A Practical Approach to Traumatic Brain Injury for the Primary Care OD

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Disclosures
No financial interest or relationships to disclose

Learning Objectives
At the conclusion of this presentation, the participant will be able to:
1. Understand pathophysiology, natural course of injury, recovery and causes of traumatic brain injury (TBI)
2. Identify the role of optometry with TBI patients
3. Identify common visual impairments within the TBI population
4. Become familiar with the TBI vision examination, diagnosis, management, treatment and follow up

Why is This Important?
• 1.6 million troops have served in Iraq or Afghanistan
  – 19% may have sustained some level of brain injury
  – Many discharged from active duty military to civilian life
  – Can present to your office!

Overview of TBI
• 1.7 million new cases per year
  – About 75% are concussions or mild TBI (mTBI)
• Considered signature wound of the wars in Iraq and Afghanistan
  – Invisible wound of war
• Functional changes include thinking, sensation, language and emotion

Overview of TBI – Cont’d
• Most rapid recovery is within first 6 months
  – Post-concussive symptoms persist beyond one year in approx 10-15% of those with mTBI
• Recovery may be slowest in older adults
• Rest is very important after a concussion because it helps the brain to heal
  – Get plenty of sleep at night, and rest during the day
  – Avoid activities that are physically demanding or require a lot of concentration
  – Return to your normal activities gradually, not all at once
TBI Definition

- Result of a blow or jolt to the head or a penetrating head injury that disrupts normal function of the brain
- Not all head injuries result in TBI
- Classified based on severity
  - Mild
  - Moderate
  - Severe

Severity Rating for TBI

<table>
<thead>
<tr>
<th>Severity</th>
<th>GCS</th>
<th>AOC</th>
<th>LOC</th>
<th>PTA</th>
<th>Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
<td>≤24 hrs</td>
<td>≤30 min</td>
<td>≤24 hrs</td>
<td>Neg</td>
</tr>
<tr>
<td>Moderate</td>
<td>9-12</td>
<td>&gt;24 hrs</td>
<td>&gt;30 min</td>
<td>&gt;24 hrs &lt;7 days</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>Severe</td>
<td>3-8</td>
<td>&gt;24 hrs</td>
<td>&gt;24 hrs</td>
<td>≥7 days</td>
<td>Pos</td>
</tr>
</tbody>
</table>

GCS - Glasgow Coma Score  
AOC - Alterations in consciousness  
LOC - Loss of consciousness  
PTA - Posttraumatic amnesia

Common Causes of TBI

- Over 80% of TBI’s occur in non-deployed setting
- Common causes:
  - Falls
  - MVA
  - Sports and recreation activities
  - Military training

Common Causes of TBI: Department of Defense

- From most common to least common
  - Improvised Explosive Device (IED)
  - Mortar blasts
  - Gun Shot Wound (GSW) head or neck
  - Rocket Propelled Grenade (RPG)
  - Vehicle Born Improvised Explosive Device (VBIED)
  - Motor Vehicle Accident (MVA)

DoD Numbers for TBI

Signs and Symptoms of TBI

- Thinking/Reasoning
  - Difficulty thinking clearly
  - Memory loss

- Physical
  - Headache
  - Nausea

- Emotional/Behavior
  - Irritability
  - Mood swings

- Sleep
  - Difficulty falling asleep
  - Trouble staying asleep
Visual Symptoms with TBI

- Photo sensitivity
- Blurred vision (distance and/or near)
- Eyestrain
- General and/or eye fatigue when reading
- Avoidance of reading and other close work
- Unable to sustain near work
- Reading problems
- Loss of place when reading
- Difficulty concentrating
- Decreased attention span
- Difficulty recalling what has been read
- Difficulty shifting focus from near to far to near
- Bothered by movement in spatial world
- Difficulty with comprehension over time
- Decreased peripheral visual field awareness
- Diplopia (or closing or covering an eye)
- Dizziness
- Headaches

Types of Injury

- Penetrating brain injury
- Closed brain injury
  - Improvised Explosive Device (IED) or blast injury
    - Shock wave of overpressurization
    - Followed by compensatory wave of underpressurization and blast wind
  - Projectile debris
  - Coup-contrecoup injury
  - Contusion (bruising)
  - Diffuse axonal injury (DAI)

Diffuse Axonal Injury (DAI)

- Most common pathological feature of TBI
- Mechanical forces that result in the shearing and strain of the axons
  - Common with acceleration-deceleration type of TBI
- Rapid stretch of an axon leads to damage to the neurons cytoskeleton
- Axonal transport continues until inflammation causes further cytoskeleton breakdown
- Leads to build up of transport products and formation of retraction ball

Imaging Techniques for DAI

- CT
  - First line, easily available
  - Less sensitivity for detecting DAI
  - Initially 50-80% will have normal CT scans
- MRI
  - Greater sensitivity
  - Several different types (including functional MRI)
  - Imaging of choice
- Diffusion tensor imaging (DTI)
  - Can characterize white matter integrity
  - Hold promising results
- PET scan
  - Shows regional brain function
  - More sensitive than CT and MRI

The TBI Eye Exam

- Case history
- Minimum data base
  - Evaluation of binocular vision, accommodation, and eye movements
- Ancillary tests as needed
- Ocular health exam

Diagnosis
Case History

- In general, history will be more detailed with additional follow up questions
  - Date of injury? (Acute vs. Chronic)
  - Cause of injury?
  - Rehabilitation (outpatient/inpatient) services to date?
  - Number of injuries in past?
  - Extended CISS questionnaire

Case History - Cont’d

- Ocular/Systemic conditions
- Past Surgical History
- Systemic Meds
  - Headaches
  - Insomnia
  - Anxiety
  - Depression
  - Nerve Pain
- Allergies
- Family History
- Social History

Visual Acuity and Entrance Examination

- DVA
- NVA
- Fixation
  - Look for nystagmus/steady or unsteady (have pt. hold for 10 sec)
- NPC
  - Repeat testing three times
  - Repeat testing with red lens
- PERRL(-) APD

Visual Acuity and Entrance Examination - Cont’d

- CVF
  - Prefer simultaneous presentation
  - If VF defect noted then schedule HVF or FDT 30-2 or Full Field 120
  - If Neglect noted referral to specialist to test further
- EOM’s
  - Evidence of CN III, CN IV, CN VI paresis or palsy
Visual Acuity and Entrance Examination - Cont’d

• Cover Test (D/N)
  — If patient has diplopic symptoms/restriction of gaze perform
  • Parks 3-step
  • Maddox Rod (in 9 positions of gaze) to check for (non) comitancy
    — Nonconstant deviations occur concurrent with palsy
  • Red lens test to check for diplopia and suspected extraocular muscle palsy
• Prism Bar Step Vergences (D/N)
  — Can do vertical ranges if find a vertical deviation on cover test and/or maddox rod
• Maddox Rod
  — Available with built in prism

Visual Acuity and Entrance Examination - Cont’d

• Saccades
  — Hold two objects 40cm apart, have pt. look between targets
  — Perform horizontal, vertical, oblique
• Pursuits
  — Have pt follow object both clockwise and counter clockwise, slowly
• Color vision ( Ishihara plates )
  — If fail Ishihara, then perform D-15
• Sensory status
  — Worth 4 dots
• Stereo Testing (RDS)

Refraction and Accommodative Assessment

• Manifest refraction
  — Performing retinoscopy can be useful
  — Best corrected VA
• NRA/PRA
• Minus lens amps
• MAF and/or BAF

Additional Tests

• Wesson fixation disparity
• Visual Field testing
  — FDT, 30-2, full field 120
  — Mixed thoughts on baseline VF testing
• OCT (macular and/or RNFL)
• Double maddox rod
• Contrast sensitivity

Ocular Health Examination

• Slit Lamp Examination
• Gonioscopy (as needed)
• Tonometry with appplanation
• Dilated Fundus Examination

Frequency of Visual Diagnosis

All subjects had experienced a TBI
• 74% of subjects complained about vision
• Convergence Insufficiency 30.4%
• Accommodative Insufficiency 21.7%
• Pursuit/Saccadic Dysfunction 19.6%

### Treatment

- Correction of refractive error
- Added lenses
- Prism
- Occlusion
- Vision rehabilitation

### Optical Correction

<table>
<thead>
<tr>
<th>Refractive condition</th>
<th>Significant amount general patient</th>
<th>Significant amount TBI patient</th>
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</thead>
<tbody>
<tr>
<td>Hyperopia</td>
<td>+1.25 D or greater</td>
<td>+0.50 D or greater</td>
</tr>
<tr>
<td>Myopia</td>
<td>–0.75 D or greater</td>
<td>–0.50 D or greater</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>–1.00 D or greater</td>
<td>–0.75 x 180 or greater</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–0.50 x 090 or greater</td>
</tr>
<tr>
<td>Anisometropia</td>
<td>1.00 D difference in either the</td>
<td>–0.75 D or greater</td>
</tr>
<tr>
<td></td>
<td>sphere or cylinder</td>
<td></td>
</tr>
</tbody>
</table>

### Optical Correction - Cont’d

- May require several different glasses
- Consider mobility for distance rx
  - Single vision rx in polycarb encouraged
  - Bifocal/PAL can be problematic
- Single-vision near and single vision intermediate glasses for sustained visual activities such as reading/computer use
- Possible change in rx at f/u visit

### Added Lenses

- Value of add determined by magnitude of AC/A
  - High AC/A = large change in alignment
  - Low AC/A = minimal change in alignment
- Good starting point as “default” add is +0.75-+1.25D

### Prism

- Most effective for non-strabismic vertical deviations and eso deviations  distance > near
  - Divergence insufficiency (consider prescribing 1/3 of distance phoria)
  - Basic esophoria
  - Vertical heterophoria (usually rx full amount; eyes must remain aligned immediately upon opening)
- Split prism > 1pd
- Ground in prism
Occlusion

• When double vision cannot be eliminated
  – Sensory fusion disruption syndrome
  – Significant non-comitancy
• Consider total or sectoral occlusion
• Eye patch is not a long term solution cosmetically
  • Bangeter foils

Vision Rehabilitation (VR)

• Different patient population
  – Lack of motivation
  – Changing status
  – Variable results
• VR with OT
  – Typically 6-10 in office sessions of once/week
  – Home therapy 5 nights/week
  – Mid evaluation after 4-5 sessions by OD to ensure progress being made

VR General Considerations

• Set realistic expectations
• Recovery is an ongoing process,
• Important to identify strengths and weaknesses of the individual
• Develop alternative strategies
• Develop a plan

VR Treatment Flow

Photosensitivity Treatment – Indoors and Night Time Glare

• Patient preference (pt should try on all options)
  ▪ Gray (40% and 60%)
  ▪ Amber (60% and 80%)
  ▪ Blue (65% and 85%)
  ▪ FL41 50%
  ▪ Demonstrated to help with light sensitivity and blepharospasm
  ▪ Consider special lens coatings such as antireflective coatings or polarizing lenses
  ▪ Avoid dark tint (can disrupt circadian rhythm)
Sample Tint Kit

Make the Right Referral

- ENT, audiologist, physical therapist
- Rotary chair for further evaluation of vestibular system
- Calorics to assess peripheral vestibular system
- Review medications/scans
- Outpatient physical therapy evaluation

Clinical Pearls

- Go SLOW!!
  - Move slowly
  - Speak slowly/clearly
  - Change prism/add lenses slowly
- Keep the room illumination dim if needed
- Take frequent breaks
- Split the examination

Clinical Pearls - Cont’d

- Remember – culture of the military is not to complain
- Prescribe separate distance/near rx for:
  - Gait
  - Vestibular
  - Physical therapy
- Frequent follow up care is essential

Thank you!