Clinical reasoning in vestibular disease

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Vestibular dysfunction occurs commonly in dogs and cats. The vestibular system, or 'system of balance', is responsible for maintaining a normal orientation of the body, head and eyes in relation to gravitational forces and maintaining a normal position of the body and eyes in relation to motion or position of the head. Common clinical signs in animals with vestibular dysfunction include vestibular ataxia, head tilt, nystagmus, and strabismus.[1] The vestibular system has a complicated anatomy and clinical signs can be localized by disorders outside and inside the central nervous system. These locations are also referred to as peripheral or central vestibular disease, respectively.[1,2] Veterinary surgeons confronted with an animal with vestibular dysfunction need to evaluate if patients with vestibular disease are more likely affected by peripheral or central vestibular disease.

ANATOMY OF THE VESTIBULAR SYSTEM[1,3]

The peripheral portions of the vestibular system are located in the inner ear (membranous portion of the petrous temporal bone) and consist of the receptors, ganglion, and the vestibular division of the vestibulocochlear nerve (Cranial nerve VIII). The central vestibular components are the vestibular nuclei in the brainstem, vestibular divisions in the brainstem, and the flocculonodular lobe of the cerebellum, fastigial nucleus of the cerebellum and the caudal cerebellar peduncle. The position of the body, head, and eyes is influenced via projections from the vestibular brainstem nuclei to the spinal cord and nuclei to the extraocular muscles. The Vestibulospinal tract connects the vestibular brainstem nuclei to all segments of the spinal cord. This pathway is responsible for coordination of motor activity in the limbs, neck and trunk in response to movement of the head. The Medial longitudinal fasciculus connects the vestibular brainstem nuclei to the nuclei of the extraocular muscles: the oculomotor nerve (Cranial nerve III), trochlear nerve (Cranial nerve IV), and abducent nerve (Cranial nerve VI). This pathway is responsible for coordinated eye movements when the head changes position and is also responsible for the observation of physiologic nystagmus, which is evaluated during the vestibulo-ocular reflex.

CLINICAL SIGNS IN VESTIBULAR DISEASE[1]

Dysfunction of the vestibular system is associated with a typical complex of clinical signs, involving postural, gait, and ocular abnormalities. *Head tilt* is one of the easiest clinical signs to recognize and the ventrally deviated ear is 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 around the axis. 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 typically directed away from the lesion. The orientation of the nystagmus can be horizontal, rotary, or vertical. Nystagmus can be physiologic, 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 strabismus, with ventrolateral deviation of the eyeball and increased exposure of the dorsal sclera when moving the head upwards.

DIFFERENTIATION BETWEEN PERIPHERAL AND CENTRAL VESTIBULAR DISEASE[1-3]

After you have recognized your patient is demonstrating vestibular dysfunction, you need to evaluate if the animal is suffering most likely from a central or a peripheral vestibular syndrome. Not surprisingly, both localizations are associated with different underlying conditions and a very different diagnostic approach (not necessarily a different prognosis). Because central vestibular disease is associated with disorders affecting the cerebellum or brainstem, affected animals can also demonstrate other brainstem or cerebellum signs. Presence of *proprioceptive deficits* and *hemiparesis* at the side of the lesion, *tetraparesis*, *decreased mentation*, and *multiple cranial nerve deficits* are therefore suggestive for central vestibular syndrome. Because the facial nerve (Cranial nerve VII) and the Sympathetic nerve are anatomically 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 also considered suggestive for a central vestibular syndrome. Nystagmus that *changes direction* when position of the head is changed (for example from horizontal to rotatory after elevating the head) and *disconjugate nystagmus* are also indications for ventral vestibular disease. Disconjugate nystagmus is characterized by both eyes demonstrating nystagmus in a different direction. The rate of resting nystagmus has also been demonstrated to be significantly higher in dogs with peripheral vestibular disease.[2]

Caution should however be exercised. Although the presence of the above discussed abnormalities are suggestive or diagnostic for a central vestibular syndrome, their absence does not exclude a central cause for vestibular dysfunction. *A central vestibular localization can be ruled in, bot not ruled out*

PARADOXICAL VESTIBULAR SYNDROME

Although proprioceptive deficits occur usually at the same side as the head tilt, animals with central vestibular disease will occasionally demonstrate proprioceptive deficits contralateral to the side of the head tilt. This specific presentation is referred to as a paradoxical vestibular syndrome and is associated with a lesion affecting the caudal cerebellar peduncle.

BILATERAL VESTIBULAR SYNDROME

Bilateral vestibular disease is occasionally seen and is characterized by the absence of a head tilt and absence of any type of nystagmus. These animals will also not demonstrate physiologic nystagmus and will therefore have a negative vestibulo-ocular reflex. Affected animals will typically crouch low over the floor, fall to both sides, and demonstrate wide bilateral excursions of the head. The most common cause of bilateral vestibular disease is bilateral middle/inner ear conditions.

COMMON CAUSES OF VESTIBULAR DISEASE

Common causes of peripheral vestibular disease include otitis media intern, nasopharyngeal polyps, aural neoplasia, inner ear trauma, congenital vestibular disease, hypothyroidism, idiopathic (geriatric) vestibular syndrome, ototoxic drugs, and inner ear trauma.
Common causes of central vestibular syndrome neoplastic and inflammatory conditions, hydrocephalus, thiamine deficiency, metronidazole intoxication, trauma, and cerebrovascular disease (eg, ischaemic brain infarct).[4,5]

Animals with vestibular disease can also present as neurological emergencies. Two conditions are typically associated with a peracute onset of severe vestibular signs. These conditions are cerebrovascular disease and idiopathic (geriatric) vestibular syndrome. Affected animals will often be non-ambulatory and be severely disoriented. Both conditions have a however a good prognosis and affected animals will typically demonstrate spontaneous improvement in a few days.[1]

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