Medical Management of Vestibular Disorders and Vestibular Rehabilitation

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Grand Rounds Presentation
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“Dizziness”

- Presyncopal faintness
- Loss of balance
- Light-headedness
- Psychologic disorders
- Vestibular disease
Vestibular Labyrinth

- 3 semicircular canals
  - rotational movement
  - cupula
- 2 otolithic organs - utricle & saccule
  - linear acceleration
  - macula
Balance

- Vestibular system
- Visual system - VOR
- Proprioceptive system - VSR
Associated Systems

- Vestibular & Visceral systems
  - nucleus of solitary tract
  - rostral ventrolateral medullary reticular formation
  - parabrachial nucleus
    - brainstem sympathetic output
    - neuroendocrine regions of hypothalamus
    - limbic regions of forebrain
Medical Treatment

• No ideal drug

• Symptomatic tx
  – control acute sx

• Specific tx
  – target underlying cause
**Neurophysiological Model**

*Fig. 1. Mechanism involved in vertigo. A = The “comparator” produces a signal (via a histaminergic neuron) that causes emesis. B = Histamine release leads to vomiting. C = C is a cholinergic system that modulates the neural store. D = Vertigo due to motion (see text)*
Fig. 2. Mechanisms involved in vomiting. I—Dopamine agonists. II—Serotonin blockers. III—Antihistamines.
Symptomatic Tx

- Anticholinergics
- Antihistamines
- Antidopaminergics
- Monaminergics
- GABAergics
Anticholinergics

- Scopolamine
  - motion sickness
  - side effects
    - dry mouth
    - blurry vision
    - drowsiness
Antihistamines

- Meclizine
  - longest acting
- Promethazine
- Dimenhydrinate
- Side effects
  - drowsiness
Antidopaminergics

- Do not prevent vertigo or motion sickness
- Chlorpromazine
- Prochlorperazine
- Chemoreceptor Trigger Zone
- Side effects
  - sedation
  - EPS
Monoaminergics

- Amphetamines
- Ephedrine
- Potentiate scopolamine
- Combination treatment
GABAergic

- Benzodiazepines
- Diazepam
- Vestibular suppressant
- Minimize anxiety and panic
- Potentially addictive
Specific Tx

- Otosyphilis
- Vertebrobasilar Insufficiency
- Migraine
- Vestibular Neuritis
- Meniere’s Disease
- BPPV
Otosyphilis

- Benzathine PCN 2.4 mu/week IM x 3
- PCN G 10 mu/day IV x 10 days then 2.4 mu benzathine PCN/week x 2
- Probenicid
- Prednisone 40-60 mg/day x 2-4 weeks
Vertebrobasilar Insufficiency

- Vertigo, diplopia, dysarthria, ataxia, sensory and motor disturbance
- 30% of TIA’s
- ASA 325 mg qd
- Ticlid
  - neutropenia
Migraine

• **Dx**
  - personal or family hx, motion intolerance, vestibular c/o not c/w other disorders

• **Lifestyle change**
  - exercise, diet, avoidance of nicotine & estrogen

• **Abortive tx**
  - ergots, sumatriptin, midrin

• **Prophylactic tx**
  - B blockers, Ca channel blockers, NSAIDs, amitryptiline, lithium
Vestibular Neuritis

- Sudden onset vertigo
- Normal hearing
- Viral changes in Scarpa’s ganglion
- Response to Methylprednisolone (Ariyasu)
Meniere’s Disease

- Unknown etiology
- Hydrops on histologic studies
Meniere’s Disease

- Salt restriction
- Diuretics
  - Thiazides - Na absorption in distal tubule
  - Side effects - hypokalemia, hypotension, hyperuricemia, hyperlipoproteinemia
Meniere’s Disease

• Vasodilators
  – IV histamine, ISDN, betahistine, cinnarizine
  – Betahistine - vasodilation of caps, arterioles, arcades, & decreased endolymphatic pressure

• Carbonic anhydrase inhibitors
  – decreased Na-H exchange in renal tubule
  – decreased CSF production
  – side effects - renal calculi, met acidosis
Meniere’s Disease

- **Immunosuppressive tx**
  - 70 kd heat-shock protein
  - systemic steroids, methotrexate, cyclophosphamide, IT steroids
Meniere’s Disease

• Torok
  • 60-80% remission with all tx

• Silverstein
  • 59% remission at 2 years and 70% remission at 8 years in untreated group

• Ruckenstein
  • vestibular suppressants only group effect
  • other tx nonspecific and no better than placebo
Chemical Labyrinthectomy

- Persistent & refractory sx
- IM streptomycin
- Intratympanic gentamicin
  - round window & annular ligament
  - properly counselled
ITAG

- Syringe
- Fluid above RW level fills half of middle ear
- Round window
<table>
<thead>
<tr>
<th>AUTHOR AND REFERENCE</th>
<th>NUMBER OF PATIENTS TREATED</th>
<th>AMINOGLYCOSIDE</th>
<th>DOSAGE</th>
<th>TREATMENT END POINT</th>
<th>CONTROL OF VERTIGO (%)</th>
<th>LOSS OF CALORIC RESPONSE (%)</th>
<th>HEARING PRESERVED (%)</th>
<th>TINNITUS DISAPPEARED OR IMPROVED (%)</th>
<th>AURAL FULLNESS IMPROVED (%)</th>
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<tbody>
<tr>
<td>Schuknecht(^1)</td>
<td>8</td>
<td>Streptomycin</td>
<td>50–300mg/dose 350–600mg total dose 30mg/day</td>
<td>Vestibular ablation</td>
<td>63</td>
<td>63</td>
<td>37</td>
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<td>Beck and Schmidt(^2)</td>
<td>43</td>
<td>Gentamicin</td>
<td>“6 doses planned”</td>
<td>Vestibular ablation First ototoxic reaction</td>
<td>91</td>
<td>NR</td>
<td>42</td>
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<td>95</td>
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<tr>
<td>Lange(^3)</td>
<td>Total 83 92</td>
<td>Streptomycin</td>
<td>60mg/day; “typically several days”</td>
<td>First ototoxic reaction</td>
<td>90</td>
<td>NR</td>
<td>76</td>
<td>35</td>
<td>43</td>
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<tr>
<td>Moller et al.(^4)</td>
<td>15</td>
<td>Gentamicin, 40mg/ml</td>
<td>15–30mg/dose 1–11 doses, mean = 5</td>
<td>First ototoxic reaction</td>
<td>93</td>
<td>100</td>
<td>66</td>
<td>82</td>
<td>78</td>
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<tr>
<td>Sala(^5)</td>
<td>62</td>
<td>Gentamicin</td>
<td>Up to 30mg/day 1–8 doses, mean = 3.5</td>
<td>First ototoxic reaction</td>
<td>86</td>
<td>51</td>
<td>70</td>
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<td>Blessing and Schlient(^6)</td>
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<td>Gentamicin</td>
<td>1 or 2/day 5–40mg/dose × 7 days, then 0.2ml qod 3–12 doses, mean = 5.3</td>
<td>Ablative nystagmus or hearing loss</td>
<td>89</td>
<td>28</td>
<td>67</td>
<td>NR</td>
<td>NR</td>
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<td>Laitakari(^7)</td>
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<td>Gentamicin</td>
<td>0.2ml/day × 3 days, then 0.2ml qod 3–12 doses, then 0.2ml qod</td>
<td>Ablative nystagmus</td>
<td>90</td>
<td>70</td>
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<td>Nedzelski et al.(^8)</td>
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<td>Gentamicin</td>
<td>0.65ml tid × 12 doses or first ototoxic reaction</td>
<td>Ablative nystagmus</td>
<td>90</td>
<td>85</td>
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<td>Magnusson and Padoan(^9)</td>
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<td>Gentamicin</td>
<td>30mg/ml bid 2 doses for 1 day</td>
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<td>100</td>
<td>100</td>
<td>0</td>
<td>NR</td>
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</tbody>
</table>

*bid = twice a day; NR = not reported; qod = every other day; tid = three times a day.*
BPPV

• Cupulolithiasis
  – calcific deposits on cupula rendering SCC
    gravity dependent

• Canalolithiasis
  – calcific debris in SCC
  – pulling of cupula by plunger-like effect
FIGURE 16-2. The Semont maneuver. The patient is moved quickly from sitting (A) into the position that provokes the vertigo (B) and is kept in that position for 2 to 3 minutes. He is then turned rapidly to the opposite ear-down position (C) with the therapist maintaining the alignment of the neck and head on the body. The patient stays in this position for 5 minutes. The patient is then slowly taken into a seated position. He must remain in a vertical position for 48 hours and avoid the provoking position for 1 week. As in Figure 16-1, the position of the right labyrinth is shown for each head position and the posterior canal is shaded. The solid arrow indicates the location of the cupula of the posterior canal; the open arrow indicates the location of debris free-floating in the long arm of the posterior canal during the different stages of the treatment.

FIGURE 16–3. The modified Epley maneuver. (A–C) The patient is quickly moved into the Hallpike-Dix position with the affected ear down.
FIGURE 16–3. Continued. (D) He is kept in that position for 3 minutes and then the head is slowly moved through extension until the opposite ear is down (opposite Hallpike-Dix position). (E) The patient stays in that position for 4 minutes and then slowly sits up. The patient must then remain with the head in an upright position for 48 hours and must avoid lying on the affected side for 5 days after that. As in Figure 16–2, the position of the right labyrinth is shown for each head position, and the posterior canal is shaded. The arrows point to the presumed location of debris in the canal with each position change. (Reprinted with permission from Herdman, SJ, et al: Single treatment approaches to benign paroxysmal positional vertigo. Arch Otolaryngol Head Neck Surg 119:450, 1993. Copyright © 1993, American Medical Association.)
BPPV - Norre

• Patient specific exercises
• Patients with BPPV superimposed on other vestibular disorders & nonclassical BPPV
BPPV - Results

- **Semont**
  - 84% after one tx, 93% after two tx

- **Epley**
  - 100% with multiple maneuvers, Herdmann - 90%

- **Brandt & Daroff**
  - 98% after 3-14 days of tx

- **Norre**
  - 32% after one wk, 100% at 6 wks
# BPPV Results

## Noninvasive Intervention for BPPV*

<table>
<thead>
<tr>
<th>Source</th>
<th>n</th>
<th>% Cured</th>
<th>Treatment Sessions</th>
<th>Treatment Protocol</th>
<th>Recurrence Rate, %</th>
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<td><strong>Canalith Repositioning</strong></td>
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<td>Harvey et al⁵</td>
<td>25</td>
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<td>Blakley⁸</td>
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<td><strong>Liberatory Maneuver</strong></td>
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<td>Semont et al⁹</td>
<td>711</td>
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<td>Norre and Beckers¹¹</td>
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<td>Repeat at 1 wk</td>
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<td>Brandt and Daroff⁵</td>
<td>66</td>
<td>100</td>
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<td>50</td>
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</table>

*BPPV indicates benign paroxysmal positional vertigo; ellipses, data not reported.*
Vestibular Rehabilitation

- Promoting vestibular compensation
- Habituation
- Enhancing adaptation of VOR & VSR
- May have initial exacerbation
Cawthorne - Cooksey

• Developed in 1940s
• Head movements
• Balance tasks
• Coordination of eyes with head
• Total body movements
• Eyes open & closed
• Noisy environments
VRT - methods

• Habituation of pathologic responses
• Postural control exercises
• Visual-vestibular interaction
• Conditioning activities
• Bid, most improve after 4-6 weeks
VRT - Elderly

- Multifactorial causes of balance difficulty
  - Need 2 of 3 systems functional
    - vestibular, visual, proprioceptive
- Good outcome measures with longer time
- Impact on complications of falls
Vestibular Rehabilitation

Fig. 1. Changes in DHI scores after rehabilitation.
Vestibular Rehabilitation

Fig. 2. Mean percentage changes and standard deviations of DHI total and subscores.
Conclusion

- Vestibular complaints common
- Often tx previously
- Difficult histories

Diagnosis
- avoidance of vestibular suppressants
- vestibular rehabilitation