrombus or embolism, depriving the brain of oxygen and glucose
- Haemorrhagic stroke, resulting from rupture of a blood vessel wall within the brain parenchyma or subarachnoid space, causing bleeding into or around the brain

CLINICAL SIGNS

In ischaemic or haemorrhagic stroke, it is the abruptness with which the neurological deficits develop that is highly suggestive of the disorder as being vascular. This event is then followed by a plateau and then resolution of the neurological deficit in all except the fatal strokes. Worsening oedema can result in progression of neurological signs for 24–72 hours. Intracranial haemorrhage can be an exception and cause rapid progressive onset over a very short period of time. Clinical signs usually improve after 24–72 hours due to a decrease in size of the haematoma and oedema.

Neurological deficits usually refer to a focal anatomical diagnosis and depend on the neurolocalization of the vascular insult (telencephalon, thalamus, midbrain, pons, medulla, cerebellum).

DIAGNOSIS

Initial evaluation of animals with suspected stroke should focus on the differential diagnosis, including traumatic, metabolic, neoplastic, inflammatory/infectious and toxic encephalopathies. Fundus examination should be considered in all animals and may reveal tortuous vessels (suggestive of systemic hypertension), haemorrhage (suggestive of coagulopathy or systemic hypertension), or papilloedema (suggestive of elevated intracranial pressure (ICP)). Imaging studies of the brain (computed tomography (CT), conventional and functional magnestic resonance imaging (MRI)) are necessary to confirm stroke, define the vascular territory involved, determine the extent of the lesion, and distinguish between ischaemic and haemorrhagic stroke. Imaging studies are also necessary to rule out other causes such as tumour, trauma and encephalitis. Once stroke is confirmed, diagnostic tests focus on identifying an underlying cause.

KEY LEARNING OBJECTIVES

- Understand the causes and pathophysiology of cerebrovascular diseases of dogs
- Recognize the clinical signs of cerebrovascular diseases in dogs
- Discuss diagnostic and treatment options for cerebrovascular diseases in dogs

MULTIPLE CHOICE QUESTIONS

1. Which are reportedly the most common risk factors for the development of brain infarction in dogs?
   (A) Phaeochromocytoma and lymphoma
   (B) Essential hypertension and hypoadrenocorticism
   (C) Chronic renal failure and hyperadrenocorticism
   (D) Hypothyroidism and dilated cardiomyopathy
2. Which drug has been shown to predispose humans to ischaemic or haemorrhagic infarction?

(A) Amlodipine
(B) Phenoxybenzamine
(C) Phenylpropanolamine
(D) Furosemide

3. Which statement regarding the use of CT in diagnosing ischaemic encephalopathies is INCORRECT?
(A) CT is inferior to MRI in detecting ischaemic infarction
(B) CT has demonstrated a sensitivity of 80% in detecting ischaemic infarction within 24 hours after occurrence
(C) Acute haemorrhagic infarction tends to result in hypodense lesions that are difficult to detect
(D) Temporal changes in CT findings following ischaemic infarction are similar to those of MRI but differ based on time from infarct to earliest detection

Poorly puppies: neurological disease in the young animal

Steven De Decker

Evaluating puppies with neurological disease is challenging. They can be considered uncooperative patients and their body systems are still in development. Interpretation of diagnostic tests is complicated by the fact that puppies are skeletally immature, and that the nervous system is still developing. It is easy to understand that congenital anomalies and infectious disorders should be considered important differential diagnoses in puppies with neurological signs. Important factors to take into account are therefore the specific breed, general physical examination findings, health status of littermates, vaccination status and country or region of origin. The following disorders can be considered more common causes of neurological disease in puppies.

HYPOGLYCAEMIA-INDUCED SEIZURES

This is one of the most common causes of seizures in puppies and occurs most often in toy-breed dogs. This cause of seizures should be immediately suspected in every toy-breed puppy with acute onset seizures. Treatment consists of administration of glucose.

HYDROCEPHALUS

This is the most common brain malformation. Although every breed can be affected, it occurs most often in toy and brachycephalic breeds. Affected dogs can have a dome-shaped head. Although little is known about the natural progression of this condition, selected cases can be treated medically. Surgical treatment consists of placement of a ventriculoperitoneal shunt.

THORACIC HEMIVERTEBRA

This condition typically affects 'screw-tailed' brachycephalic dogs. Hemivertebra can be associated with an abnormal dorsal (kyphosis) or lateral (scoliosis) curvature of the spine. Although this condition can cause progressive spinal cord dysfunction, it should most often be considered an incidental finding on diagnostic imaging studies. Up to 94% of neurologically normal French bulldogs have radiographic evidence of hemivertebra. Hemivertebra are more likely associated with clinical signs when they occur in Pugs and when they are associated with severe kyphosis. Recent information suggests a poor response to medical management, while surgical treatment is technically challenging.

SPINAL ARACHNOID DIVERTICULA

This is probably the most clinically important spinal malformation. This condition is characterized by a focal dilatation of the subarachnoid space with progressive accumulation of cerebrospinal fluid. The most common locations are the cranial cervical vertebral column in large-breed and the thoracolumbar vertebral column in small-breed dogs. Pugs, French Bulldogs and Rottweilers are predisposed to this condition. Medical management results in 30% improvement, while surgery results in 80% long-term improvement.

ATLANTO-AXIAL INSTABILITY

This condition most often affects toy-breed dogs and is characterized by a dorsal and cranial displacement of the axis relative to the atlas. It is often associated with abnormalities of the dens and failure of ligamentous support. Excessive cervical flexion in a dog with atlanto-axial instability can have devastating and even fatal consequences. Selected cases can be treated medically, while surgery is technically demanding.

STEROID-RESPONSIVE MENINGITIS AND ARTERITIS

Affected animals have a typical clinical presentation consisting of severe cervical hyperaesthesia, lethargy, pyrexia and a stiff gait. Blood work often demonstrates a leucocytosis and a diagnosis is confirmed by evaluation of cerebrospinal fluid. Although relapses are possible, most dogs respond favourably to a prolonged period of corticosteroids.

KEY LEARNING OBJECTIVES

- Understand why the neurological assessment in puppies is often more complicated than in mature dogs
- Become familiar of the most common neurological disorders that affect puppies
- Learn how common neurological conditions are diagnosed and treated in puppies

MULTIPLE CHOICE QUESTIONS

1. Spinal arachnoid diverticula most often occur in which of the following?
   - **(A)** Labrador Retrievers and Pugs
   - **(B)** French Bulldogs and Labrador Retrievers
   - **(C)** German Shepherd Dogs and Rottweilers
   - **(D)** Pugs and French Bulldogs
2. Which statement is correct about hemivertebra?
   - **(A)** Medical management is associated with a good prognosis
   - **(B)** Hemivertebra are more likely to result in clinical signs when associated with severe kyphosis
   - **(C)** Hemivertebra are more clinically relevant in French Bulldogs compared to Pugs
   - **(D)** Hemivertebra occur rarely in neurologically normal dogs
3. Which statement is correct about atlanto-axial instability?
   - **(A)** Excessive flexion can have devastating and even fatal consequences
   - **(B)** This condition most often affects Rottweilers
   - **(C)** Most affected cases have a normal dens
   - **(D)** This condition is characterized by a caudal and ventral displacement of the axis relative to the atlas

Cervical spondylomyelopathy ('Wobblers'): diagnosis and treatment options

Steven De Decker

Cervical spondylomyelopathy or 'wobbler syndrome' is a complex, multifactorial, incompletely understood and controversial neurological syndrome. It can be considered a collective term for disorders in which cervical vertebral canal stenosis is caused by a combination of soft tissue and bony structures. Two major forms have been recognized: disc-associated (DA-CSM) and osseous-associated cervical spondylomyelopathy (OA-CSM). Clinical signs reflect those of a chronic and progressive cervical myelopathy.

DISC-ASSOCIATED CERVICAL SPONDYLOMYELOPATHY

This condition typically affects older (>7 years old) large-breed dogs with the Dobermann being over-represented in most studies. As the name suggests, caudal cervical spinal cord compression is caused by chronic protrusion of one or multiple intervertebral discs. The intervertebral discs at C6–C7 and C5–C6 are most often affected. In up to 50% of cases, multiple sites of spinal cord compression are observed. Other abnormalities that can be seen are dorsal spinal cord compression caused by ligamentum flavum hypertrophy, and an abnormal position and (mildly) abnormal shape of vertebral bodies. Although the diagnosis can be made by myelography and post-myelography computed tomography, magnetic resonance imaging (MRI) is the imaging modality of choice. A high prevalence of complications is seen when myelography is used for the diagnosis of cervical spondylomyelopathy. The application of traction studies has been reported and can influence the choice of therapy. The application of dynamic studies with the neck in flexion and extension is more controversial and not necessarily part of a standard diagnostic approach.

Treatment of DA-CSM is considered one of the most controversial topics in veterinary neurology. Outcome after medical management is guarded with several studies suggesting around 40% success rates. More than 20 surgical techniques have been and are being reported for this technique. This large number of techniques reflects the difficulty of treating this disorder and the fact that the best surgical technique is yet unknown. The reported surgical techniques can broadly be divided into three categories:

- Direct decompressive surgery by a ventral slot procedure
- Distraction–stabilization techniques
- Motion preservation techniques by artificial disc implants

Although most authors claim a success rate of 75%, up to a quarter of successfully treated cases will develop clinical signs at an adjacent intervertebral disc space. This is referred to as 'adjacent segment disease'.

OSSEOUS-ASSOCIATED CERVICAL SPONDYLOMYELOPATHY

This condition typically affects young adult (often 18 to 24 months of age) giant breeds, such as the Great Dane. As the name suggests, spinal cord compression is caused by bony structures. The predominant cause of cervical spinal cord compression is degeneration and hypertrophy of articular processes. In up to 85% of cases, multiple sites of spinal cord compression are seen at the time of diagnosis. Other abnormalities that can be seen are

ligamentum flavum hypertrophy and hypertrophy of the dorsal lamina. MRI is the diagnostic modality of choice. Little is known about the results of medical management. Surgical treatment typically consists of a (continuous) dorsal cervical laminectomy. Although long-term outcome can be favourable, up to 80% of dogs experiences early postoperative neurological deterioration.

KEY LEARNING OBJECTIVES

- Understand the difference between disc-associated (DA-CSM) and osseous-associated cervical spondylomyelopathy (OA-CSM)
- Understand the different treatment options for DA-CSM and OA-CSM
- Be aware of the prognosis and most common complications after surgical treatment for DA-CSM and OA-CSM

MULTIPLE CHOICE QUESTIONS

1. Which statement is correct about disc-associated cervical spondylomyelopathy?
   - **(A)** It most often affects young mature giant-breed dogs
   - **(B)** Computed tomography is the diagnostic method of choice
   - **(C)** The intervertebral disc spaces at C6–C7 and C5–C6 are most often affected
   - **(D)** Medical treatment is associated with an excellent prognosis
2. Which statement is correct about osseous-associated cervical spondylomyelopathy?
   - **(A)** The Dobermann is over-represented in most studies
   - **(B)** Spinal cord compression is typically caused by hypertrophy of the articular processes
   - **(C)** Distraction–stabilisation surgery is a common surgical technique
   - **(D)** Older (>7 years of age) large-breed dogs are most often affected
3. Which of the following is an important long-term complication after surgery for disc-associated cervical spondylomyelopathy?
   - **(A)** Adjacent segment disease
   - **(B)** Incomplete bony fusion
   - **(C)** Vertebral subluxation
   - **(D)** Collapse of the operated intervertebral disc space

Spinal cord disorders on a budget

Richard LeCouteur

A question faced by most veterinarians in private practice is: How do I approach a case with suspected spinal cord disease when referral is not an option due to financial limitations of the owner?

This lecture will discuss the two major aspects of this issue. First, what can be done *before* an animal with a spinal cord disorder is presented to a practitioner? Second, what can be done *after* an animal with a spinal cord problem has been presented to a practitioner?

PRACTISING PREVENTATIVE CARE

- Inform your clients regarding the costs of veterinary care
- Advise clients to make a budget
- Advise clients to be proactive with the health of their pet
- Advise clients to schedule regular check-ups for their pet

FOLLOWING THE DIAGNOSTIC PLAN

Clinical signs associated with spinal cord dysfunction depend upon the location, the size and the rate of development, of a lesion. The abilities to complete and interpret results of a neurological examination, compile a list of differential diagnoses and understand the available diagnostic procedures and current treatment recommendations, are essential in the management of spinal cord disorders of cats and dogs.

Clinical syndromes affecting the spinal cord may be characterized by a single focal lesion (transverse myelopathy) or by several focal lesions (multifocal disorders). Myelopathies may be extrinsic, in which spinal cord dysfunction is secondary to diseases of the vertebrae, meninges or epidural space, or may be intrinsic, in which the disease begins as an intramedullary lesion. Extrinsic myelopathies are almost always transverse myelopathies.

As the nervous system can respond in only a limited number of ways to the numerous causes of myelopathies, it is necessary to follow a systematic diagnostic approach in an animal with a spinal cord disorder.

KEY LEARNING OBJECTIVES

- Understand what can be done *before* an animal with a spinal cord disorder is presented to a practitioner
- Understand what can be done *after* an animal with a spinal cord disorder is presented to a practitioner
- Discuss the limitations and benefits of using 'clinical reasoning' to aid decision making in the treatment of animals with suspected spinal cord disease

MULTIPLE CHOICE QUESTIONS

1. When referral to a specialist is not an option due to financial limitations of the owner, which is the most critical factor in managing a case with suspected spinal cord disease?
   - **(A)** Radiographs of the entire vertebral column
   - **(B)** An accurate neurological examination
   - **(C)** Cerebrospinal fluid analysis
   - **(D)** A complete blood count and serum chemistry panel
2. Certain spinal cord diseases consistently may be associated with a particular signalment, onset, progression and manifestation of apparent spinal pain. Which of the following disorders is most likely to have a chronic progressive course in the absence of apparent spinal pain?
   - **(A)** Ischaemic myelopathy
   - **(B)** Intervertebral disc extrusion
   - **(C)** Degenerative lumbosacral stenosis
   - **(D)** Degenerative myelopathy
3. The following clinical signs of spinal cord dysfunction are most consistent with a lesion in which location?
   - Ataxia and paresis of all four limbs
   - Proprioceptive positioning deficits in all four limbs
   - Normal or decreased spinal reflexes in thoracic limbs and normal or exaggerated spinal reflexes in pelvic limbs
   - Depressed or absent cutaneous trunci reflex unilaterally or bilaterally
   - **(A)** Cervical (C1 to C5)
   - **(B)** Cervical enlargement (C6 to T2)
   - **(C)** Thoracolumbar (T3 to L3)
   - **(D)** Lumbar enlargement (L4 to Cd5) and cauda equina

Cranial nerve disorders: figuring out the floppy faces

Richard LeCouteur

In this lecture several common disease processes that result in peripheral cranial neuropathies in dogs and/or cats will be discussed.

OTITIS INTERNA

Inner ear infection (otitis interna) is the most common cause of peripheral vestibular disease in dogs and cats. It typically results from extension of bacterial infection within the external ear canal through a ruptured tympanic membrane, or from the nasopharynx via the auditory tube.

The most commonly identified pathogens in dogs include *Staphylococcus* spp., *Streptococcus* spp., *Proteus* spp. and *Pseudomonas* spp. In cats, *Staphylococcus* spp., *Streptococcus* spp., *Pasteurella* spp. and anaerobic bacteria are the most commonly involved.

TRIGEMINAL NEURITIS AND IDIOPATHIC TRIGEMINAL NEUROPATHY

The most frequently recognized inflammatory entity in dogs affecting peripheral branches of cranial nerves is trigeminal neuritis or idiopathic trigeminal neuropathy. Affected dogs typically have an acute onset of clinical signs secondary to bilateral motor branch dysfunction of the trigeminal nerves. This bilateral involvement of the trigeminal nerve results in inability to close the mouth (drop jaw), difficulty prehending food, and drooling. About 33% of dogs have sensory involvement of the trigeminal nerve, and <10% have Horner's syndrome or facial nerve dysfunction. While the underlying pathogenesis of this disease is not known, it is believed to be non-infectious and inflammatory in origin.

NERVE SHEATH TUMOURS

Nerve sheath tumours (NSTs) are perhaps the most common cause of chronic, progressive peripheral cranial nerve disease in older dogs. They arise from Schwann cells or pericytes, are typically slow growing, and are invasive to surrounding nervous system tissue. Metastasis is a rare event. Whereas they most commonly affect the brachial plexus and lumbosacral plexus, NSTs also can arise within cranial nerves, with the trigeminal nerve most frequently affected.

IDIOPATHIC FACIAL NERVE PARALYSIS

Approximately 50% of dogs with peripheral facial nerve weakness are diagnosed with idiopathic facial nerve paralysis. Clinical signs are often relatively acute in onset. Cocker Spaniels are believed to be over-represented, and affected dogs usually are older than 5 years. Dysfunction may be bilateral or unilateral. The underlying aetiopathogenesis of idiopathic facial nerve paralysis in dogs is unknown but has been speculated to involve immune-mediated neuritis or viral infection.

IDIOPATHIC VESTIBULAR SYNDROME

Idiopathic vestibular syndrome occurs in older dogs and cats of any age. It results in acute-onset, unilateral vestibular dysfunction, without concurrent Horner's syndrome or facial nerve signs. The underlying aetiopathogenesis is unknown, but possibilities include transient viral infection similar to vestibular neuritis in humans or disturbance in endolymph flow, as seen in Ménière's disease in humans.

CAVERNOUS SINUS SYNDROME

The cavernous sinus is a paired venous sinus that runs along either side of the pituitary gland on the floor of the calvarium. Cavernous sinus syndrome (CSS) refers to deficits in more than one of the cranial nerves III, IV, V and VI, as they are in close association in this region. Mydriasis and ophthalmoplegia are common signs of CSS. A mass lesion within the cavernous sinus is the most common cause.

KEY LEARNING OBJECTIVES

- Understand the most commonly occurring cranial neuropathies of dogs and cats
- Understand Idiopathic trigeminal neuropathy and idiopathic facial neuropathy
- Discuss the localization of vestibular disorders and distinguish between peripheral, central and bilateral vestibular syndromes

MULTIPLE CHOICE QUESTIONS

1. You are presented with an 8-year-old Rottweiler with an acute onset of head tilt to the left, rolling and falling to left, and a non-positional, rotary nystagmus with the fast phase to the right (and slow phase to the left). Also, the dog has facial weakness on the left side and the left eye has a Horner's syndrome. The remainder of the neurological and physical examination is normal. What is the most likely neuroanatomical diagnosis to account for all the above clinical signs?
   - **(A)** Left-sided middle/inner ear
   - **(B)** Right-sided middle/inner ear
   - **(C)** Left-sided brainstem
   - **(D)** Right-sided brainstem
2. Which of the following is NOT a function of the facial nerve (cranial nerve VII)?
   - **(A)** Sensory for taste (rostral two-thirds of tongue)
   - **(B)** Motor to the muscles of facial expression
   - **(C)** Innervates sublingual and mandibular salivary glands
   - **(D)** Sensory to the nasal mucosa, cornea and face
3. Which of the following clinical signs is PRESENT on the affected side of the head of a dog with a unilateral Horner's syndrome?
   - **(A)** Exophthalmos
   - **(B)** Mydriasis
   - **(C)** Retraction of the third eyelid (nictitating membrane)
   - **(D)** Failure of the pupils to dilate to equality in the dark

A logical approach to vestibular disease

Steven De Decker

The vestibular system has a complex anatomy and clinical signs can be localized by disorders outside or inside the central nervous system. These locations are also referred to as peripheral or central vestibular disease, respectively. The peripheral portions of the vestibular system consist of receptors in the inner ear, and the vestibulocochlear nerve (CN VIII). The central vestibular components are located in the brainstem and cerebellum.

CLINICAL SIGNS IN VESTIBULAR DISEASE

Dysfunction of the vestibular system can be associated with a combination of clinical signs. Head tilt is easy to recognize and the ventrally deviated ear is most often directed towards the affected side. Vestibular ataxia is characterized by a wide-based stance and a tendency to fall, drift or even roll towards the side of the lesion. Affected animals can also demonstrate circling towards the affected side with the circles being very tight. Ocular abnormalities can be more difficult to recognize and consist of pathological nystagmus and strabismus. Nystagmus, or the involuntary movement of eyes, is typically characterized by a jerk nystagmus, with the fast phase directed away from the lesion. The orientation of nystagmus can be horizontal, rotary, or vertical. Nystagmus can be physiological, which is evaluated during the vestibulo-ocular reflex, or pathological. Pathological nystagmus can be classified as spontaneous/resting or positional nystagmus. Animals with vestibular disease can also demonstrate ipsilateral ventrolateral strabismus.

DIFFERENTIATION BETWEEN PERIPHERAL AND CENTRAL VESTIBULAR DISEASE

Peripheral and central vestibular syndrome are associated with different underlying conditions and a different diagnostic approach (not necessarily a different prognosis). Because central vestibular disease is associated with disorders affecting the cerebellum or brainstem, affected animals can demonstrate other brainstem or cerebellum signs. Presence of proprioceptive deficits and hemiparesis, tetraparesis, decreased mentation and multiple cranial nerve deficits are therefore suggestive for central vestibular syndrome. Because the facial nerve (CN VII) and the sympathetic nerve are closely related to the inner ear, facial nerve paralysis and Horner's syndrome can be seen in animals with peripheral vestibular syndrome. Although debatable, pure vertical nystagmus is considered suggestive for central vestibular syndrome. Nystagmus that changes direction when the position of the head is changed and disconjugate nystagmus are also indications for central vestibular disease. Disconjugate nystagmus is characterized by both eyes demonstrating nystagmus in a different direction. Although the presence of these

abnormalities is suggestive for central vestibular syndrome, their absence does not exclude a central localization. A central vestibular localization can be ruled in, but not ruled out.

COMMON CAUSES OF VESTIBULAR DISEASE

Common causes of peripheral vestibular disease include otitis interna, nasopharyngeal polyps, aural neoplasia, inner ear trauma, congenital vestibular disease, hypothyroidism, idiopathic (geriatric) vestibular syndrome and ototoxic drugs. Common causes of central vestibular syndrome are neoplastic and inflammatory conditions, hydrocephalus, thiamine deficiency, metronidazole intoxication, trauma and cerebrovascular disease.

Animals with vestibular disease can also present as neurological emergencies. Two conditions are typically associated with a peracute onset of severe vestibular signs: cerebrovascular disease and idiopathic (geriatric) vestibular syndrome.

KEY LEARNING OBJECTIVES

- Recognize the clinical signs associated with vestibular disease
- Be aware of the anatomical structures that can cause vestibular disease
- Be able to recognize indications for central vestibular disease

MULTIPLE CHOICE QUESTIONS

1. Which statement is correct about central vestibular disease?
   - **(A)** Animals with central vestibular disease have a poor prognosis
   - **(B)** Central vestibular disease can be caused by a brainstem disorder
   - **(C)** Central vestibular disease can be caused by a lesion affecting the vestibulocochlear nerve
   - **(D)** Central vestibular disease can be caused by a lesion affecting the cerebral cortex
2. Which of the following findings is suggestive for a central vestibular syndrome?
   - **(A)** Head tilt
   - **(B)** Spontaneous nystagmus
   - **(C)** Proprioceptive deficits
   - **(D)** Strabismus
3. Which cranial nerve can be affected in peripheral vestibular disease?
   - **(A)** Facial nerve
   - **(B)** Trigeminal nerve
   - **(C)** Optic nerve
   - **(D)** Hypoglossal nerve