Symptoms of “Dizziness”

- Dizziness – non-specific term; encompasses any and all of the specific symptoms:
  - Vertigo
  - Imbalance – general or actual ataxia and possible falls
  - Lightheadedness (near syncopal event), giddiness
  - Combinations of the above

- In the history it is important to obtain symptom descriptions that are specific in nature

- Detailed characterizations of the patients symptoms are of significant help in narrowing the etiologies
Characterizations of Dizziness Symptoms

- Temporal course --- paroxysmal lasting sec, minutes, hours, days, weeks OR continuous with exacerbation lasting sec, minutes, hours, days, weeks
- Type of dizziness --- vertigo, imbalance, lightheadedness, falls, disorientation; are there traveler symptoms:
  - nausea & vomiting, head aches, heart palpitations, feelings of panic, drop attacks, any of the “Ds”= diplopia, dysphasia, dysarthria, dysmetria, asymmetric muscle weakness
- Onset of symptoms --- Spontaneous OR head motion or visual motion provoked (most likely treated with VBRT)
- Hearing --- involvement in the auditory system, e.g. tinnitus, aural fullness, progressive or fluctuant loss of hearing

Symptoms: Generalizations

- Labyrinthine / VIII n
  - Sudden memorable onset
  - Typically True vertigo at onset
  - Paroxysmal Spontaneous events < 24 hours
  - Head movement provoked symptoms <2 minutes
  - Vestibular crisis - sudden onset vertigo slowly improving from continuous to head movement provoked symptoms in days
  - More likely to have auditory involvement

- Central vestibular or non-vestibular Sx
  - Sudden onset of Vertigo, lightheadedness / Imbalance with one of the D’s
  - Slow onset imbalance standing and walking
  - Vague sx of any character
  - Slow vertigo lasting 24 / 7
Vertigo

- Independent of lesion site the underlying pathophysiology is that of asymmetrical neural activity
- The asymmetrical neural activity could occur anywhere from the labyrinth through lesions in the pons and even posterior cerebellum
- Highly unlikely to get true vertigo from lesion above the level of the pons --- more likely to get imbalance, lightheadedness
- Highly unlikely to get true vertigo from lesion in the area of the anterior circulation – carotid arteries --- imbalance, lightheadedness
- Differentiation of labyrinthine versus posterior fossa by travelers --- especially the Ds

Labyrinthine Disorders without Vertigo-Is it Possible?

- Unilateral Labyrinthine/VIII n --- as long as the lesion develops slow and insidiously and central compensation is functioning. E.g. vestibular schwannoma, hereditary auditory/ vestibular degeneration
- Bilateral Labyrinthine lesions --- as long as the two labyrinths undergo symmetrical damage vertigo is not experienced. E.g. ototoxic drugs, idiopathic (thought to be hereditary), head trauma
Signs: Generalizations

- Labyrinthine / VIII n
  - Direction fixed nystagmus – horiz.
  - Nystagmus more likely to be exacerbated when gazing in the direction of the fast component – Alexander’s Law
  - Nystagmus more likely to be exacerbated post horizontal head shake – horizontal nystagmus
  - Pursuit tracking and saccade performance normal (or age dependent)
  - If sudden onset can stand & walk with assistance

- Central vestibular or non-vestibular Signs
  - Direction changing nystagmus
  - Nystagmus more likely to be pure vertical or pure torsional
  - Nystagmus post head shake vertical
  - Likely to have abnormal performance on pursuit and/or saccades
  - If sudden onset likely not to be able to stand & walk even with assistance

Vestibular Neuritis

- Symptoms: History
  - Vestibular crisis improving over 1-4 days
  - Left with head movement sensitivity
  - No hrg loss

- Signs: Direct examination & Typical Lab findings (including hearing test)
  - Nothing specific – peripheral no central

- Classic treatments
  - Meds to control sx – Vestibular and Balance Rehabilitation Therapy (VBRT) to push compensation

- Prognosis – excellent with compensation – common to have Posterior canal BPPV as a sequela

- Lesion site – neural vascular causing selected labyrinthine damage
Meniere’s Disease

◆ Symptoms: History
  – Spont event >20 minutes <24 hours
  – Fluctuant hrg with documented loss
  – Tinnitus and aural fullness
  – No CNS indicators
◆ Signs: Direct Exam & Typical Lab findings (including hearing test)
  – No specific Pattern of results – peripheral no CNS –
    Progressive SN hearing loss
◆ Classic treatments (including use of VBRT)
  – Diet / suppressive meds / Surgery – Gent / VBRT if sx
    between and spells >4 weeks apart
◆ Prognosis – excellent control with Gentamicin / surgery
  otherwise time typically helps
◆ Lesion site - Labyrinthine

Migraine Related Dizziness

◆ Symptoms: History
  – Patient is determined as being a migraineur by IHS criteria
  – “Dizziness” can be of a variety of characterizations from true vertigo to
    only chronic sensitivity to motion – spontaneous or motion provoked sx
    only
  – May occur temporally related to headache or independent
  – If spontaneous the vertigo may last seconds to days
◆ Signs: Direct exam & Typical Lab findings (including hearing test)
  – No specific pattern – may range from normal to indications for either
    peripheral or central involvement
◆ Classic treatments (including use of VBRT)
  – Primary treatment is treatment for migraine – risk factors / medications
  – The migraine treatment may be supplemented with use of VBRT
◆ Prognosis – good for reduction or elimination of the “dizziness”
  symptoms with control of migraine events
◆ Lesion site – Not known but speculated to involve the labyrinth
  and vestibular nuclei with other areas of the brainstem and midbrain
In the Chronic Dizzy Patient – Why are symptoms continuing? Why has the Natural Compensation process not worked?

◆ Group 1
  – The patient has an UNSTABLE lesion, ie, the locus of the lesion is changing over time.
  – The historical hallmark is spontaneous events
  – More likely to be assisted with medicine or surgery

◆ Group 2
  – The patient has a STABLE lesion yet uncompensated by the central process
  – The historical hallmark is symptoms are provoked by something
  – More likely to be served with VBRT

Surgical Management of the Dizzy patient

◆ Reparative
  – Middle ear procedures for erosive process
  – Perilymphatic fistula both the controversial form at OW or RW & Superior SCC dehiscence
  – Sac decompression or endolymphatic shunt

◆ Ablative procedures
  – Labyrinthectomy
  – Vestibular nerve section
  – Canal plugging procedures
  – Chemical destruction - not necessarily complete ablation
Rationale for Ablative Procedures

- Compensation process difficult if not impossible with fluctuating lesion
- If lesion site is confined to the labyrinth then partial or full destruction of this site produces:
  - A stable peripheral lesion
  - Thus changing the patient from group 1 to group 2 where compensation is possible

Medical & Dietary Control of the Dizzy Patient

- Medical
  - Control of an underlining Metabolic or hormonal disorder
  - Steroid sensitive disorder
  - Migraines
  - Destructive or degenerative disorders
  - Symptom control

- Dietary
  - Low sodium diet -- 1.5 to 2 grams daily
  - migraine control
Difficulty with use of Rx Medications

◆ As a group they produce a sedentary effect with CNS depression that can possibly prevent or slow down the compensation process

◆ There are patients that will need the medications to cut the edge off the symptoms in order to get active enough to drive compensation – judicious use is the order of the day

Common Disorders in Group 1

◆ In general these are ‘unstable’ lesions - changing over time:
  – Meniere’s
  – Migraine
  – Anxiety (and other psychological) disorders
  – Degenerative CNS disorders
    » SCA, Parkinsonism (PSP), MS, Cerebellar paraneoplastic
  – Cardiovascular disorders / orthostatic hypotension
  – Mass lesions of the CPA
    » Schwanoma, meningioma (respond very well to therapy)
  – Autoimmune inner ear disorder
Common Disorders of Group 2

- Vestibular and Balance Rehabilitation - Primary
  - BPPV
  - Uncompensated Stable Peripheral, eg
    » Vestibular neuritis
    » Labyrinthitis
    » Ablative surgery
  - Dysequilibrium of aging
  - Stable central lesions
  - Mild Anxiety
  - Bilateral peripheral paresis

- Vestibular and Balance Rehabilitation - Adjunctive
  - Migraine
  - More severe anxiety and other psychological disorders
  - Head trauma
  - Aspects of Meniere’s disease
  - Aspects of Degenerative CNS

Handling BPPV

- Treat first – Then treat the residual symptoms left after the BPPV resolved.
- In many cases with the BPPV resolved the residual symptoms may be reduced dramatically.
Who is appropriate for VBRT

- This is a symptom driven indication system
- Test from laboratory studies play only a minor roll in assisting to determine who is appropriate
  - SOT – to help design and monitor
  - DVA – to help design and monitor
  - Caloric asymmetries and Chair time constant
    abnormalities – indicate abnormal VOR – This can be an indication for a type of therapy (Adaptation) if sx are appropriate for VBRT
- Work to date would indicate that the indications for a VBRT program are the same for adults and children

Vestibular Rehabilitation

- Appropriate
  - Head, visual motion provoked
  - Continuous with motion exacerbation
  - Functional balance or gait dysfunction
  - Stable peripheral or central lesion
  - Any age

- Inappropriate
  - Only spontaneous events or too freq. (unstable / progressive periph.)
  - No provocative activity or balance dysfunction
  - Progressive Central lesion (balance/gait)
Vestibular Rehabilitation

- **Good Prognosis**
  - Stable peripheral lesion
  - Head movement or position provoked, including BPPV
  - Stable brain stem lesion
  - Post-operative

- **?? Prognosis**
  - Head injury
  - Cerebellar lesions
  - Unstable peripheral
  - High DHI score
  - Significant postural control abnormality

Techniques for assessment and exercises

- The assessment tools for determining specific system and functional deficits are generally applicable to:
  - Peripheral vestibular lesions
  - Central vestibular lesions
  - Children as well as adults

- There are reasonable normative data for children 3-4 and above on most of the major tools used for therapy assessment and for all of the laboratory studies (ENG, rotary chair, Dynamic posturography, postural evoked EMG responses, dynamic visual acuity and otolith function testing – Multiple work by Rose Rine et al
Vestibular and Balance Rehabilitation Technique

◆ Individual Systems Review
  – By Direct exam or via lab testing
  – Vision / Ocular motor control
  – Vestibular Status and Vestibulo-Ocular Reflex
  – Musculoskeletal
  – Neurological
  – Cognitive status
◆ System Integration
  – By Direct exam or via lab testing
  – Organization & use of Sensory inputs (SOT of Dynamic Posturography or office technique of Clinical Test of Sensory Interaction on Balance
  – Reaction to unexpected perturbations (clinical or machine)
  – Functional use of Vestibulo-Ocular Reflex (DVA / GST)
  – Gait & Balance (clinical tests)
  – Movement sensitivity via MSQ (16 fast movements coding intensity duration)

Vestibular and Balance Rehabilitation

◆ Adaptation Exercises
  – Goal - to improve Vestibulo-Ocular Reflex functional performance (indications are that gain in hypofunction patients does not actually change)
  – X1 & X2 gaze exercises with horizontal or vertical head rotation
◆ Habituation Exercises
  – Goal - to reduce or eliminate response to a specific stimulus with repeated exposure – repeated head movements with or without total body movement
◆ Dose related activities
◆ Do not appear to generalize
Vestibular and Balance Rehabilitation

- Balance Exercises
  - Static and Dynamic Postural Control

- Substitution Exercises
  - Use of one sensory input when another system is out

- Gait Exercises
  - Ambulation over short and long courses
  - Should be combined with horizontal head rotations

- General Conditioning
  - Life style change
  - Maintenance program
Vestibular and Balance Rehabilitation –
General summary of Results - Adults

♦ Controlled Studies
  – CRP for BPPV
  – Customized vs generic
  – Customized vs sham vs Medicine
  – Post -operative recovery
  – Gait improvement with bilaterals
  – Balance improvement demonstrated with CDP
  – Migraine & anxiety associated dizziness
  – Reduction in fall risk in young & elderly with unilateral vestibular hypofunction
  – General reduction in fall rate from prevention programs in young and elderly

♦ Observational Studies
  – Overall 85 - 90% improvement with all patients
  – Central brainstem as well as peripherals
  – Cerebellar and progressive CNS show only minimal improvement in ambulation
  – Elderly do as well as young - longer course
  – Suppressive Meds slow course - outcome same
  – Reduction in the injury rate from falls in elderly

VBRT in Children

♦ Anecdotal reports have suggest that children as young as 3-4 do well with directed activities for eye / head coordinated movements as therapy exercises – using usual childhood play and sports.

♦ Rine et al 2004 --- completed a prospective, single blinded, placebo-controlled wait listed design of exercise versus placebo (no exercise) on children with bilateral vestibular hypofunction. Ages were 3-8 yrs. Groups were age matched and matched for functional deficit – 21 randomly assigned to experimental or control group
VBRT in Children

- While only a single study with a special homogeneous group of children its well controlled design strongly supports:
  - The effectiveness of VBRT in children with exercises activities used in adults modified to be age appropriate for children
  - The ability to obtain reliable quantitative assessment data on young children
- Clearly there is significant need for further investigations on a variety of vestibular impairments.

VBRT in Children

- Study by Medeiros et al, Otology & Neurotology 26, July 2005
- Unilateral peripheral involvement suspected from positional nystagmus or caloric asymmetry > than 20%
- 16 patients mean age 8yrs
- 16 age and gender matched controls
- Primary outcome measure conditions 5 & 6 on EquiTest and the ratio of condition 5 to condition 1 (vestibular ratio)
- All evaluated on CDP pre / post therapy; controls at same interval
- All patients given same exercise activities seen during 4 in lab sessions
VBRT in children – Medeiros et al 2005

♦ The results from this more heterogeneous group of children also support the contention that VBRT is an effective treatment procedure for children using adult techniques for the intervention
♦ Like the study of Rine – this one also points out the reliability of the use of objective testing methods in children

VBRT in work with Falls - Hypofunction

♦ Hall et al, Otology & Neurotology, 25, 2004
♦ Work with both young and elderly patients all with unilateral vestibular hypofunction & at risk for falls via DGI score < 19
♦ Retrospective study with 47 patients, 27 – 86 years
♦ All with customized VBRT program using adaptation, balance and gait exercises
♦ Outcomes: DGI / DVA / Visual analog scales
VBRT and Falls in the Elderly

- Cochrane Systematic review from 2005 involved 62 randomized trials of interventions designed to minimize effect of, or exposure to risk factors for falling in the elderly
- The 62 studies meeting search criteria involved 21,668 adults
- Conclusion: interventions to prevent falls that are likely to be effective appear available. Cost per fall prevented require careful economic analysis in the context of the local healthcare system.

VBRT and Falls in the Elderly

- Per the Cochrane report interventions likely to be successful in falls prevention were:
  - Multidisciplinary, multifactorial health/environmental risk factor programs
  - Multifactorial that target persons with history of falls
  - Multifactorial in residential care facilities
  - Combinations of strengthening and balance training
  - Home hazard modifications by a trained professional
  - Withdraw of psychotropic
  - Tai Chi
VBRT and Falls in the Elderly

- If the rate of falls is reduced does this reduce the rate of fall related injuries?
- A second Cochrane systematic review from 2005 addressed the issue of group interventions that attempted to reduce the rate of fall related injuries in the elderly.
- Of 23 studies in the literature, only 5 met the criteria of using a control group study although none were of a randomized design
- Conclusion: The consistency of the findings support the preliminary contention that population based intervention programs can reduce the rate of fall related injuries in the elderly

New VBRT intervention Work

- Use of alternative sensory input to improve balance and gait in bilateral hypofunction
  - Auditory feedback related to body angle and sway
  - Vibratory feedback to the torso related to body angle and sway
  - Tactile feedback to the tongue for body angle and sway
- Devices to help with traditional habituation and adaptation exercises done in home therapy
- Force platform auditory or visual feedback for in lab training: 2005 Cochrane review with 7 studies and 246 subjects showed improved standing balance but impact on general balance, gait and independence is unclear and requires further study.
Outcome Measures for Vestibular Rehabilitation

- Want quantitative measures (pre / post)
- Measures different from tx activities
  - Questionnaires / Subjective reports
    - Global, eg, DHI
    - Disability scale
    - ABC / Tinnette falls risk scales / Berg Balance Scale
    - Visual Analog Scales
  - ADL tasks
  - Clinical measures such as DGI (FGA)/TUG/Functional reach/Gait speed/Single leg stance/DVA
  - Dynamic Posturography (SOT)

Outcome Measures continued

- Measures not different from therapy activities performed
  - Some of the clinical tests; Single leg stance / some features of the DGI
  - Motion Sensitivity (eg MSQ)
  - Dynamic Posturography (SOT) in some cases