Vestibular Anatomy

- The vestibular apparatus is in the inner ear (petrosal portion of temporal bone) comprised of the cochlea, semicircular canals, and the vestibule.
- The vestibular neurons travel with the vestibulocochlear nerve (CN VIII) and enter the skull through the internal acoustic meatus, entering the medulla between the caudal cerebellar peduncle and the trigeminal nerve tract, terminating in the vestibular nuclei by the lateral wall of the fourth ventricle.
  a. Some of the vestibular neurons travel to the flocculonodular lobe and the fastigial nucleus of the cerebellum.
- The efferent pathway travels in the vestibulospinal tract to inhibit ipsilateral flexor and contralateral extensor muscles. They also descend in the medial longitudinal fasciculus (MLF) which projects to CN III, IV and VI to control eye position with respect to the head.

Clinical Signs of Vestibular Disease

Peripheral Vestibular System Disease

- Head tilt, circling, rolling, falling toward the side of the lesion.
- Pathologic nystagmus (horizontal or rotary) with fast phase away from the side of the lesion.
- Can see concurrent facial nerve paralysis or Horner’s syndrome with inner/middle ear lesions.
**Bilateral Peripheral Vestibular System Disease**

- Occurs infrequently and animals may have no head tilt and no nystagmus (no pathologic or physiologic nystagmus). Main clinical sign is usually a wide crouching stance with wide swaying of the head.

**Central Vestibular System Disease**

On the basis of vestibular signs alone, you cannot determine the side of the lesion with central disease. For the purposes of this PowerPage, we are grouping all central lesions together, meaning the direction of vestibular signs can be either way with respect to the side of the lesion. This is in contrast to some professors and textbooks which discuss central vestibular disease and paradoxical vestibular disease as separate entities.

- Head tilt, circling, rolling, falling either toward or away from the side of the lesion
- Pathologic nystagmus (horizontal, rotary or vertical)
- Conscious proprioceptive deficits or hemiparesis on the side of the lesion
- May be mentally depressed
- May see facial nerve paralysis

**Additional Things to Look for on Your Neurologic Examination**

- In addition to a detailed history and general physical exam, the following tips on a neurologic exam may help localize a vestibular lesion.
  a. **Horner’s syndrome** (miosis, ptosis, enophthalmos)- Indicates peripheral disease
  b. Conscious proprioceptive deficits- Indicates brainstem disease
  c. **Cranial nerve** deficits- Multiple deficits usually indicate central disease (Facial nerve paralysis also occurs with peripheral lesions).
  d. Presence of a **head tremor**- Indicates **cerebellar** disease
  e. Altered mentation- Indicates central disease
Vestibular Disease

- Analyze the nystagmus – Not the best way to determine location unless vertical nystagmus is present.
  i. Acute peripheral lesions typically cause spontaneous nystagmus with horizontal and rotational components. Central lesions can cause purely vertical, horizontal, or rotational nystagmus.
- If you can localize your lesion to peripheral or central, ancillary tests in addition to a minimum database may include:
  i. For peripheral - Otoscopic exam, radiographs of tympanic bulla, thyroid testing, BAER testing or cross sectional imaging (CT/MRI).
  ii. For central - Cross sectional brain imaging (CT/MRI) and CSF analysis.

Differential Diagnoses

Peripheral Vestibular System Disease

- Idiopathic vestibular syndrome
  a. Often peracute without apparent cause
  b. Common in dog and cat and a diagnosis of exclusion.
  c. Will start to improve within several days without treatment. Often, the head tilt does not completely resolve.
- Otitis media and interna
  a. Common cause of vestibular disease in most species.
  b. Antimicrobial culture is ideal but commonly treated with enrofloxacin.
  c. Antibiotic therapy should be continued for up to 8 weeks. (Aminoglycosides are contraindicated).
  d. In refractory cases, TECABO (Total ear canal ablation and bulla osteotomy) may be needed.
- Ototoxicity
  a. Chlorhexadine is commonly implicated. Also consider aminoglycosides
- Neoplasia - Ceruminous gland adenocarcinoma, squamous cell carcinoma, lymphoma, miscellaneous sarcomas and other tumors can arise in the middle/inner ear.
- Nasopharyngeal polyps
  i. May arise around eustachian tube or tympanic cavity (most common in cats). Often require CT/MRI to visualize.
- Hypothyroidism - can cause polyneuropathy with vestibular signs, resolves with treatment.
- Trauma and congenital vestibular disease also occur and should be suggested by history or other clinical signs for trauma and a young age (usually weeks to months) for congenital disease.
Central Vestibular System Disease

- Neoplasia
  a. Tumors at cerebello-pontine angle (i.e. Meningioma, lymphoma)
  b. Tumors elsewhere in brain causing tentorial herniation and brainstem compression.
- Drug toxicity
  a. Metronidazole - doses > 30 mg/kg/day
     - Often acute onset, even in patients at high doses over long course.
     - May also occur at lower doses, particularly if hepatic or renal metabolism/excretion is reduced.
- Inflammatory brain disease
  a. Often vestibular with other CNS signs as part of multifocal brain disease.
  b. Many diseases including FIP, GME, parasitic, fungal, or bacterial infection.
- Cerebrovascular disease.
  a. Generally sudden onset. May be idiopathic or secondary to hypertension, neoplasia, endocrine disease, or sepsis.
- Thiamine deficiency - in small animals, most commonly from overcooked meat diets or all fish diets.
Non Species Specific Vestibular Disease

References