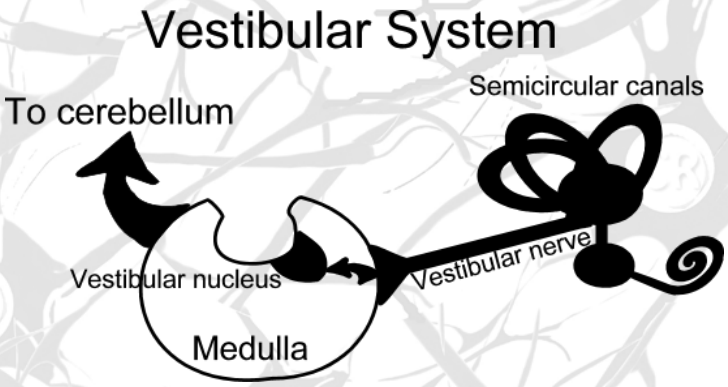
ACUTE ONSET VESTIBULAR DISEASE

The vestibular system is responsible for maintaining balance, posture, and the body's orientation in space. This system also regulates locomotion and other movements and keeps objects in visual focus as the body moves. The vestibular system is comprised of the vestibular apparatus itself, the vestibulocochlear nerve, and those parts of the brain that interpret and respond to information derived from these structures



The vestibular apparatus comprises the vestibule and three semicircular canals of the inner ear. Like a spirit (carpenter's) level, these structures work with the brain to sense, maintain, and regain balance and a sense of where the body and its parts are positioned in space

Damage to the vestibular system results in a vestibular syndrome which comprises one or more of the following signs

- Asymmetric ataxia i.e. drunken gait (worse on the side of the problem)
- Abnormal posture e.g. leaning or head tilt (towards the side of the problem)
- Circling/deviating (towards the side of the problem)
- Nystagmus (rapid eye flick – the slower flick is towards the side with problem)
- Vestibular (positional) strabismus (i.e. a squint, typically down, when the head position is changed)
- Vomiting (motion sickness)

Vestibular syndrome is one of the most common neurological emergencies in neurology and can be one of the most challenging. For prognostic purposes it is vital to distinguish between peripheral (ear and nerve) and central (brain) disease. The most reliable indication of central disease is depressed mental status (e.g. poorly interactive and disorientated) and postural deficits i.e. loss of strength and proprioception (i.e. the sense of where the joints are in space).

Investigation of vestibular disease

The most important "test" is a good neurological examination as this is used to determine if the vestibular syndrome is peripheral or central. The table below illustrates the salient differences between the two

CENTRAL (BRAIN)	**PERIPHERAL (EAR AND NERVE)**
Vestibular signs	Vestibular signs
Proprioceptive deficits (ipsilateral)	Proprioception normal
Paresis (ipsilateral)	Normal strength
Altered mental status	Mental status normal
Cranial nerve deficits (esp. CN V, VII)	Cranial nerve deficits (CNVII and Horner's only)

Differentials of acute onset peripheral vestibular disease

M	**METABOLIC**	As part of polyneuropathy associated metabolic disease e.g. hypothyroidism
N	**NEOPLASTIC**	Neoplasia involving temporal bone (fibrosarcoma, osteosarcoma, chondrosarcoma, squamous cell carcinoma)
		Neoplasia of the vestibulocochlear nerve (e.g. lymphoma)

I	**IDIOPATHIC**	**Idiopathic vestibular disease** (sometimes referred to as "Stroke" by veterinary surgeons however it is not a "brain" vascular event and carries a fair to good prognosis). Two entities – geriatric and associated with facial nerve paralysis
	INFECTIOUS	**Otitis media-interna – bacterial or viral or associated with polyp**
T	**TOXIC**	Aminoglycoside antibiotics
	TRAUMA	Associated fracture of the petrosal bone

Differentials of acute onset central vestibular disease

D	**DEGENERATIVE**	Thiamine (B1), Folate (B12) deficiency
N	**NEOPLASTIC**	**Primary or secondary (at the cerebellopontine angle)**
I	**INFLAMMATORY**	**Granulomatous meningoencephalomyelitis (GME),** Pug / Maltese / Yorkshire terrier encephalitis, Eosinophillic meningoencephalomyelitis
I	**INFECTIOUS**	**FIP**, Toxoplasma, Cryptococcus, Polioencephalomyelitis, Distemper
	TOXIC	Metronidazole
T	**TRAUMA**	Injuries can appear devastating many make an excellent recovery
V	**VASCULAR**	Infarction to the territory of the cerebellar /medulla arteries (i.e. stroke – this is rare and not to be confused with idiopathic vestibular syndrome)

To further elucidate the diagnosis, imaging may be recommended. The most useful is MRI as this allows both the ears and the brain to be appreciated. However ear infections may be better appreciated on CT and sometimes with radiographs.

Additional tests which may be recommended are blood pressure determination, cerebrospinal fluid (CSF) analysis (protein concentration, cell counts and other parameters). This test is most useful to determine if there is an inflammatory and / or infectious disease. Tests for infectious agents such as viruses and protozoa may also be appropriate (see table below). If there is a middle ear effusion then myringotomy,

flushing and fluid cytology and culture are indicated. Some neurologists use BAER (Brainstem Auditory Evoked Response) to assess the hearing pathways which are close to the vestibular pathways.

If diagnostic tests are not possible e.g. for financial reasons then the best course of action is to monitor the neurological examination as knowing if the disease is central (brain) or peripheral (ear or nerve) can be a guide as to both prognosis and management.

Treatment of vestibular disease

Treatment of vestibular disease is twofold 1) dealing (if possible) with the underlying cause and 2) providing supportive care. Supportive care can include intravenous fluids especially if the pet is unable to drink and/or is vomiting. Anti-nausea drugs are recommended if vomiting occurs. Recovery for some causes of vestibular disease, e.g. idiopathic (geriatric) vestibular syndrome, is by compensation - i.e. the brain (especially vision) compensates for a permanent deficit. Consequently the pet may be left with a permanent head tilt and a slight balance problem especially when doing more complex tasks. There is some experimental evidence (in rats) that suggests that propentofylline speeds up the brain's ability to compensate after unilateral vestibular damage. Therefore some vets may advise a (1 month or more) course of this drug. If the pet is aged then it is also recommended to supplement the diet with antioxidants and essential fatty acids (many suitable veterinary formations and diets are available).

Occasionally there can be an acute decompensation (e.g. after suddenly being deprived of vision e.g. by turning of the lights). In this circumstance acute signs such as nystagmus etc can return for a few hours. In this circumstance it is advisable to keep the pet in a quiet environment and monitor. If signs are persistent then re-examination / re-investigation is warranted.

Infectious diseases causing ataxia

DISEASE	COMMON NEUROLOGICAL CLINICAL SIGNS	OTHER USEFUL DIAGNOSTIC TESTS	FREQUENCY
Toxoplasma	Altered mental state, Seizures Systemic signs	CSF analysis (mixed pleocytosis) Serum biochemistry Radiography Bronchoalveolar lavage Antibody titres CSF PCR or Antibody titre Electrophysiology	Rare
Neosporosis	PNS/ muscle and hepatic involvement typical	CSF analysis (mixed pleocytosis) Antibody titres Serum biochemistry Electrophysiology Radiography	Occasional
FIP	Cerebellar Vestibular disease Seizures Spinal pain	CSF analysis (neutrophilic pleocytosis, cell count >100 cell/mm^3, protein > 2mg/l) Positive CSF anti-feline corona virus titre PCR corono virus if CSF in inflammatory MRI/CT (hydrocephalus, hydromyelia, meningitis, ependymitis, choroiditis)	Common
FeLV	Myelopathy Associated with lymphoma	Imaging (myelography, MRI) CSF analysis Retroviral titres	Occasional
Borna (staggering disease)	Behavioural changes pelvic limb ataxia/paresis	CSF analysis (mild mononuclear pleocytosis) Assay for Borna virus-specific RNA (RT-PCR) and virus specific antigen	not reported in UK
Polioencephalo-myelitis	Spinal cord (LMN), cerebellar, vestibular signs, pupillary abnormalities, spinal pain	N/D	not reported in UK, causal agent not identified and may be Borna virus
Distemper	Seizures Caudal fossa disease Optic neuritis Spinal cord signs Spinal pain	CSF analysis (mononuclear pleocytosis occasionally mixed) CSF antibody titre / PCR MRI Indirect immunofluorescence antigen test	Occasional
Cryptococcus	Seizures, cerebellar and vestibular disease +/- systemic signs	CSF analysis (mixed pleocytosis) Demonstration of organisms by India Ink stain CRAG titre (serum/CSF). MRI / CT	Rare

The hallmark of CNS infection is multifocal signs. The only other differentials for rapidly progressive multifocal signs would be multifocal neoplasia, especially lymphoma, and non-infectious CNS inflammatory disease e.g. eosinophilic meningoencephalomyelitis.
N/D – not described,