Interdisciplinary Role of Audiology

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Scope of Problem
Mar 03 – Feb 05

- 4189 OIF/OEF soldiers treated at WRAMC
  - 1960 Disease
  - 1159 Non-Battle Injury
  - 1070 Battle Injury
- Army Audiology and Speech Center
  - 371 seen in Audiology; 247 seen in Speech
  - 335 soldiers seen with blast injuries
  - Over 200 soldiers seen with TBI
  - Over 100 soldiers seen with amputations

Scope of Problem
Mar 03 – Feb 05

- 371 soldiers seen by Audiology
- 259 (70%) have some hearing loss
- 212 (57%) with blast injuries:
  - Average age = 28 y/o (18-54 y/o)
  - 70 (33%) had known traumatic injuries (amputation, TBI)
  - 131 (62%) had hearing loss in at least one ear
    - 75 had bilateral hearing loss
    - 56 had unilateral hearing loss
    - 56% SNHL
    - 27% Mixed
    - 17% Conductive

How does Audiology get involved?

- By consult
  - From primary attending physician or teams
  - Specialty referrals
- Proactively
  - Weekly lists obtained from the TBI and PM&R teams
- Collaboration with Physical Therapy
  - Amputee team
  - Weekly screenings
  - SOT

Traumatic Brain Injury (TBI)

- Members of TBI Team
  - Neurology
  - Neuropsychology
  - Social Work
  - Psychiatry
  - Speech Pathology
  - Audiology
- Assessments
  - Team evaluations
  - Ward visits
  - Clinic visits
  - ICU coverage

Physical Medicine and Rehabilitation (PM&R) Team

- Physiatrists
- Physical Therapists
- Occupational Therapists
- Psychiatrists
- Speech Pathologists
- Audiologists
- Nursing
- Nutrition
- Social Work

Audiologic Diagnostics

- Behavioral Tests
  - Air/bone
  - Speech in quiet/noise
  - Hearing aid evaluation
- Electrophysiological Tests
  - OAE
  - ABR
  - ASSR
- Vestibular screening and evaluation

Patient Characteristics

- Types of hearing loss
  - Normal
  - Conductive
    - Ruptured TMs
    - Healed perfs w/ effusion
    - Blood in canal/behind TM
  - SNHL
    - Pre-existing
    - Acoustic trauma
    - Noise exposure
- Co-morbidity
  - Eye damage
  - Spinal cord injury
  - Facial trauma
  - Skull fractures
- Number of visits (1-4)

Treatment

Medical

- Surgical repair
- Acute, on-going care for co-morbidity

Audiological

- Balance
- Tinnitus
- Hearing aids, ALD, CI

Physical Therapy

- Balance
- Vestibular Rehab
- CRM
- Prosthetics/assistive devices

Interdisciplinary Approach to Blast Injury Management

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Introduction and Rationale

- PTs and Audiologists may be first clinicians to identify oto-vestibular impairments in blast-injured
- Complex nature of systems involved requires interdisciplinary management and education
- Balance and hearing deficits often overlooked by providers in complex multi-trauma patients
- Postural instability, hearing impairment and inner ear dysfunction may be evident up to 6 months post-blast trauma (Coen, 2002)
- Early identification and management can expedite return to duty or high functional level

Interdisciplinary Management

- Audiologist
  - Assess for TM integrity
  - Assess for blast related hearing dysfunction
  - Quantify vestibular loss / dysfunction
- Physical Therapist
  - Identify vestibular dysfunction
  - Prescribe and progress VRT
  - Referrals to Audiology and ENT PRN

Incidence of Vestibular and Hearing Pathology among Traumatic Amputees

Post Blast Injury Pilot Study*

- Etiology / MOI
  - IED (49%)
  - RPG (19%)
  - Mortar (5%)
  - Other (27%)
- Aural fullness (9%)
- Tinnitus (7%)
- Hearing impairment (18%)
- Subjective report of depression (67%)
- Mean time post injury to full eval = 5-6 mos

(* Scherer, Burrows, et al.)

Clinical Oto-Vestibular Pathology

- BPPV (Traumatic vs. Idiopathic)
- Post concussive / mild TBI
- Unilateral / bilateral vestibular loss (Ototoxicity vs. Trauma)
- Perforated TMs
- Hearing loss

Physical Therapy Standard of Care
(Amputee Section)

- Initial Physical Therapy Evaluation
  - Motor function, postural stability, gait
- Current Blast Injury Screening Protocol
  - MOI
  - DOI
  - Subjective chief complaint
  - WRAMC blast injury questionnaire

Blast Injury Questionnaire

Physical Therapy Service/ Audiology Service

Descriptive Data

- Name
- Gender
- Age
- Date of Injury (DOI)
- Mechanism of Injury (MOI)
- Deployment (OIF vs. OEF)
- Pre-Existing Conditions
- Location at time of Blast
- Distance from blast

Symptoms

- Vision related impairments
  - Dyplopia
  - Blurring
  - Oscillopsia
- Hearing related difficulties
  - Hearing Loss
  - Aural Fullness
  - Tinnitus
  - Headaches
- Balance related difficulties
  - Dysequilibrium
  - Vertigo
- Depression

Objective Assessment

- Initial screening tests and measures
  - Cervical ROM, Vertebral Artery test
  - Dynamic Visual Acuity (DVA)
  - Head Thrust Test (HTT)
  - Sensory Organization Test (SOT)
- Comprehensive vestibular evaluation
  - Occulomotor exam
  - Dix – Hallpike
  - Gait assessment as appropriate

Ongoing Management and Reassessment

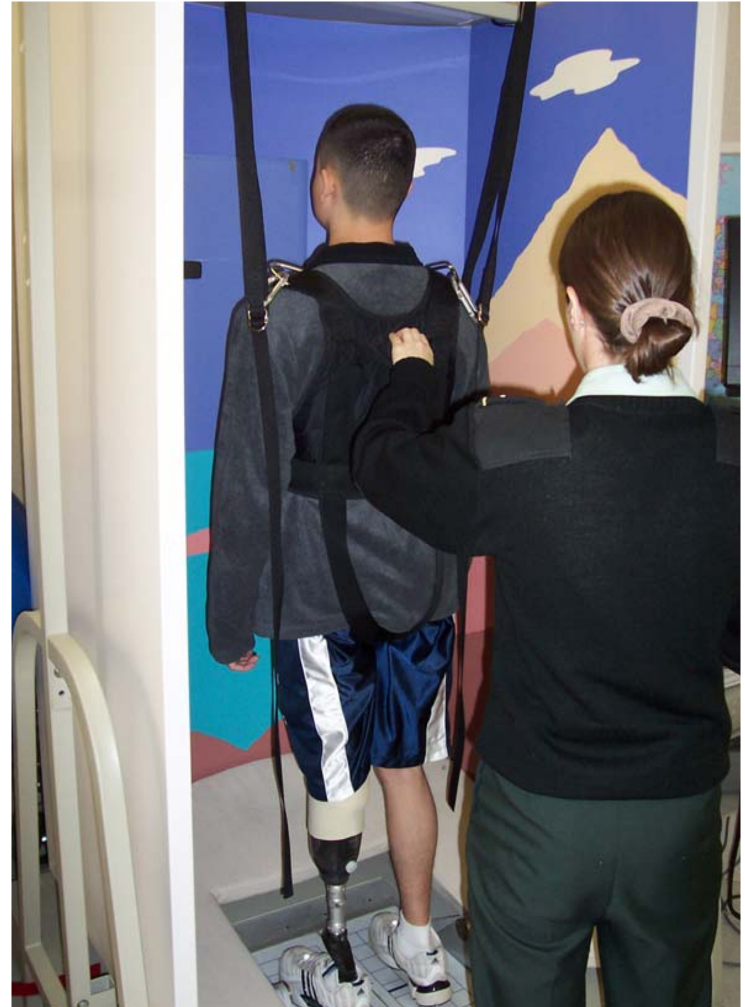
- Vestibular Rehabilitation Therapy (VRT)
  - Adaptation (gaze stabilization exercises)
  - Substitution (bilateral loss)
  - Habituation program (MSQ - Motion Sensitivity)
- Canalith repositioning maneuver (CRM)
- Static and dynamic postural stability training
- Sensory Organization Test (re-evaluations)
- Audiology referral / ENT management
  - VNG
  - Rotary Chair

Sensory Organization Test

- Initially administered upon modified-Independence c. prosthetic limb (Intake)
- Standardized per SOP
- Documents function pre- and post-rehabilitation
- Prognostic, not diagnostic

Sensory Organization Test

- 6 conditions assess visual, proprioceptive and vestibular inputs to balance
- Rates results of patient vs. age / gender matched norms (for able bodied pop.)
- Graphic data on weight bearing and balance strategies used



Assessment and Treatment Challenges

- Medical/ Orthopedic Status
  - Cervical stability, multiple lines, weight bearing status, pain control
- Timeliness of assessment
- Sensitivity of low tech bedside exam
- High functioning patient population
- Affective component and compliance

Case Study

- 21 y/o AD USMC, evaluated 4 Jan 05
- IED blast 24 Nov 04 (L BKA), bilateral TM perfs
- C/O dizziness, positional vertigo, hearing loss, tinnitus (AD), bilateral aural fullness
  - c/o motion sensitivity (7 Feb 05)
- AGG: L or R rolling in supine (5-8 sec of vertigo)
- Ease: Rest
- DHI score: 14%
- Audiology evaluation, 5 Jan 05

Initial Audiological Findings

- Hearing
  - Moderate-severe mixed loss (AD), TM perforation
  - Mild conductive loss (AS), reportedly healed TM perforation
- Vestibular
  - Normal ocular motor exam
  - No spontaneous, positional or headshake nystagmus
  - Positive Hallpike right
  - CNT calorics due to perforation AD
  - Normal phase, gain and symmetry on rotary chair
  - Impression: Right P-SCC BPPV

Tests and Measures

- Ocular motor exam WNL
- (+) R HTT
- (+) DVA (3 line loss)
- Dix-Hallpike bil (sxs s. nystagmus <3 sec)
- Sensory Organization Test

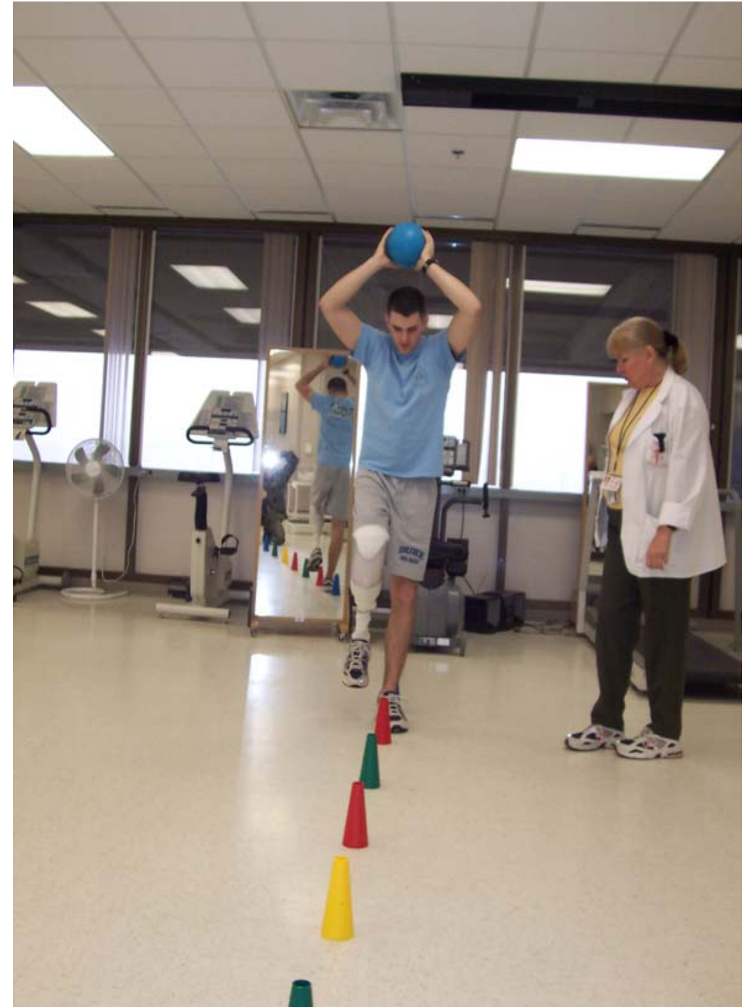
- PT Dx:
  R vestibular hypofunction, BPPV resolving

Vestibular Rehabilitation

- X1 viewing exercises for adaptation, habituation
  - 60-90 secs
  - Arms length
- X2 viewing progression
- CRM x 3 sessions
  - R rolling
  - L rolling

Balance and Gait Rehabilitation

- Static postural stability (Romberg, Sharpened Romberg)
- Dynamic postural stability activities
- Gait training
- Proprioception and balance training for L BKA / prosthetic training



Patient’s Outcome

- No c/o increased motion sensitivity, dysequilibrium, vertigo, oscillopsia
- SOT composite score: 76 (above age matched norms in able bodied population)
- Post VRT DHI score: 2%
- Return to full function and sport level activity with prosthesis
- Audiological status
  - Right ear: mixed HL, tympanoplasty scheduled
  - Left ear: healed TM perforation, improved hearing