

## Pathogenesis, Diagnosis, and Treatment of Cervical Vertigo

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### KEY POINTS FROM THIS ARTICLE:

- 1) Non-cervical spine causes of vertigo include:
  - Disturbances of the ear, nose, and throat (ENT)
  - Central nervous system (CNS)
  - Cardiovascular system
  - Benign positional paroxysmal vertigo (BPPV)
  
- 2) Vertigo can arise from problems in the cervical spine. There are 4 hypotheses explaining cervical vertigo:
  - A)) Proprioceptive Cervical Vertigo:
    - Was first described in 1996
    - Abnormal afferent input to the vestibular nucleus from damaged joint receptors in the upper cervical region alter vestibular function resulting in cervical vertigo.
    - Often occurs from whiplash trauma. "Whiplash injuries often cause cervical proprioception disorders, leading to cervical vertigo."
    - "In whiplash-associated disorder, pain, limitation of movement, and strains of joint capsules, paravertebral ligaments, and cervical musculature could modify the proprioceptive cervical balance in a sustained way and produce mild but chronic vertigo."
    - Cervical vertigo can be caused from damaged joint receptors in the upper cervical spine. Cervical zygapophyseal joints are the most densely innervated of all the spinal joints, having an extremely well developed proprioceptive system; 50% of all cervical proprioceptors were in the joint capsules of C1-3.
    - "Cervical vertigo may be a result of whiplash injury, other forms of cervical spine dysfunction, or spasms in the cervical muscles."
    - There is an abundance of mechanoreceptors in the muscle spindles of the deep segmental upper cervical muscles, and these mechanoreceptors are a critical component of the proprioceptive system, giving the CNS information about the orientation of the head with respect to the rest of the body via direct neurophysiological connections to the vestibular and visual systems.
    - Effective treatment includes manual therapy and/or physical therapy.
    - "Manual therapy is recommended for treatment of proprioceptive cervical vertigo."
    - "Manual therapy is effective for cervical vertigo."

- "Evidence leads to the current theory that cervical vertigo results from abnormal input into the vestibular nuclei from the proprioceptors of the upper cervical region."
- B)) Barré-Lieou Syndrome (Sympathetic Dysfunction)
- It is a sympathetic nervous system dysfunction.
  - Was first described in 1928.
  - Symptoms include vertigo, tinnitus, headache, blurred vision, dilated pupils, nausea, vomiting.
  - Pathological changes of cervical vertebra might stimulate sympathetic nerve fibers and play a role in modifying the blood volume of the vertebral artery.
  - The sympathetic plexus surrounding the vertebral arteries could be stimulated by cervical degenerative disease and this stimulation could contribute to reflexive vasoconstriction of the vertebrobasilar system.
  - Studies indicate that there are bidirectional nerve fiber connections between cervical spinal and sympathetic ganglia. **[Important]**
  - Sympathetic nerves regulate blood flow of posterior circulation including the blood vessels of the inner ear. Abnormal input from cervical sympathetic nerves produces reflex vasoconstriction in the vertebrobasilar system and inner-ear ischemia, thus resulting in vertigo or dizziness.
  - Cervical spine magnetic resonance imaging showed cervical disc degeneration.
  - Clinical symptoms include vertigo, tinnitus, headache, blurred vision, dilated pupils, nausea, vomiting, etc.
  - Effective treatment includes manual therapy and/or physical therapy. Fusion surgery may be required.
  - "Anterior cervical surgery and percutaneous laser disc decompression are effective for the cervical spondylosis patients accompanied with Barré-Liéou syndrome."
- C)) Rotational Vertebral Artery Vertigo (Bow Hunter Syndrome)
- First described in 1978.
  - The vertigo caused by reversible obstruction or stenosis of the dominant vertebral artery at the atlantoaxial level upon head rotation is called "rotational vertebral artery vertigo."
  - Occlusion or insufficiency of the vertebral artery during neck rotation resulting in decreased blood flow through the posterior inferior cerebellar artery, causing vertebrobasilar insufficiency and vertigo.
  - Insufficient blood supply does not cause symptoms if there is sufficient collateral circulation.
  - Vertebrobasilar insufficiency (VBI) can manifest as tinnitus, vertigo, and dizziness.
  - The decrease of vertebral artery velocity is identified during head rotation using color duplex sonography. Vertebral arterial compressive pathology was identified using magnetic resonance or computed tomography angiography.
  - May respond to conservative treatment, but cervical decompression and/or cervical spine fusion may be required.

- Rotational vertebral artery vertigo is rare. The exact area of arterial compression is identified through magnetic resonance angiography (MRA), computed tomography angiography (CTA) or digital subtraction angiography (DSA) decompressive surgery should be the chosen treatment.
- D)) Migraine-associated Cervicogenic Vertigo
- First described in 2012.
  - Reciprocal connections between the vestibular nuclei and the trigeminal nucleus can provide a mechanism in which the vestibular signals would influence the trigeminal nerve and cause headache.
  - Typically these patients suffer from cervical pain and stiffness, migraine, and vertigo.
  - The association between migraine and vertigo has been well documented in the literature.
  - 39.7% of patients with migraine were reported to experience neck pain.
  - There is no proven treatment, so conservative efforts should be the primary.
- 3) 65% of dizziness in the elderly is attributed to cervical spondylosis.
- 4) Anesthetic injections to the upper cervical dorsal nerve roots can produce dizziness and nystagmus.
- 5) Electrical stimulation to cervical muscles induces a sensation of tilting or falling.
- 6) "Proprioceptive input from the neck helps in the coordination of eye, head, and body posture as well as spatial orientation."
- 7) Afferent cervical activity is primarily controlled by neck mechanoreceptors in the upper cervical spine.
- 8) "Patients with whiplash injuries always have postural control impairment."
- 9) "Cervical spondylosis and cervical muscle spasms can also cause vertigo."
- 10) There are "close connections between the cervical dorsal roots and the vestibular nuclei with the neck receptors (such as proprioceptors and joint receptors), which played a role in eye-hand coordination, perception of balance, and postural adjustments via an experimental study in animals. With such close connections between the cervical receptors and balance function, it is understandable that traumatic, degenerative, inflammatory, or mechanical derangements of the cervical spine can affect the mechanoreceptor system and give rise to vertigo."
- 11) The diagnosis of cervical vertigo is made only after other potential causes for dizziness or vertigo have been excluded.

- 12) If a patient has a chief complaint of vertigo, but no neck pain, a diagnosis of cervical vertigo is excluded.
- 13) "Patients with cervical vertigo usually have pain in the back of the neck and occipital region, sometimes accompanied by stiffness of the neck."
- 14) "Cervical vertigo typically occurs in episodic nature lasting minutes to hours."
- 15) Cervical vertigo is often increased with neck movements or neck pain and decreased with interventions that relieve neck pain.
- 16) In cervical vertigo, symptoms can be reproduced with head/neck movement.
- 17) In cervical vertigo, pain is often elicited with palpation of the suboccipital region, cervical transverse processes of C1 and C2, cervical spinous processes of C2 and C3, levator scapulae, upper trapezius muscle, splenius, rectus, and semi-spinalis muscles.
- 18) The most reliable test to identify the exact area of vertebral arterial compression is digital subtraction angiography (DSA). However, DSA is an invasive method requiring considerable iodine-containing contrast.
- 19) Non-invasive techniques to identify vertebral arterial compression include cervical magnetic resonance angiogram (MRA) and CT angiogram (CTA), but CTA exposes the patient to significant radiation.
- 20) The neck torsion nystagmus test may identify cervical vertigo: the head of the patient is stabilized while the body is rotated underneath.
- 21) Since cervical vertigo originates from proprioceptive dysfunction of the upper cervical spine, treatment should be to the upper cervical spine. Chiropractic and other manual spinal therapies have been shown to be effective in treating cervical vertigo, typically with around 80% acceptable clinical outcomes.
- 22) An effective technique for treating cervical vertigo is a type of spinal mobilization known as "sustained natural apophyseal glides" (SNAGs), often resulting in significant immediate and sustained effect in reducing dizziness and neck pain. It restores "normal movement of the zygapophyseal joints, reducing pain and muscle hypertonicity, and thereby restoring normal proprioceptive and biomechanical functioning of the cervical spine."