THE CASE OF DIZZINESS

AN OSTEOPATHIC PERSPECTIVE
Key Concepts

The body’s system of balance
  — Sensory inputs
  — Central processing
  — Motor output

Two types of vertigo presenting without hearing loss
  — Cervicogenic vertigo
  — Benign Paroxysmal Positional Vertigo
Dilemma of the dizzy patient

Oh no! Patient c/o dizziness. What do I do?
Vertigo can be disabling, but seldom life-threatening

However:

- Seriousness of falls associated with dizziness or unsteadiness
  - 30% fall rate over age 65; 50% of those over 80
  - Twenty to thirty percent of those who fall suffer injuries that reduce mobility and independence and increase the risk of premature death

- Fear of Falling higher if patient has dizziness

- Variety of conditions cause dizziness, light headedness, poor balance, etc.
Risk Factors for Falls among Elderly Persons in the Community

- Postural hypotension
- Medications—Sleep aids, anti-anxiety, anti-depression
- Four or more Rx medications
- Environmental hazards
- Balance dysfunction, impaired muscular strength or ROM
- Other chronic health issues
- Low Vitamin D levels
- Fear of falling
Dizziness-like Symptoms (lightheadedness, disorientation, unsteadiness)

- Cardiovascular
  - Anemia
  - Arrhythmias
  - Orthostatic hypotension
  - TIA/stroke
    - Vertebrobasilar system

- Migraine

- Anxiety, Panic Attack, Hyperventilation
Medication Side Effects

Numerous drugs have dizziness as side effect

Some such as aminoglycosides are toxic to the inner ear causing permanent damage

Get drug history
Meclizine HCl (antihistamine)

**Effective:** Management of nausea and vomiting, and dizziness associated with *motion sickness*.

**Possibly Effective:** Management of vertigo associated with diseases affecting the vestibular system.

**Side effects:**
- Blurred vision
- Dry mouth
- Constipation
- Dizziness, drowsiness
VERTIGO WITH HEARING LOSS
Vertigo with Hearing Loss

- Acute labyrinthitis
  - Self limiting
- Meniere’s disease
  - Increased endolymphatic pressure with tinnitus
  - Progressive with remission & exacerbation
- Acoustic neuroma (schwannoma of CN VIII)
  - Vertigo not early symptom
VERTIGO WITHOUT HEARING LOSS
Patient 1
Dizziness without hearing loss

A 45 year-old male presents with a chief complaint of a sensation of whirling and unsteadiness. Onset 3 weeks ago, following a MVA. He is also experiencing neck pain and neck stiffness. Movement of his neck aggravates his dizziness. He reports no other neurological signs/symptoms, no hearing loss and no tinnitus. He takes no medication.
Patient 2  
**Dizziness without hearing loss**

A 65-year-old woman presents with a chief complaint of dizziness. She describes it as a sudden and severe spinning sensation precipitated by rolling over in bed onto her right side. Symptoms typically last <30 seconds. They have occurred nightly over the last month and occasionally during the day when she tilts her head back to look upwards. She describes no precipitating event prior to onset and no associated hearing loss, tinnitus, or other neurological symptoms.
Key: Understanding the body’s system of balance control
Three Primary Sensory Inputs to balance system

- Vestibular
- Visual
- Proprioceptive (especially neck and ankles)
Central Processing

- Vestibular nuclear complex
- Cerebellum
Motor Output

- Postural Muscles
- Eyes
Vestibular System

Housed in temporal bones

Bony and membranous labyrinth
  – Cochlea (hearing)
  – Semicircular canals
  – Vestibule

Inside bony portion, membranous portion is suspended in perilymphatic fluid
Semicircular Canals

- Three arranged perpendicularly
- Detect motion in any direction
- Arrangement similar to orientation of extraocular muscles
- Helps with clear vision
B Structure of the ampulla and ampullary crest
Utricle & Saccule

- In the vestibule
- Contain otoconia=calcium carbonate crystals
- Sensory hair cells
- Sense gravity and linear acceleration
Orientation of Utricle & Saccule

- **Utricle horizontal**
  - Sense horizontal acceleration

- **Saccule verticle**
  - Sense vertical acceleration
D  Stimulus transduction in the vestibular sensory cells

Illustrator: Karl Wesker

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Afferent Nerves from Labyrinthine Organs

• Vestibular nerve
  – Courses with cochlear & facial n. & labyrinthine a.
  – Through internal auditory canal (petrous temporal)
    – Enters brainstem at pontomedullary junction
    – Cerebellum and vestibular nuclear complex
**Impact Players! Right & Left Temporal Bone**

- Orientation of vestibular apparatus critical
- Nerve conduction via internal auditory canal of petrous portion
- ? Impact of temporal bone dysfunction
Arterial Supply

- Vertebral basilar system
- Labyrinthine artery (usually branch of anterior inferior cerebellar artery)
  - No Collateral Circulation!
- Again, what is the impact of temporal bone dysfunction?
Proprioceptive Input

All proprioceptors are used for balance

Ankle and Neck proprioceptors especially important
Central Processing

- Vestibular nuclear complex - pons/medulla
  - Primary processor
  - Fast, direct connection

- Cerebellum
  - Adaptive processor
  - Fine tuning
Working with incoming information

Need accurate, symmetrical & consistent info

Compensation for missing info possible
  – Generally, can compensate with 2 of 3 systems working properly
  – May adapt over time
Reflexes involved in Balance

- VOR – Vestibulo-ocular reflex
- VSR – Vestibulospinal reflex
- VCR – Vestibulocollic reflex
- COR – Cervico-ocular reflex
Vestibulo-ocular Reflex (VOR)

- Input from semicircular canals, utricle & saccule
- To vestibular nucleus
- Motor to extraocular eye muscles
- Result = clear vision during head movement
Vestibulospinal Reflex (VSR)

- Vestibular nuclear complex and cerebellum process info
- Motor to skeletal muscles
- Result = strategies to maintain upright posture
- Complex
Vestibulocollic Reflex (VCR)

- Input - movement sensed by otoliths
- (neural pathways unclear)
- Motor to neck muscles
- Result = stabilize neck & head
Cervico-ocular Reflex (COR)

- Input from neck proprioceptors
- Interacts with VOR
- Motor to eye muscles
- Gain in normally very low
  - Neck injury → gain
VERTIGO WITHOUT HEARING LOSS
Vertigo without Hearing Loss

- Cervicogenic Vertigo
- Benign Paroxysmal Positional Vertigo (BPPV)

Misinformation to central processing from different sources
- Cervical proprioceptors (cervicogenic vertigo)
- Otoliths-vestibular organs (BPPV)
Patient 1
Dizziness without hearing loss

A 45 year-old male presents with a chief complaint of a sensation of whirling and unsteadiness. Onset 3 weeks ago, following a MVA. He is also experiencing neck pain and neck stiffness. Movement of his neck aggravates his dizziness. He reports no other neurological signs/symptoms, no hearing loss and no tinnitus. He takes no medication.
Cervicogenic Vertigo

Associated with neck pain/injury
  – Whiplash associated disorder (WAD)
  – Dizziness, unsteadiness, imbalance reported
Cervicogenic Vertigo
Characteristics

- Vertiginous symptoms concurrent with neck pain and stiffness
- Made worse by neck movement
- No hearing loss or tinnitus
- May have nausea
- Disturbance of proprioceptive input from neck implicated

Could normalizing proprioceptive input help?
What’s in the literature?

1977 DeJong & DeJong produced ataxia & nystagmus with injection of local anesthetic into neck
   – Cervicogenic vertigo recognized (yet disputed)

1995 Karlbert et al showed pt with cervicobrachial pain had poor postural control

2003 Schieppati et al demonstrated altered balance control with prolonged contraction of posterior neck muscles
2003 Treleaven, et al—WAD pt with neck pain and dizziness had greater joint position errors
2008 Montfoort—increased COR gain in WAD
Magnusson & Karlberg suggest SNS has role
   – Alarm & anxiety with dizziness and pain
   – Enhanced sympathetic drive
   – Impairs proprioceptive feedback
2006 Passatore & Rotta discuss involvement of SNS in chronic muscle pain syndromes (including the role of impaired proprioception in WAD/dizziness)
OMT effect on proprioceptors

- Manual manipulation & physiotherapy effective treating cervicogenic vertigo
  - Various studies
  - Clinical experience
- Improved ROM
- Decrease/normalize afferent input to VNC
- Restore low COR gain
Effects of Comprehensive Osteopathic Manipulative Tx on Balance in Elderly Patients

Pilot Study--JAOA June 2011
Lopez, King, Knebl, Kosmopoulos, Collins, Patterson
40 healthy patients aged 65 or older
3 balance tests (AP and mediolateral sway) on a force plate
Half received 4 weekly OMT
OMT Protocol

- Soft tissue & myofascial release (MFR) T1-L5 & sacral rock
- MFR shoulders & scapulae bilaterally
- Cervical spine (MFR, SCS, ME or soft tissue)
- OA & condylar decompression
- Venous sinus technique
- V-spread, frontal & parietal lifts
- CV4
- Recheck and treat other key tenderpoints
Results

- After visit # 4:
- Statistically significant decrease in AP sway for the eye-open test
- No statistically significant difference in mediolateral sway in either group
Patient 1

Dizziness without hearing loss

Good evidence for treating this patient with OMT
Patient 2

Dizziness without hearing loss

A 65-year-old woman presents with a chief complaint of dizziness. She describes it as a sudden and severe spinning sensation precipitated by rolling over in bed onto her right side. Symptoms typically last <30 seconds. They have occurred nightly over the last month and occasionally during the day when she tilts her head back to look upwards. She describes no precipitating event prior to onset and no associated hearing loss, tinnitus, or other neurological symptoms.
Benign Paroxysmal Positional Vertigo (BPPV)

Thought to be caused by debris in endolymph of posterior semicircular canal

Otoconia displaced from utricle
BPPV Characteristics

- Episodic vertigo
- Brought on by changes in head position
- “Rolling over in bed” common aggravating factor
- Episodes last 30 seconds to 2 minutes
- Rotatory nystagmus
- Uncommon in children and young adults
- Dix-Hallpike used diagnostically
Dix Hallpike Test for BPPV
(observe nystagmus & sx aggravation)
Particle repositioning treatment for BPPV

1. Have the patient lie down quickly onto her back.

2. First, turn the patient’s head to the symptomatic side at a 45° angle for 30–60 seconds.

3. Then turn the head to the opposite side for 30–60 seconds.

4. Finally, roll the head facing 45° downward on the same side. Return the patient to a sitting position.
Self Treatment of BPPV

Treatment of the dizziness
1. Sit on the bed positioned as above and with the pillow positioned as above.
2. Turn your head 45 degrees
   a. If your head turned to the right produced the most uncomfortable feelings, turn to the right in #3
   b. If your head turned to the left produced the most uncomfortable feelings, turn to the left in #3
3. Rapidly lie down in the bed turning your head to the above position, with your shoulders positioned on the pillow and your head touching the bed
4. Remain in that position for one minute
5. Turn your head 90 degrees toward the opposite side (45 degree angle but to the other side) without raising your head.
6. Remain in that position for one minute
7. Turn your head 90 degrees further in the direction you are presently turned (so you will be looking down at an angle), and move your body as necessary
8. Hold this position for 1 minute
9. Sit up in this manner:
   a. keep facing the direction your head was turned
   b. hang feet off the bed
   c. place your chin on your chest throughout the sitting up motion
10. Remain in that sitting position for one minute
11. Do not lie flat for 24 hours. A semi-recumbent position is best (recliner position).
12. Assume normal activity after 24 hours
Vestibular sedating drugs

E.g. meclizine; diazepam
Impair central processing
By decreasing sensory input, interfere with compensation
Sedation may also cause falling
Avoid use or use short term
Approach to Dizziness

History

– Description
– Timing and nature of episodes
– Precipitating factors
– Other conditions
– Drugs
Appreciate Functional Anatomy & Physiology

Consider three major components in achieving good balance
- Sensing the environment
- Central processing of information
- Musculoskeletal response

Consider the three dominant sensory inputs
- Vestibular
- Visual
- Somatosensory (proprioceptive)
Understanding Structure/Function relation makes the evaluation and treatment of patients with dizziness much more satisfying.