

Overview of dizziness and balance disorders


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Lecture Goals

- Describe distribution of causes of dizziness, including both otologic and non-otologic types.
- Describe heuristics for diagnosis of dizziness
- Provide examples of how neurological considerations impact the utility of audiologic tests in diagnosis of vertigo

Dizziness is an imprecise term

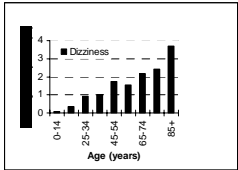
- Vertigo (sensation of motion)
- Lightheaded
- Ataxia
- Confusion



Because “Dizziness” is an imprecise term, a major role of the clinician is to sort patients

Dizziness is VERY Common

- Dizziness is the chief complaint in 2.5% of all primary care visits.
- 30% lifetime prevalence of dizziness requiring medical attention
- Older people have more dizzy problems



Age (years)	Percentage
0-14	0.1
15-24	0.2
25-34	0.3
35-44	0.5
45-54	0.8
55-64	1.2
65-74	1.8
75-84	2.5
85+	3.5

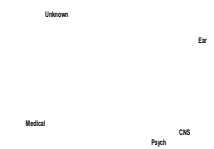
Diagnostic Categories

Category	Example
<ul style="list-style-type: none"> Otological Neurological Medical Psychological Undiagnosed 	<ul style="list-style-type: none"> Meniere's disease Migraine Low BP Anxiety Post-traumatic vertigo

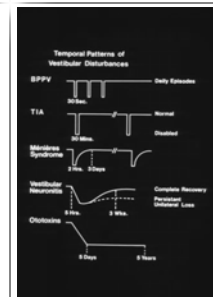
Question 1

- Which category is associated with the most dizziness ?
 - Inner ear disorders
 - CNS problems (e.g. Stroke)
 - Blood pressure
 - Psychological problems
 - Undiagnosed

	Answer 1
	<ul style="list-style-type: none"> ■ It depends on your specialty <ol style="list-style-type: none"> 1. Inner ear disorders (about 50% of ENT, 30% in general) 2. CNS (about 25% of neurology, 5% everyone else) 3. Blood pressure (30% of family practice, 5% everyone else) 4. Psychological problems (15% to 50%) 5. Undiagnosed (up to 50%)

	Implications for ENG testing
	<ul style="list-style-type: none"> ■ ENG tests should be negative in about half of causes of dizziness (e.g. orthostatic hpn, migraine headache, psychiatric, intermittent) ■ "No measurable otologic disorder" should be a common conclusion ■ Few ENG's should suggest a "central" disorder 

	Tertiary care heuristics: multiple causes of dizziness, overlapping signs/symptoms
	<ul style="list-style-type: none"> ■ Complete history (questionnaire) ■ Examination (otological, neurological, some medical, some psychiatry) ■ Pick off easy ones – BPPV, Menieres, Orthostatic hpn. ■ Have a plan to deal with the rest → <p>http://www.dizziness-and-balance.com/practice/default.htm</p>

	Tertiary Care Heuristics-2
	 <ul style="list-style-type: none"> ■ For remaining, group into etiologic categories and send for tests or attempt treatment □ Or regroup into timing based categories and send for tests or attempt treatment

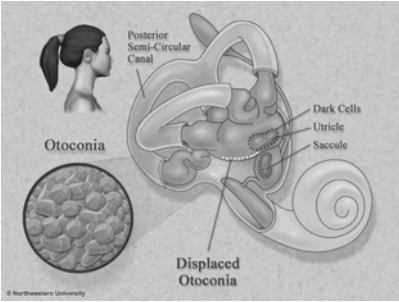
	Otologic Dizziness
	<ul style="list-style-type: none"> ■ BPPV (benign paroxysmal positional vertigo) -- about 50% of otologic, 20% all ■ Meniere's disease -- about 20% ■ Vestibular neuritis and related conditions (15%) ■ Bilateral vestibular loss (about 1%) ■ Fistula and related conditions

	Positional Vertigo The most common syndrome
	<ul style="list-style-type: none"> ■ Benign Paroxysmal Positional Vertigo (BPPV) ■ Orthostatic hypotension ■ Central positional nystagmus ■ Low CSF pressure syndrome

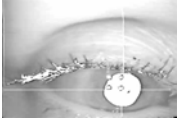
	Benign Paroxysmal Positional Vertigo (BPPV)
	<p>61 Y/O man slipped on wet floor. LOC for 20 minutes. In ER, unable to sit up because of dizziness Hallpike Maneuver: Positive</p>

	Positional Vertigo Dix-Hallpike Maneuver
	 <p>Frenzel Goggles</p>

	Benign Paroxysmal Positional Vertigo (BPPV)
	<ul style="list-style-type: none"> ■ 20% of <u>all</u> vertigo ■ Brief and strong ■ Provoked by change of head position ■ Definitively diagnosed by Hallpike test

	BPPV Mechanism: Utricular debris migrates to posterior canal
	


	BPPV Differential
	<ul style="list-style-type: none"> ■ Orthostatic Hypotension <ul style="list-style-type: none"> - Low blood pressure on standing (90/60 typically) ■ Central positional nystagmus <ul style="list-style-type: none"> - Very rare, usually a conclusion after BPPV rx fails. Nonfatiguable nystagmus. Prominent ataxia. ■ Low CSF pressure <ul style="list-style-type: none"> - Dizziness and headaches on standing - Normal blood pressure

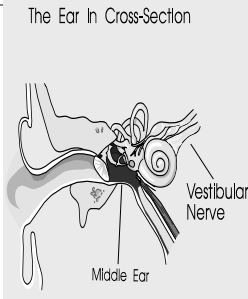
	BPPV Variants
	<ul style="list-style-type: none"> ■ Lateral canal (DCPN) ■ Anterior canal (DBN) <div style="text-align: center;">  <p>Direction changing Horizontal Nystagmus due to Lateral Canal BPPV</p> </div>

	Unilateral Vestibular Loss
	<ul style="list-style-type: none"> ■ Vestibular Neuritis/Labyrinthitis ■ Meniere's disease (unusual, 1/2000 prevalence) ■ Acoustic Neuroma (very rare)

	Vestibular Neuritis: Case
	<p>56 y/o woman began to become dizzy after lunch. Dizziness increased over hours, and consisted of a spinning "merri-go-round" sensation, combined with unsteadiness.</p> <p>Vomiting ensued 2 hours later, and she was brought by family members to the ER.</p>

	Vestibular Spontaneous Nystagmus seen with video Frenzel Goggles
	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;">  <ul style="list-style-type: none"> •Low amplitude, away from bad ear •Greater in dark •Greater in direction fast phase </div> </div>

	Aside: how to detect SN without an ENG
	<ul style="list-style-type: none"> ■ Frenzel Goggles (best) ■ Ophthalmoscope (good – but backwards) ■ Gaze-evoked nystagmus (pretty good) ■ Sheet of white paper (neat) <div style="text-align: right; margin-top: 20px;">  </div>

	Vestibular Neuritis: Rx
	<ul style="list-style-type: none"> ■ Steroids (NEW), symptomatic Rx (meclizine, phenergan, benzodiazepine) ■ Rehab if still symptomatic after 2 months. ■ These patients can still get BPPV ! <div style="text-align: center; margin-top: 20px;">  <p style="font-size: small;">The Ear In Cross-Section</p> </div>

	Bilateral Vestibular Loss
	<p>A stewardess developed a toe-nail infection. She underwent course of gentamicin and vancomycin. 12 days after starting therapy she developed imbalance. 21 days after starting, she was "staggering like a drunk person". Meclizine was prescribed. Gentamicin was stopped on day 29. One year later, the patient had persistent imbalance, visual symptoms, and had not returned to work. Hearing is normal. She unsuccessfully sued her doctor for malpractice.</p>

SYMPTOMS OF BILATERAL VESTIBULAR LOSS




- OSCILLOPSIA
- ATAXIA



SYMPTOMS OF BILATERAL VESTIBULAR LOSS

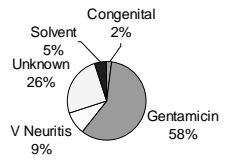
- ATAXIA

ECTR – eyes closed tandem romberg
 ECRR – eyes closed regular romberg
 EOTR – eyes open tandem
 EORR – eyes open regular



Bilateral Vestibular Loss Causes:

- Ototoxicity !
- Bilateral forms of unilateral disorders (e.g. bilateral vestib neuritis)
- Congenital (e.g. Mondini malformation)
- idiopathic



Cause	Percentage
Gentamicin	58%
Unknown	26%
V Neuritis	9%
Solvent	5%
Congenital	2%

N=43, NMH 1990-1998


DIAGNOSIS IS EASY

- History of recent IV antibiotic medication
- Eyes closed tandem Romberg is positive
- Dynamic illegible 'E' test (DIE) failed

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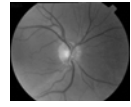
Dynamic Illegible 'E' test (DIE test)

- Distance vision with head still
- Distance vision with head moving
- Normal: 0-2 lines change.
- Abnormal: 4-7 lines change



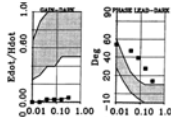
DIAGNOSIS Continued

- Ophthalmoscope test is failed too

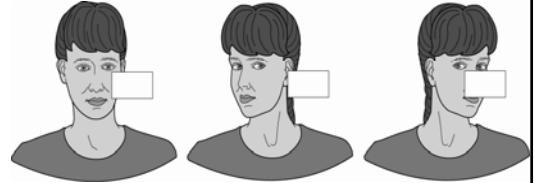
DIAGNOSIS Continued

- ENG and Rotatory chair confirm diagnosis



Treatment of Bilateral Loss

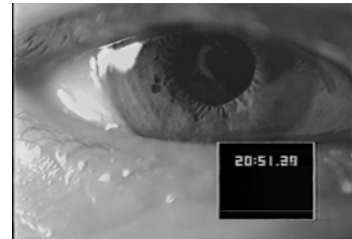
- Avoidance of ototoxins
- Physical Therapy



Case: WS

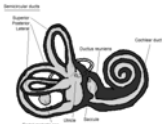
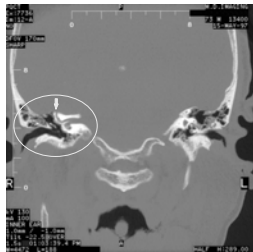
Retired plastic surgeon, with impaired hearing related to war injuries, found that complained that when he went to church, when organ was playing, certain notes made him stagger. His otolaryngologist noted that during audiometry (with hearing aid in), certain tones reliably induced dizziness and a mixed vertical/torsional nystagmus. This "Tullio's phenomenon" could be easily reproduced experimentally. MRI scan was normal.

Tullios



Superior Canal Dehiscence

Pressure in ear causes endolymph movement in superior canal



Tullio


Nystagmus with loud noise

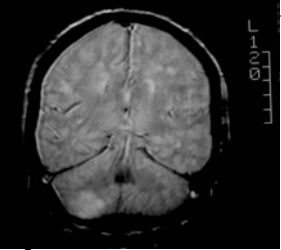
Abnormal VEMP/T-bone CT


Diagnostic Categories

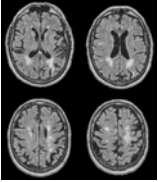
- Otological (Vertigo or ataxia)
- Neurological (i.e. posterior fossa)
- Medical (i.e. low blood pressure)
- Psychological (anxiety)
- Undiagnosed


Causes of Neurological Dizziness 15-30% subspecialty, 5% ER	
<ul style="list-style-type: none"> ■ 35% Stroke and TIA ■ 16% Migraine ■ Ataxias ■ Seizures ■ Multiple Sclerosis ■ Tumors ■ Head Trauma 	

Common Strokes with Dizziness	
<ul style="list-style-type: none"> ■ SCA (cerebellar) ■ AICA (pons and cerebellum) ■ PICA (lateral medullary and cerebellum) – 	

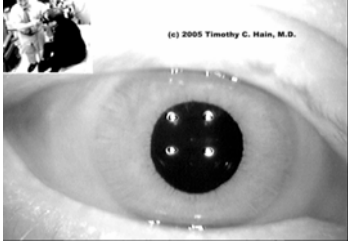
Case HA	
<ul style="list-style-type: none"> ■ 50 year old OB doctor developed vertigo and unsteadiness ■ Continued to deliver babies for a week before seeking medical attention ! (but wife wouldn't let him drive). ■ PICA stroke seen on MRI 	

Strokes and dizziness	
<ul style="list-style-type: none"> ■ SCA <ul style="list-style-type: none"> – Ataxia, overshoot dysmetria ■ AICA <ul style="list-style-type: none"> – Hearing loss, facial weakness, ataxia ■ PICA – <ul style="list-style-type: none"> – Ptosis, ataxia, hoarse voice, nystagmus, overshoot dysmetria 	

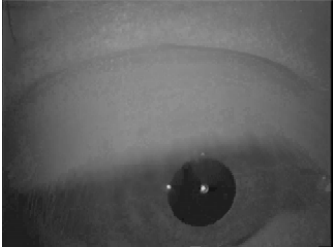
Ataxias – includes most of neurology	
<ul style="list-style-type: none"> ■ Cerebellar ■ Basal Ganglia ■ Hydrocephalus ■ Sensory loss (B12) ■ Bilateral vestibular loss ■ Periventricular WM lesions 	<ul style="list-style-type: none"> ■ Drugs (e.g. anticonvulsants) ■ Degenerations 


Saccadic Nystagmus may be clue to underlying cerebellar damage	
	

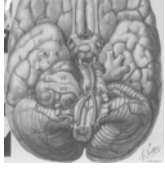
	<p>Computerized ENG's do NOT detect saccadic nystagmus: Look at your patient's eyes !</p>
	<ul style="list-style-type: none"> ■ Small saccadic oscillations are too fast for relatively slow sampling rate of contemporary ENG systems (30 hz) ■ VNG tracking artifact looks identical to saccadic nystagmus ! ■ Blink rejection algorithms reject saccadic nystagmus

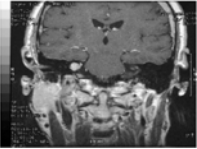
	<p>Watch out though</p>
	 <p style="font-size: small;">(c) 2005 Timothy G. Hain, M.D.</p>

	<p>Other reasons to look at your patient's eyes</p>
	<ul style="list-style-type: none"> ■ Blind people don't track ■ <u>Oculomotor palsies</u> are easy to see at the bedside but harder to see on recordings ■ Some disorders are very easy to see on direct inspection (such as CN) ■ <u>Inconsistency</u> between direct exam (normal) and testing (convergence) suggests lack of cooperation. <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">Fix</div> </div> <div style="display: flex; align-items: center; margin-top: 10px;">  <div style="margin-left: 10px;">Dark</div> </div>

	<p>This patient's ENG was interpreted as "normal"</p>
	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Patient blind in one eye, 6th nerve palsy in other eye, ENG lab didn't comment about either.</p> </div> </div>

	<p>Latent Nystagmus – another reason to look at patient's eyes.</p>
	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>If you don't know patient has an esophoria, you might miss a Latent Nystagmus</p> </div> </div>

	<p>Brain Tumors Causing Dizziness We worry a lot about these rare disorders</p>
	<ul style="list-style-type: none"> ■ Acoustic Neuroma – just 10 tumors/million persons/year (Evans et al, 2005) ■ Meningioma ■ Cerebellar astrocytoma ■ Cerebellar hemangioblastoma <div style="text-align: right;">  </div>


	<h3>Brain tumors are generally NOT diagnosed with audiological testing</h3>
	<ul style="list-style-type: none"> ■ MRI with gadolinium is the procedure that identifies brain tumors. ■ MRI's also identify MS and strokes ■ For a clinician, an MRI is a far more efficient diagnostic procedure than an ABR. 

	<h3>Seizures causing Dizziness</h3>
	<ul style="list-style-type: none"> ■ Quick spins (1-2 seconds) <ul style="list-style-type: none"> – Also caused by vestibular nerve irritation/surgery (Moon and Hain, 2005) ■ <u>Confusion</u> and dizziness ■ May be triggered by flashing lights ■ Head injury is common antecedent

	<h3>Migraine & Vertigo: Prevalence is huge</h3>
	<ul style="list-style-type: none"> ■ Migraine: <ul style="list-style-type: none"> – 10% of U.S. population has Migraine† – 20-30% of women childbearing age ■ Vertigo: 35% of migraine population.* ■ Migraine + vertigo (MAV): <ul style="list-style-type: none"> – ~ 3.5% of U.S. pop. – ~ 10% of women of childbearing age <p>† Lipton and Stewart 1993; Stewart et al, 1994 * Kayan/Hood, 1984; Selby/Lance, 1960; Kuritzky, et al, 1981</p>

	<h3>Diagnosis of MAV</h3> <p>Clinical judgment – not ENG</p>
	<ul style="list-style-type: none"> ■ Headaches and dizziness ■ Lack of alternative explanation (normal otological exam, neurological exam, CT) ■ High index of suspicion in women of childbearing age. Perimenstrual pattern. ■ Family history in 50% ■ Response to prophylactic medication or a triptan

	<h3>Diagnostic Categories</h3>
	<ul style="list-style-type: none"> ■ Otological (Vertigo or ataxia) ■ Neurological (i.e. posterior fossa) ■ Medical <ul style="list-style-type: none"> ■ Psychological (anxiety, malingering) ■ Undiagnosed

	<h3>“Medical Dizziness”</h3> <h4>30% of ER cases</h4>
	<ul style="list-style-type: none"> ■ Cardiovascular (23-43%) <ul style="list-style-type: none"> – Orthostatic hypotension – Arrhythmia ■ Infection (4-40%) ■ Medication (7-12%) ■ Hypoglycemia (4-5%)  <p>Source: Madlon Kay (85), Herr et al (89)</p> <p><small>Rapid improvement with sitting, squatting, or recumbency strongly suggests near-syncope. Once symptoms begin to improve, patients usually regain normal alertness over several seconds to a few minutes.</small></p>

Medical Dizziness

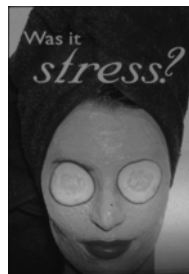
- Otologic testing should be entirely normal
- Audiologists should be aware that dizziness that only occurs on standing is unlikely to be otologic (should be cardiac)

Psychogenic Vertigo

- Anxiety, hyperventilation, panic, Agoraphobia
- Somatization
- Malingering

Anxiety

- Long-duration dizziness
- Situational
- Responds to benzodiazepines
- Some have vestibular disorders too

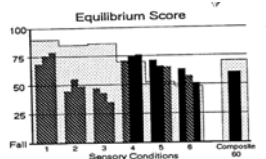


Somatization Disorder (SD) (used to be called neurotic)

- Chronic dizziness
- Numerous bodily ailments
- One goes away to be replaced by another
 - I.e. dizziness goes away, tinnitus replace it
 - Tinnitus goes away, replaced by fullness
- We don't have a treatment for SD.
- We do not tell these people there is "nothing wrong". Rather, we try to minimize the health-care cost.

We have many good otologic tests for malingering

- Moving Platform Posturography -- An algorithm for detecting inconsistency (Cevette score)



Malingering of hearing loss

- The "Stenger" – an awesome test !
- Consistency between various hearing measures (i.e. acoustic reflexes, subjective hearing)
- Many other methods of documenting factitious hearing loss are available.
 - OAE
 - Baer

	<h2 style="margin: 0;">Audiology and Malingering Big Picture</h2>
	<ul style="list-style-type: none"> ■ Audiology has many fantastic tests for malingering ■ Most physicians don't know that they exist (e.g. Stenger; Posturography, OAE). ■ Audiology is underutilized in diagnosis of malingering

	<h2 style="margin: 0;">Formulating your impression</h2>
	<ul style="list-style-type: none"> ■ Otologic (30-50%) – BPPV, Menieres, VN. ■ CNS (5-30%) – CVA, Migraine ■ Medical (5%-30%) Orthostatic, drug ■ Psychiatric (15-50%) ■ Undiagnosed (15%)

	<h2 style="margin: 0;">Undiagnosed Dizziness</h2>
	<ul style="list-style-type: none"> ■ About 15% of all dizzy patients ■ Our tests are not 100% sensitive ■ We are not perfect either ■ Refer– maybe someone else will figure it out.

	<h2 style="margin: 0;">Summary</h2>
	<ul style="list-style-type: none"> ■ There are an immense number of dizzy patients ■ Sorting them out is the big problem. ■ A flexible heuristic approach is recommended. ■ Not everyone can be diagnosed

	<h2 style="margin: 0;">More on the Web</h2>
	<p style="margin: 0;">www.dizziness-and-balance.com</p>