Dizziness

IU Medical Student Lecture at Purdue University
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Format of Presentation

- Types of Dizziness (I-IV)
- Dizzy Patient History
- Acute Vestibular Syndrome (AVS)
- List common peripheral and central causes of AVS
- Discuss why differentiating peripheral from central causes is important
- Review history and examination findings that help differentiate peripheral from central AVS
- Introduce infrared video-oculography and vestibular function testing
- Discuss specific peripheral and central disorders in case presentation format
- Q&A

Types of Dizziness

- Type I - Vertigo - "spinning" sensation, mild or intense
  - vestibular migraine (#1 cause) - 50%
  - BPPV (Benign Paroxysmal Positional Vertigo) - 15%
  - vestibular neuritis/labyrinthitis - 12%
  - Meniere's disease - 3%
  - stroke or MS (multiple sclerosis)

From BalanceMD study of every new 'dizzy' patient seen (904) in 2014

Types of Dizziness

- Type II - Presyncopal Dizziness - feel faint, transient tunnel vision
  - (orthostatic) hypotension ± related to BP meds
  - vasovagal
  - cardiac arrhythmia

Types of Dizziness

- Type III - Disequilibrium Dizziness - mostly imbalance
  - vestibular migraine (not classically placed in this category)
  - vestibular nerve hypofunction
  - loss of 2 of 3 - inner ear, vision, proprioception
    - peripheral neuropathy - B12 deficiency - and close eyes
    - vision loss (macular degeneration, glaucoma) in combination with a peripheral neuropathy or vestibular nerve hypofunction
  - multifactorial and presbyastasis (age-related)
  - medication side effect - incorrectly felt to be more common than it really is
  - central - cerebellum, brainstem, spinal cord - neurologic symptoms - rare

Types of Dizziness

- Type IV - Non-specific Dizziness (antiquated categorization)
  - vague description
  - stress and/or anxiety related
  - reproduced by hyperventilation
- CAUTION
  - vague description is common in migraine
  - **anxiety related is uncommon - but there is a new ICD-11 diagnosis of 3PD - Persistent Postural-Perceptual Dizziness - treated mainly with SSRI medications**
  - hyperventilation-induced dizziness or vertigo could be due to a tumor

History

- Dizziness vs Vertigo - Characteristics
- Associated Symptoms
- Duration and Frequency of symptoms
- Triggers
- **Migraine Questions**
- Past Ear History
- Past Medical History
- Medication History

Dizziness vs Vertigo - Characteristics

- Single Spell
- Constant
  - Better - what makes it better?
  - Worse - what makes it worse?
  - Same
- Episodic
  - Duration
  - Frequency
  - Severity
  - Triggers

Associated Symptoms

- Headache or Prior History of Headache
- Photophobia or Phonophobia
- Nausea or Vomiting
- Tinnitus
- Hearing Loss
- Aural Fullness
- Neurologic Symptoms - diplopia, visual field loss, incoordination, dysarthria, weakness, numbness
- Syncope or pre-syncope

Duration

- Seconds - **Migraine**, BPPV, Cardiovascular
- Minutes - **Migraine**, Anxiety, Meniere's, TIA
- Hours - **Migraine**, Meniere's
- Days - **Migraine**, Vestibular Neuritis
- Chronic - **Migraine**, 3PD (anxiety-related), Multifactorial Disequilibrium, Ototoxins, Stroke or Brain Tumor, Paraneoplastic Syndrome

Triggers

- Head Position
- Head Movement
- Visual Stimuli, including bright lights or complex patterns
- Weather Changes
- Lack of Sleep
- Hormonal Changes
- Anxiety / Stress
- Dietary items or Lack of Food
- Pressure Changes or Loud Noise (Tullio's)

Focus - Type I Dizziness
Acute Vestibular Syndrome

Define Acute Vestibular Syndrome (AVS)

- Dizziness or Vertigo that develops acutely
- May be accompanied by nausea/vomiting, gait instability, nystagmus and/or head-motion intolerance
- Persists for a day or longer (but symptoms come and go)

Causes of AVS

Peripheral

- BPPV* (#2)
- Vestibular Neuritis
- Labyrinthitis
- Meniere's*
- Trauma
- Stroke (Labyrinthine artery)
- Autoimmune Inner Ear Disease

Central

- Migraine(#1)
- Stroke (brainstem/cerebellum)
- Multiple Sclerosis
- Trauma
- Toxicity
- Wernicke syndrome
- Encephalitis

*Individual spells rarely last > 24 hours

Why is Differentiating Important?

- If you don't know why the patient is dizzy, you will not likely provide the most appropriate treatment
  - Where is it?
  - What is it?
- Unidentified brainstem/cerebellar stroke may lead to death
- Reduce unnecessary CT/MRI scans

AVS Clinical History

- Characteristics of vertigo - duration, isolated or recurrent, triggers, associated symptoms
- Prior history of dizziness/vertigo
- History of migraine
- History of cancer
- History of autoimmune disease
- Recent trauma
- Vascular risk factors
- Current or prior neurologic symptoms
- Hearing loss

AVS Clinical Symptoms

Peripheral

- Dizziness/Vertigo
- Nausea/Vomiting
- Imbalance - but able to walk
- Hearing loss
- Tinnitus

Central

- "Peripheral" PLUS
- Double vision/visual field loss
- Face and/or limb weakness or numbness
- Dysarthria/dysphagia
- Ataxia
- Imbalance - unable to walk

AVS Exam Findings

Peripheral

- Nystagmus - Horizontal (follows Alexander's law) or torsional - fixation-suppression
- Positive head thrust test
- Hearing loss
- Unsteady, but able to walk

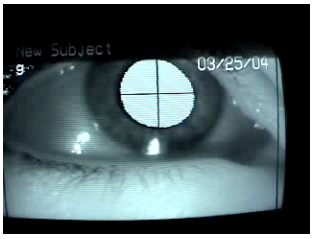
Central

- Horizontal, torsional, vertical or direction-changing - NO fixation-suppression
- Weakness of CN 3,4,6, INO, skew deviation
- Asymmetric pursuit, saccades or OKN
- Neurologic exam abnormal
- Unsteady and UNable to walk

Vestibular Function Testing

http://www.balancemd.net/Vestibular_Function_Test.html

Infrared Video-oculography



Vestibular Function Evaluation

- Utilizes infrared video goggles
- Series of tests to analyze and differentiate between peripheral and central causes
  - Spontaneous and positional nystagmus
  - Caloric testing
  - Pursuit, Saccades, OKN
  - Rotational chair*
  - VEMP*
  - Audiogram
- Results direct appropriate treatment

*Very few facilities offer

Peripheral vs Central

An Aside

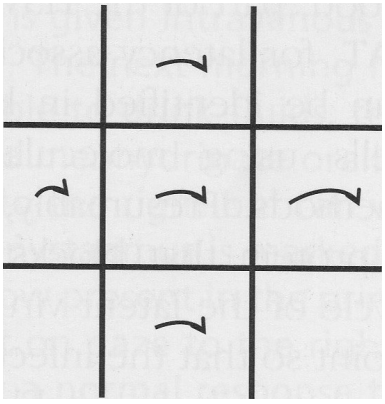
- Our knowledge and technology when it comes to the diagnosis and treatment of dizziness/vertigo/imbalance has literally exploded in the past 2 decades
- No one can properly treat the "dizzy" patient without knowing the underlying cause
- Treatment, depending on the cause, might include
  - Canalith repositioning maneuver specific for BPPV type
  - Medication (not meclizine or diazepam unless acute vestibular loss)
  - PT/vestibular rehabilitation
- CT/MRI, carotid doppler, EEG, EKG, Labs rarely help establish diagnosis

Peripheral vs Central

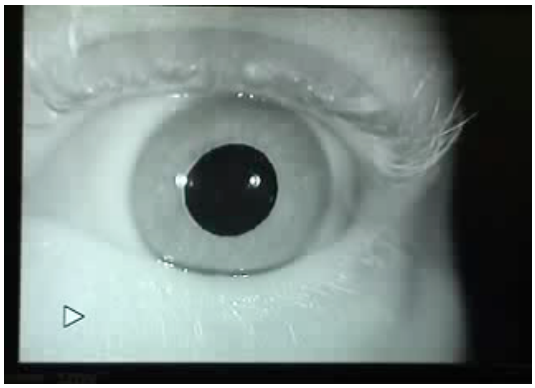
	Peripheral	Central
Nausea and vomiting	Severe	Variable, may be absent
Imbalance	Mild to moderate	Severe
Neurological symptoms	Rare	Common
Nystagmus	Unidirectional in all gaze positions; inhibited with fixation	Direction changing in different gaze positions; not inhibited with fixation
Head thrust test	Positive	Negative
Compensation	Rapid	Slow

Peripheral Eye Findings

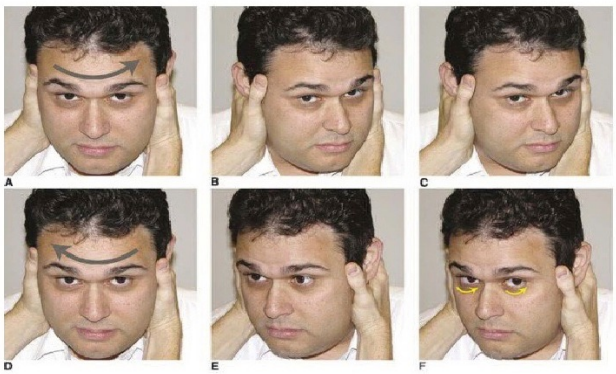
Alexander's Law



Alexander's Law

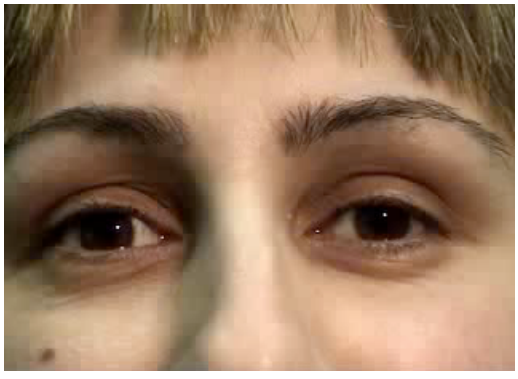


Head Thrust Test



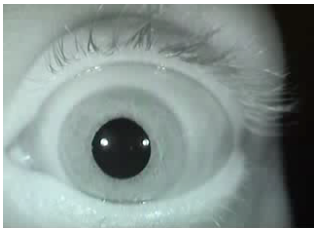
Central Eye Findings

Bilateral INO



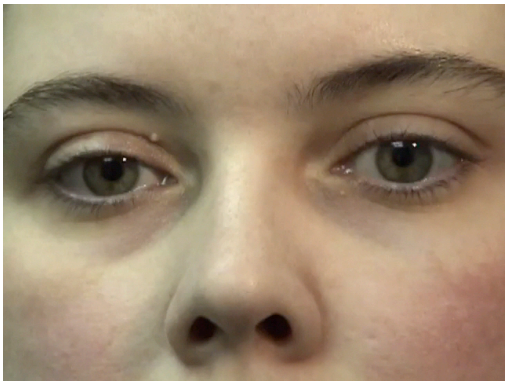
Nystagmus

Upbeat



Downbeat

Pendular Nystagmus



Peripheral Cases (Classic Presentations)

- Benign Paroxysmal Positional Vertigo (BPPV)
- Vestibular Neuritis
- Meniere's Syndrome

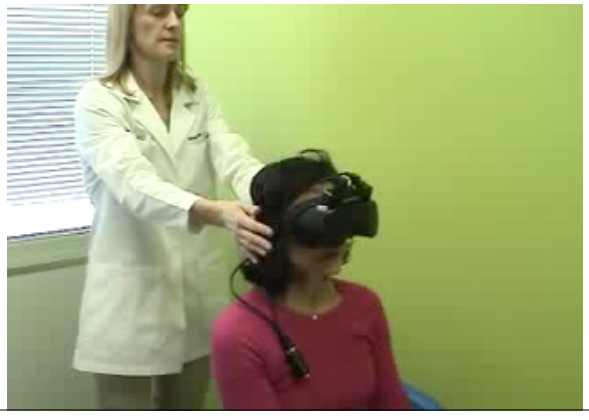
BPPV

http://www.balancemd.net/BPPV.html

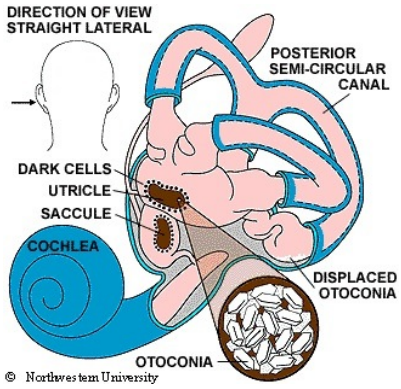
Benign Paroxysmal Positional Vertigo (BPPV)

- 52 year old woman who has started sleeping with her head elevated on 3 pillows because she usually develops vertigo laying down in bed
- Vertigo lasts 10-15 seconds and may also occur when she gets up from bed, rolls over in bed, looks up or looks down
- She was evaluated in the ER and given meclizine, but this just made her sleepy

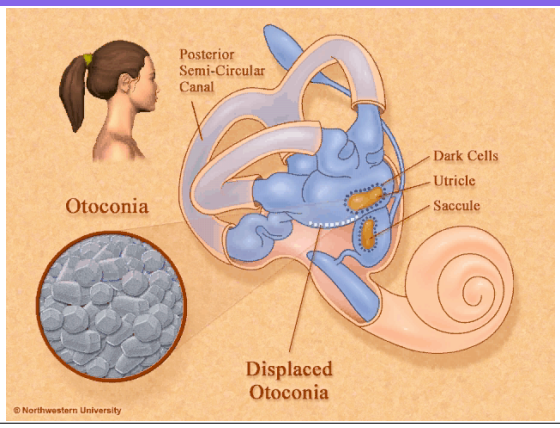
Dix-Hallpike Position for Posterior Canal BPPV



Otoconia "Crystals"



"Crystals" Displaced into Posterior Canal



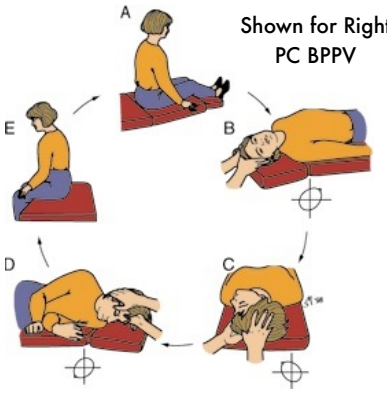
Treatment of PC BPPV

- Canalith Repositioning Maneuvers (CRM)
  - (modified) Epley
  - Semont
  - Half Somersault
- **NOT** vestibular suppressant medications (meclizine, diazepam, phenergan) or habituation exercises (Cawthorne-Cooksey, Brandt-Daroff) or have the patient do their own Epley maneuver at home 10 times/day

(Modified) Epley Maneuver

Turn head to left and move opposite direction for Left PC BPPV

Shown for Right PC BPPV

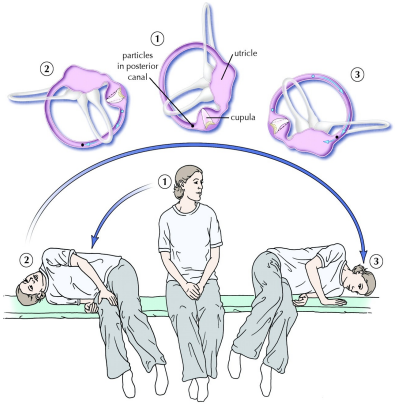


(Modified) Epley Maneuver

Shown for Right PC BPPV

Turn head to left and move opposite direction for Left PC BPPV

Semont Maneuver for Right PC BPPV

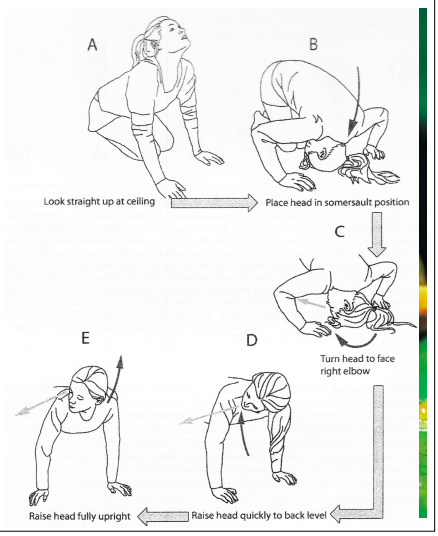


Opposite for left PC BPPV

Half Somersault for Right PC BPPV

Audiology & Neurotology 2012;2:16-23

Head turn to left elbow in "C" for Left PC BPPV



The Goal of CRMs

- Put the "crystals" back in the utricle
- Enzymes (dark cells) that dissolve loose "crystals"

BPPV

- Associations
  - Maturity :-)
  - Head Injury
  - After vestibular neuritis/ labyrinthitis
  - Meniere's
- Treatment
  - CRM - Canalith Repositioning Maneuver
  - Maneuver to perform depends on type of BPPV (see Table)
  - For PSC BPPV - 92% cure after 1 maneuver - 99% after 3 maneuvers
- Prognosis
  - Excellent
  - 30% recur in first year, then 15% per year

Variations of BPPV

Canal	Position	Nystagmus	Treatment (CRM)
Posterior (85-90%)	Dix-Hallpike	Upbeat rotational	Epley, Semont
Horizontal (5-10% including Cupulolithiasis*)	Supine, head elevated	Horizontal geotropic	Lempert
Anterior (2-3%)	Dix-Hallpike	Downbeat rotational	Epley from deep Hallpike

*Cupulolithiasis - "crystals" stuck to cupula

BPPV is over diagnosed

Vestibular Neuritis

http://www.balancemd.net/Vestibular_Neuritis.html

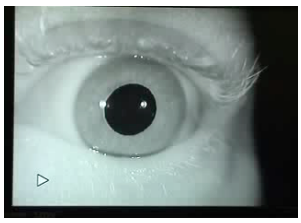
Vestibular Neuritis

- 61 year old man with no prior medical history, except for a recent viral illness, awakened from sleep with the room spinning and crawled to the bathroom to vomit
- He was taken to the ER and given IVF and anti-emetics, underwent MRI, EKG, basic labs, all normal
- He was admitted for observation, then released the next day, no longer with vertigo, but dizziness exacerbated by head movement and gait instability

Vestibular Neuritis

Examination

- Vestibular function evaluation
  - right-beat nystagmus
  - left caloric weakness
  - VOR asymmetry
- Positive head thrust to the left
- No focal neurologic findings
- No hearing loss (if hearing loss, then Labyrinthitis)
- Unstable gait, but able to walk



Vestibular Neuritis

Treatment

- Pulse of prednisone
- Vestibular suppressants for a few days, then discontinue
- PT / vestibular rehabilitation - promotes central (brain) compensation for the damaged vestibular nerve

Prognosis

- Excellent - near 100% recovery over 1-3 months with rare recurrence
- May develop BPPV

Meniere's Disease

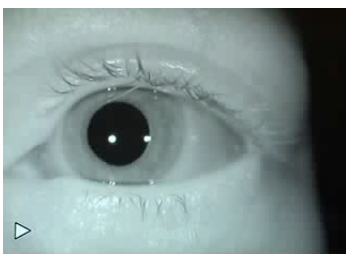
http://www.balancemd.net/Meniere_s_Syndrome.html

Meniere's Syndrome

- 47 year old man presents with the sudden onset of fullness, pressure, roaring tinnitus and hearing loss on the right, followed by a 3 hour spell of vertigo
- He stays in bed and finally falls asleep, awakening feeling nearly back to normal
- He has several more spells over the next couple of months, noting spells triggered after eating a salty meal

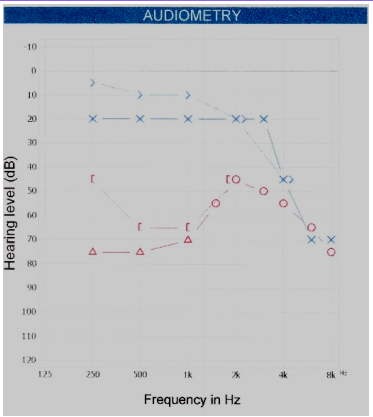
Meniere's Syndrome

- Examination (in between attacks)
  - Vestibular function evaluation - normal
  - Audiogram - low frequency sensorineural hearing loss
  - No focal neurologic findings



Nystagmus during an attack

Meniere's Syndrome



Meniere's Syndrome

Treatment

- Diet - low sodium, reduce caffeine and alcohol
- Medications
  - acute - vestibular suppressants (diazepam, meclizine), prednisone
  - chronic - diuretic (triamterene-HCTZ)
- Surgery
  - transtympanic steroid or gentamicin
  - endolymphatic shunt
  - labyrinthectomy

Prognosis

- chronic disease with 20-50% bilateral

Over diagnosed

- diagnostic criteria includes hearing loss
- 20:1 Migraine:Meniere's

Central Cases

- Migraine
- Cerebellar Stroke
- Multiple Sclerosis

Vestibular Migraine

http://www.balancemd.net/Vestibular_Migraine.html

Migraine-associated Dizziness

- 41 year old woman presents with morning dizziness, which she finds difficult to describe, often lasting several hours
- She had problems with migraine headaches when she was in high school and college, but only has an occasional mild headache lately
- Her symptoms worsen when driving, going into the grocery store, when under fluorescent lights, and looking at patterns of carpeting or clothing that are visually 'busy'
- Examination is normal

Migraine-associated Dizziness

Treatment

- Identification and modification/elimination of triggers
- Preventative Medications
  - Tricyclic
    - amitriptyine
    - nortriptyline
  - Anti-hypertensive
    - verapamil
    - propranolol
  - Anti-seizure
    - valproic acid
    - topirimate
    - gabapentin

Prognosis - Excellent!

Migraine-associated Dizziness

- The #1 cause of dizziness
- Under-recognized
- Often have mild or no concurrent headaches, but usually have a headache history ('sinus headache' = migraine)

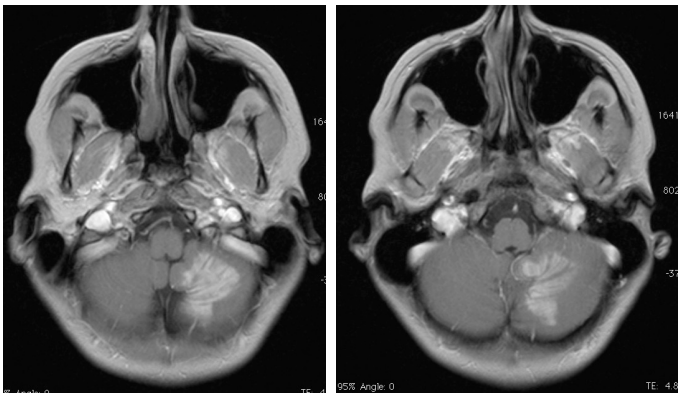
Cerebellar Stroke

- 22 year old college student who had been studying for finals developed a sore neck and went to her chiropractor, where she had a neck manipulation performed
- Later that evening, she was at a bar with friends celebrating the end of the semester when she became acutely vertiginous
- She began to vomit and was unable to walk
- Her friends carried her into the ER, where she underwent a CT of the brain and was discharged with a prescription for meclizine and phenergan

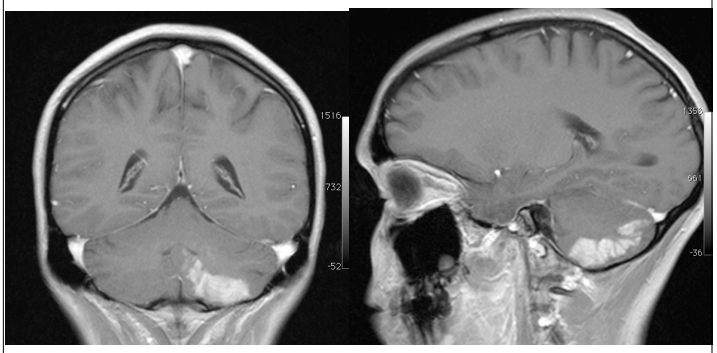
Cerebellar Stroke

- As she was still unable to walk, her friends carried her back to her apartment, where she continued to vomit for the next 12 hours
- She also felt that the world was "shifted to the left"
- Her tongue and lips felt numb
- She had diplopia when she tried to focus
- She had a focal headache on the left, from the back of her head to behind her left eye

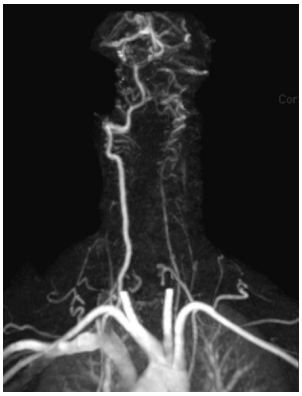
Cerebellar STroke

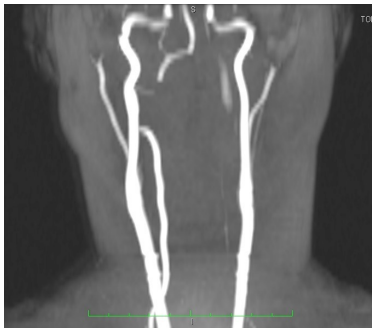


Cerebellar STroke



Cerebellar Stroke



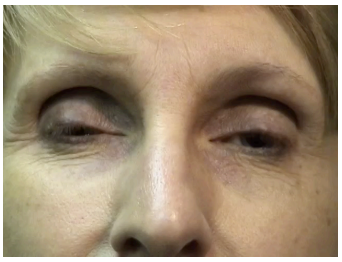


Multiple Sclerosis

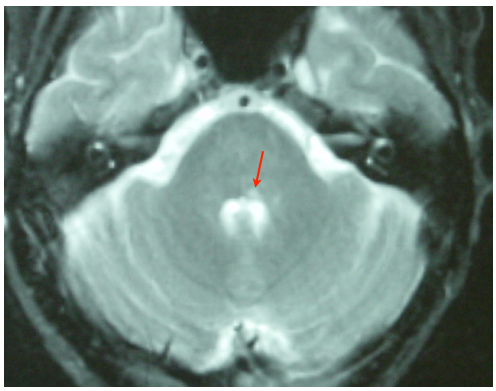
- 55 year old woman presents with recent onset diplopia, dizziness and imbalance
- She has a prior history of vision loss in one eye when she was in her 20s. The vision returned in a month to (near) normal
- She was diagnosed with a stroke based on "small vessel ischemic changes" on her MRI

Multiple Sclerosis

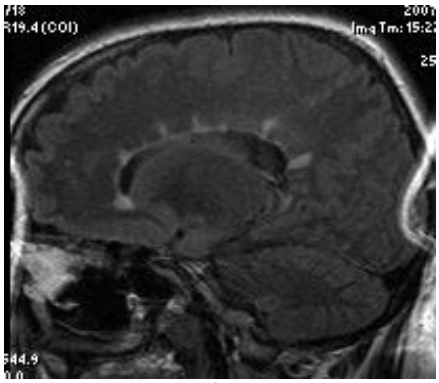
- Examination
  - Rightward saccades are abnormal, revealing a slow left medical rectus saccade and right abducting nystagmus = left INO
  - Pale right optic nerve with a small RAPD



MLF Lesion of INO



Multiple Sclerosis



Dawson's Fingers

3PD - New in ICD-11

http://www.balancemd.net/3PD.html

3PD - What is it?

- Persistent Postural-Perceptual Dizziness
- Non-vertiginous, waxing-waning dizziness and/or unsteadiness, persisting for at least 3 months, with symptoms present at least 15 days per month, but typically daily
- Often often follows a separate triggering event (vestibular neuritis, vestibular migraine, head injury) that caused dizziness, vertigo or unsteadiness
- With the anxiety or worry over an underlying sinister cause or with the anticipation of having another vestibular event, symptoms of 3PD develop

3PD Symptoms

- Dizziness and /or unsteadiness, worse when upright, head or body in motion, and in visually busy environments, becoming worse later in the day
- Exacerbation of symptoms in grocery or large stores, when reading, scrolling on the computer or cell phone, and with exposure to complex patterns on carpeting, wallpaper or clothing
- Dizziness and/or unsteadiness become intrusive and those affected often report trouble focusing/ concentrating or "brain fog"

3PD Treatment

- Medications - benzodiazepines and SSRIs (selective serotonin reuptake inhibitors)
- Vestibular rehabilitation therapy
- Cognitive behavioral therapy

Summary of AVS

- Most common causes
  - Central - Migraine (#1 overall)
  - Peripheral - BPPV (#2 overall)
- Listen to the patient's description of symptoms
  - Probe about a prior history of headaches
  - Inquire about hearing loss or neurologic symptoms
- Observe for nystagmus, do head thrust test
- Treat BPPV if present (>90% instant cure)
- Proceed with highest value diagnostic test if necessary
  - Vestibular function evaluation - VNG, Rotary Chair, VEMP, Audiogram
  - MRI brain if neurologic signs or symptoms or abnormalities on vestibular testing
- Treatment is individualized and based on most likely diagnosis

Summary of AVS

Treatment based on diagnosis

- BPPV - determine canal and perform appropriate CRM
- Migraine - eliminate triggers, preventative medication
- Vestibular Neuritis - prednisone pulse, short-term vestibular suppressant, PT/vestibular rehabilitation
- Meniere's Syndrome - short-term vestibular suppressant, low salt diet and other dietary modifications, diuretic, sometimes PT/vestibular rehabilitation if inactive Meniere's and have fixed deficit
- Multiple Sclerosis - steroid treatment, then DMA and PT depending on response to steroid
- Stroke - short-term vestibular suppressant, vascular and vascular risk factor evaluation/modification, appropriate antiplatelet or anticoagulant, PT
- Trauma - determine cerebellar/brainstem contusion, vestibulopathy (peripheral) and/or BPPV - PT specific to the underlying deficits

Summary of AVS

- Vestibular suppressant medications - meclizine, diazepam, promethazine
  - Should RARELY be used more than 3 days at a time
  - Indications include AVS or motion sickness associated with travel
  - Prolonged use PREVENTS patient recovery from vestibular nerve disfunction and interferes with PT/vestibular rehabilitation in general
  - Especially in elderly, may lead to increased risk of falls

Thank You - Questions?

BalanceMD
Solutions for Dizziness and Hearing Loss

www.BalanceMD.net