Introduction

1. Neck: balance control (afferent)
   cardiovascular control (carotid bodies),
   neurovascular structures (carotid & vertebral arteries, venous return, spinal cord)
2. Dizziness or vertigo associated with neck movement due to vestibular, visual, neurovascular or cervicoproprioceptive mechanism.
3. Vestibular afferent gave CNS about head position/head movement in space but not about head position & movement in relation to trunk
   ➔ Neck movement = head position change relative to trunk
   ➔ Neck proprioceptive input coordinate eye, head, and body posture
   ➔ On this basis: a syndrome of cervical vertigo may exist
4. Dizziness due to dysfunction in C-spine has been recognized in early 20th century
   ➔ 1920's Barre & Lieou: experimentally induced dizziness/tinnitus/Horner's syndrome by injecting anesthetic into upper cervical region
   ➔ 1955 Ryan and Cope introduced the term "cervical vertigo" (Ryan M., Cope S. Cervical vertigo. Lancet. 1955; 2: 1355-1358)
6. Question relevant for the discussion of the cervical vertigo: what is the functional relevance for neck afferent input and how does the lack of or distortion of such input lead to vertigo

Functional relevance of neck afferents

1. Proprioception ➔ deep short intervertebral neck muscles
2. Neck afferent input make up perceptual function and lead to reflex
   (cervico-postural & cervico-ocular reflexes)

  • Afferent of reflex
  1. Two reflex by neck proprioceptors:
2. Cervico-postural reflexes
   - tonic neck reflex: innervate limb muscles asymmetrically
   - elicited only in human newborn (ipsilateral flexion and contralateral extension of the limbs with head rotation, fencing posture)
3. Cervico-ocular reflex: Bárány first demonstrated tonic cervico-ocular reaction in rabbits (by motion of the trunk relative to the head)
4. Above 2 reflexes in humans usually observed in newborn/severe brain-damaged

- Efferent of reflex
  1. Vestibulocollic reflex: neck stabilizes the head with respect to the trunk

- In individuals
  1. Rotating the trunk about the stationary head: weak reflex normally
      - but elicited low velocity nystagmus in some normal
  2. Neck reflex adaptively enhanced in acquired vestibular loss
      - partially substituting the vestibulo-ocular reflex deficit in the monkeys and humans
  3. Define cervical vertigo on the cervical nystagmus is impractical: cervical nystagmus occurs in healthy and strong in patient with no cervical vertigo

**Experimental cervical vertigo**

1. In primates: transverse section of suboccipital muscles, surgical deafferentation on C1-C3 or suboccipital anaesthesia → locomotor ataxia
2. Positional nystagmus due to anesthetic injection in upper cervical root is rabbits (> cat > rhesus monkey 恒河猴)
3. In human: local anesthesia of deep posterolateral neck tissue in humans
   - elicit a transiently ↑ ipsilateral and ↓ contralateral extensor muscle tone
   - a tendency to fall and gait deviation towards the injected side.
   - Some confirmed this by therapeutic anesthetic C2 blockades in cervicogenic headache
   - no specific abnormality with static posturography or subjective visual vertical or routine ENG
4. Bipolar electric stimuli to the head near the ears induced lateral body deviation towards the side with positive electrode
Clinical evidence for cervical vertigo

1. Section/anesthesia of cervical roots or muscles → asymmetry in somatosensory input
2. Unilateral irritation or deficit of neck afferents → create cervical tone imbalance → disturbing integration of vestibular & neck inputs
3. However [ whiplash injuries or cervical pain syndrome → a tone imbalance with ataxia and vertigo ] was not seen
4. Rotational vertigo and nystagmus with pain and tenderness arising from the cervical spine and limitation of neck movement ≠ cervical vertigo ( when post-traumatic, vertebral artery dissection should be r/o )
5. Symptoms of cervical vertigo: sensation of lightheadedness or floating unsteadiness and slight ataxia of stance and gait, ↑ when head turns (neck movement)
6. If
   vestibular function → tested by vestibular stimuli
   visual function → visual stimuli
   somatosensory cervical function should be tested with selective somatosensory stimulation?
7. Clinical studies to define CV include static conditions and dynamic measurement
8. Some studies based on posturography data
   ● chronic cervicobrachial pain ( not selected from complaints of vertigo) had poorer postural control than normal control ( on vibration induced or galvanically induced body sway)
     → 107 pts, excluding whiplash injury and trauma, neck pain radiated to arm > 3 months, 89 cervical root compression(CRC) and 18 non-CRC ( by MRI and plain x-rays)
     → 50% of the pts complained of vertigo or dizziness
     → A frequency higher than in general population
     → In accord with earlier reports of vertigo in cervical spondylosis
   ● Physiotherapy was of value in reducing neck pain and dizziness along with postural balance
   ● Patient with neck pain had poorer ability to reassume the original position of the head
9. Longet: the incidental finding that post-traumatic vertigo and ataxia improve with the use of a neck collar 1971
but head trauma and whiplash injury affect not only neck structures
whiplash injuries often damage the brain to confuse the interpretation of
abnormal vestibulo-ocular tests
dislodged otoconia enter the lumen of the SCC to cause BPPV
10. Traumatic changes of the spine could induce vertigo.

**Hypothetical mechanisms**

1. Vascular compression
   - **Bow-Hunter's syndrome**: is an uncommon condition in which the VA is
     symptomatically occluded during neck rotation.
   - vertebral artery in the neck can be compressed by the vertebrae (arthritis,
     surgery, chiropractic manipulation)
2. Cervical cord compression:
   - narrowing of the cervical canal exerting pressure on the spinal cord
     would reasonably be accompanied by symptoms from the long spinal tracts
   - vertigo in pt without evidence of root compression: pressure on the
     spinal cord in certain head positions cannot be ruled out as the MRI scan
     were performed with the head in the neutral position
   - MRI scans of the cervical region during extension or flexion of the neck
     show protrusive lesions compressing the spinal cord while only narrowing of
     the spinal canal in neutral head position
   - no vertigo symptoms even in some root compression pt group
3. Abnormal sensory input from neck proprioceptors:
   - it is not known how traumatic, degenerative, inflammatory or rheumatic
     diseases affect neck sensory input?
4. Altered upper cervical somatosensory input associated with neck
   tenderness and limitation
   - interstitial inflammatory mediators and metabolites sensitize
     proprioceptive as well as nociceptive receptors
   - erroneous proprioceptive information from the cervical muscles
   - myofascial trigger points exhibit spontaneous EMG activity
     (compatible with hyperactive muscle spindles)
   - if firing character change due to neck pain → sensory mismatch
     between vestibular and cervical inputs would be expected to result in
     cervical vertigo
   - pain per se affect postural control function
   - no correlation between the intensity of cervical pain and the degree
of impaired cervicocephalic kinaesthesia

- restriction of cervical motion by a cervical collar is reported to impair postural control in healthy subjects
  → range of cervical motion manifest great inter-individual variation and normal value differ from study to study
  → cervical range of motion and cervical pain are closely related
  → hard to distinguish separate effects on postural control function

**Diagnosis criteria**

1. Cervical vertigo is a diagnosis of exclusion
2. The neck-torsion nystagmus test, head-fixed with body-turned maneuver had been used to identify cervical vertigo
3. However these tests were not specific to the cervical vertigo
   (262 post-whiplash pts with neck pain, 64% nystagmus elicited with head-fixed body-turned maneuver. But 50% in subjected without cervical pathology)
4. Increased postural sway is also a nonspecific finding
5. The diagnosis of cervical vertigo is suggested by⁹
   (1) a close temporal relationship between neck pain and symptoms of vertigo
   [Symptoms of cervical vertigo : sensation of lightheadedness or floating unsteadiness and slight ataxia of stance and gait, ↑ when head turns(neck movement)]
   (2) previous neck injury or pathology
   (3) elimination of other causes of vertigo

**Differential diagnosis**

1. Post-traumatic or cervical whiplash injuries → BPPV, brainstem concussion, vertebral artery dissection and perilymph fistula
2. Non-traumatic → cerebellar or spinal ataxia, bilateral vestibulopathy, psychogenic origin
3. Lesion of extracranial portion of the vertebral artery should be considered → v1 portion : prevertebral portion
   v2 portion : transverse portion, travels the cervical column within the transverse foramina
   v3 portion : atlas portion, loops from c2 into the foramen magnum
   v4 portion : intracranial portion
relatively free from atherosclerosis
occlusions due to neck movements, manipulation, osteophyte compression, trauma, and spontaneous dissection can occur

**Treatment**

1. Use of a soft cervical collar during acute phase of neck injury
2. Muscle relaxant [tizanidine(sirdalud), baclofen(befon), cyclobenzaprine]
3. Trigger point injection
4. Manual therapy (mobilization and manipulation)
   - Mechanical traction
   - Physical modalities
   - Postural re-education
   - Active range of motion
   - Massage
   - Balance training and vestibular rehabilitation

5. A review article on manual therapy using Cochrane format
7 electronic databases
9 studies
2 reviewers
→ low methodological quality but a consistent finding that all studies had a positive result with significant improvement in symptoms and signs of dizziness after manual therapy treatment
→ level 3 evidence: manual therapy treatment of cervicogenic dizziness should be concerned in the management of patients with this disorder provided there is evidence of improvement.

**Summary**

1. Vertigo can be accompanied by cervical pain, with head injury, whiplash injury or cervical spine disease
2. In some cases physiotherapy improves the symptoms dramatically
3. So far, there is no convincing evidence of a cervical mechanism
4. All clinical studies on CV to date have 3 weak points
   → inability to confirm the diagnosis
   → the lack of a specific laboratory test
   → unexplained discrepancy between pts with severe neck pain without vertigo and pts complaining of disabling vertigo with moderate neck pain
5. Appropriate management is the same as that for the cervical pain syndrome

附録:

無敵鐵金剛之製造設定

身高 18 公尺

身高 18 m 步行時速 50 km/hr (每秒兩步 14 m/s)
= 180 cm 高 每秒 2 步 步幅 70 cm 前進 上下 3 cm 震盪
= 指揮艙 30 cm/s 上下震盪

全力奔跑 360 km/hr
= 180 cm 高 每秒 5 步 步幅 200 cm 上下 20 cm 震盪
= 指揮艙 200 cm/s 上下震盪

以生理學角度 人是無法坐在內部操縱的