Concussion/Mild Traumatic Brain Injury
A Primer for Psychiatrists

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Introduction and Objectives

At the conclusion of the symposia participants will be able to:

- Understand neurobiology of MTBI and diagnostic criteria.
- Discuss current clinical practice guidelines for the treatment of mTBI.
- Demonstrate knowledge of comorbid disorders and symptoms.
- Identify non-pharmacological symptom management of mTBI.
Significance of TBI

- > 1.5 million TBI each year in US (CDC data).
- 75% of all TBI are categorized as mild.*
- Cost of mTBI $17 Billion a year.
- TBI causes disability in 2.3-3.5 million people in US.

DoD World Wide Numbers

DoD Numbers for Traumatic Brain Injury Worldwide – Totals

2000-2015

- Penetrating: 4,971
- Severe: 3,578
- Moderate: 30,072
- Mild: 283,216
- Not Classifiable: 22,193

Total - All Severities: 344,030

Source: Defense Medical Surveillance System (DMSS), Theater Medical Data Store (TMDS) provided by the Armed Forces Health Surveillance Branch (AFHSB)

Prepared by the Defense and Veterans Brain Injury Center (DVBIC)

*percentages do not add up to 100% due to rounding convention

2000-2015, as of March 30, 2016
What are the implications in practice?

- Recovery is the norm
- However over 15% of mTBI persists with symptom cluster described as Chronic Post Concussion Syndrome (PCS) beyond 1 year
  - Headache,
  - Sleep disturbances,
  - Fatigue, cognitive deficits*
  - Depression,
  - Anxiety,
  - PTSD,
  - Suicidality

What is mTBI?

True/False

- Defined as concussion?
- Shows structural abnormality in CT?
- Loss of Consciousness is necessary?
Traumatic Brain Injury (TBI)

DoD Definition:

- A traumatically induced structural injury or physiological disruption of brain function as a result of an external force, that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event:
  - Any period of loss of or decrease of consciousness, observed or self-reported (LOC)
  - Any loss of memory for events immediately before or after the injury (PTA)
  - Any alteration in mental status (confusion, slowed thinking, disorientation) (AOC)

(Memorandum: TBI Updated Definition and Reporting, April 06, 2015)
Imaging studies in MTBI

- Normal CT / standard MRI.

- Diffuse Axonal Injury or Traumatic Axonal Injury demonstrated with advanced imaging technique, e.g. DTI and FA.
Normal Conventional MRI*

“Medically Ready Force...Ready Medical Force”
Diffusion Tensor Imaging*

- Tractography

Normal

Parietal/Occiptial axonal injury

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**Possible Impact of mTBI**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Manifestation</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Headache</td>
<td>Failure to sleep at night</td>
<td>Poor marksmanship</td>
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<tr>
<td>Sleep disturbance</td>
<td>Decreased energy</td>
<td>Decreased situational awareness</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Slower reaction time</td>
<td><strong>Difficulty performing quickly under time pressures</strong></td>
</tr>
<tr>
<td>Dizziness/balance problems</td>
<td>Difficulty negotiating uneven terrain</td>
<td>Difficulty multi-tasking, such as driving a vehicle while listening to instructions on a radio</td>
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<tr>
<td>Visual disturbance and light sensitivity</td>
<td>Easily distracted</td>
<td>Performance difficulties can affect self-esteem and confidence</td>
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<tr>
<td>Ringing in ears</td>
<td>Difficulty processing multiple sources of information</td>
<td>Fear of performing in certain operational environments</td>
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<tr>
<td>Slowed thinking</td>
<td>Interpersonal problems</td>
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<tr>
<td>Difficulty finding words</td>
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<tr>
<td>Poor concentration</td>
<td></td>
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<tr>
<td>Memory problems</td>
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<tr>
<td>Anxiety/depression</td>
<td></td>
<td></td>
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<tr>
<td>Irritability/mood swings</td>
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Traumatic brain injury, posttraumatic stress disorder, and postconcussive symptoms *

- Retrospective analysis of data among troops returning from Iraq.

- 1247 members of a US Army Brigade Combat Team with injuries.

- 26% had history of mTBI and screened positive for PTSD.


“Medically Ready Force...Ready Medical Force”
Army study to assess risk and resilience in service members (ARMY STARRS)*

- Prospective longitudinal evaluation of the effect of deployment-acquired traumatic brain injury on posttraumatic stress and related disorders.

- Army STARRS study of 4645 service members shows that one in five soldiers reported exposure to mild TBI (19.2%) during deployment.

- After adjusting for other risk factors (e.g., predeployment mental health status, severity of deployment stress etc.), deployment-acquired mTBI was associated with elevated adjusted odds of PTSD, anxiety disorder and major depressive episode.

Comorbidity at 3 months post deployment (Army STARRS Study-N=4645-19%mTBI)
Am J Psychiatry 172:11, November 2015

Past 30-Day Disorders at 3 Months Postdeployment

- Major Depressive Episode: 14.8%
- Suicidality: 3.0%
- Suicidality: 9.2%
- Suicidality: 1.5%
- Major Depressive Episode: 1.6%
- Generalized Anxiety Disorder: 14.3%
- Generalized Anxiety Disorder: 5.3%
- Generalized Anxiety Disorder: 0.3%
- Posttraumatic Stress Disorder: 24.0%
- Posttraumatic Stress Disorder: 4.9%
- Posttraumatic Stress Disorder: 2.0%
- Posttraumatic Stress Disorder: 0%
Comorbidity past 30 days at 9 Months Post deployment
Am J Psychiatry 172:11, November 2015

Past 30-Day Disorders at 9 Months Postdeployment

- Posttraumatic Stress Disorder: 29.3%
- Generalized Anxiety Disorder: 6.1%
- Major Depressive Episode: 5.8%
- Suicidality: 14.6%

Overlap percentages:
- Posttraumatic Stress Disorder and Major Depressive Episode: 5.2%
- Posttraumatic Stress Disorder and Suicidality: 4.4%
- Major Depressive Episode and Suicidality: 1.9%
- Generalized Anxiety Disorder and Suicidality: 1.8%
- Posttraumatic Stress Disorder and Generalized Anxiety Disorder: 13.1%
- Generalized Anxiety Disorder: 4.3%
- Major Depressive Episode: 1.1%
- Suicidality: 1.1%
- Generalized Anxiety Disorder: 2.6%
- Major Depressive Episode: 8.1%
- Suicidality: 0.6%
- Generalized Anxiety Disorder: 1.1%
- Major Depressive Episode: 1.1%
- Suicidality: 0.6%
Management of comorbid disorder

Screen and assess for Neurocognitive, psychiatric symptoms and co-morbid psychiatric/medical disorders

1. Post concussive syndrome: Neurobehavioral symptom inventory (NSI) 18 item
2. Headache: Headache Impact Test-6 (HIT) 6 item
3. Sleep: Sleep diary-Insomnia Severity Index (ISI) 3 item
4. Fatigue: Multi Dimensional Assessment of Fatigue (MAF) 16 item
5. Neurocognitive symptoms
6. Major depressive disorder (MDD) : PHQ 9
7. Anxiety Disorders: GAD 7
8. Combined scale: Somatization, GAD, Panic, depression (PH-20)
10. Substance use disorders (SUD) : CAGE
11. Suicidality : Columbia-Suicide Severity Scale (C-SSRS military)

Consult appropriate VA/DoD clinical practice guidelines (new VA/DoD CPG - 2016)*

*www.DVBIC.ORG
Suicide rate in the military
DoDSER Report 2014

- Active duty 269 (Army 27.9%, Marine Corps 7.8%, Air Force 13.7%, Navy 12.1%)
- All Reserve: 80 (18.3%)
- All National Guard: 89 (20.3%)
- History of deployment was identified in 153 Suicides (54.4%)
- Rate of suicide (per 100,000) Active duty: 19.9
  - Reserve: 21.9
  - National Guard: 19.4

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Risk of suicide after a concussion*

Retrospective study

N = 235 110 patients with a mild concussion.

Mean age was 41 years (52% male).

667 subsequent suicides occurred over a median follow-up of 9.3 years.

31 deaths per 100 000 patients annually (3 times the population norm) Weekend concussions were associated with a one-third further increased risk of suicide compared with weekday concussions (relative risk 1.36, 95% confidence interval 1.14–1.64).

The increased risk applied regardless of patients’ demographic characteristics, was independent of past psychiatric conditions, became accentuated with time and exceeded the risk among military personnel.

Adults with a diagnosis of concussion had an increased long-term risk of suicide, particularly after concussions on weekends.

*Michael Fralick MD BScH, Deva Thiruchelvam MSc, Homer C. Tien MD MSc, Donald A. Redelmeier MD MS(HSR) CMAJ February 8, 2016 First published February 8, 2016, doi: 10.1503/cmaj.150790
PTSD

- SSRIs: limited benefit in PTSD.
- Exposure based cognitive therapy has the best outcome for PTSD.
- As a rule DO NOT USE Benzodiazepines in PTSD.
A 2012 meta-analysis by Mathias and Alvaro showed that 50% of people suffered from some form of sleep disturbance after a TBI.*

- Stimulus control/Sleep Hygiene
- APPS: T2 health.dcoe.mil
- CBTi Coach, Breath 2 Relax, Dream eezy,
  
  - Melatonin 3mg
  - Low dose short duration hypnotics
  - Doxepin 3.5 mg daily
  - Do not use Benadryl
Management of Sleep Disturbances after Concussion—Second most common Symptom
Clinical Recommendation

Four common sleep disturbances following concussion

- Short-term insomnia (previously known as acute insomnia).
- Chronic insomnia.
- Circadian rhythm sleep-wake disorders (CRSWD) (previously known as circadian rhythm sleep disorder).
- Obstructive sleep apnea (OSA).
First-Line Non-Pharmacological Treatment

**Stimulus Control**
- Remove TV, radio, smartphone, electronic tablet, etc. from bedroom
- Relax before bedtime
- Go to bed only when tired and sleepy
- If unable to fall asleep within 15-20 minutes, get up, go to another room with the lights dim and do something relaxing while avoiding electronic use; return to bed when sleepy, etc.

**Sleep Hygiene**
- Avoid caffeine/stimulant intake within six hours of bedtime
- Engage in daily exercise; avoid exercise too close to bedtime
- Avoid alcohol and nicotine use, large/heavy meals and excessive fluid close to bedtime
- Get up at the same time every morning (regardless of the amount of sleep obtained); avoid naps, etc.
Fatigue

Third most common in symptom in mTBI

- DoD survey of 2,525 Operation Iraqi Freedom SMs showed 92.9% fatigue compared to 25% without TBI.*

- Literature reviews reveal that Methylphenidate, Modafanil and Amantadine are commonly used for the treatment of fatigue in persons with TBI. The added benefit includes improving cognition and persisting fatigue.

Dizziness after TBI-Types

Dizziness is broadly identified as a sensation of imbalance, instability or altered spatial orientation. It is typically categorized into one of the following three subtypes:

<table>
<thead>
<tr>
<th>Type of Dizziness</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Vertigo</td>
<td>A false sense of motion (spinning, rocking, swaying, movement of environment)</td>
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<tr>
<td>Disequilibrium</td>
<td>Being off-balance or unsteady while standing or attempting to walk (in absence of vertigo or orthostatic hypotension)</td>
</tr>
<tr>
<td>Lightheadedness</td>
<td>Feeling faint or other vague sensations such as disconnect with environment</td>
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</tbody>
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Dizziness – Clinical takeaways

- Vestibular / balance symptoms following concussion are common.
- By categorizing the type of dizziness disorder, it will lead you to the most effective treatment.
- Recent literature has identified that some individuals’ recovery following concussion may be aided by a progressive approach to activities that involve the vestibular domain.

Resources: Neurologist/Physical Therapist trained in Vestibular Disorders.
Posttraumatic Headache

- The four most common types of PTH following concussion
  - Migraine (most common PTH in the Military)
  - Tension-type
  - Cervicogenic
  - Headache related to neuropathic pain

- Primary Care Manager treatment options
  - Non-pharmacologic treatment include
    - sleep hygiene, physical therapy and relaxation
  - Pharmacologic treatment may include
    - over the counter meds or NASIDS

- Most PTH resolve within 6-12 months

- Specialty Referral
  - Neurology

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PTH Diagnosis and Classification

- PTH may occur from injury not only to the head but also to the neck or face.

- The diagnosis of PTH is largely dependent on the timing of the injury and headache onset.
  - Focus History
  - Focus Exam
  - Classification
    - Acute (<3 months) or persistent (>3 months).

www.spineuniverse.com
Post Traumatic Headache - PTH

- Patient presents with headache after a concussion
- Perform focused headache history and assessment
- Concussion or headache red flags present?
  - Yes: Emergent or specialty referral as indicated
  - No: Review diagnostic criteria and determine headache type
    - Migraine
    - Tension-Type
    - Cervicogenic
    - Neuropathic
mTBI and Cognitive Symptoms

- Most individuals with a single mTBI are symptom-free within days to weeks and will not require cognitive rehabilitation.

- A small number report new, persistent or worsening symptoms weeks, months, or sometimes years post-injury.

  - These numbers vary widely but potential for functional impact cannot be underestimated.
Predisposing risk factors

- Prior history of brain injury
- The psychological experience of combat
- Female sex
- Pre-existing psychiatric conditions
- Older age
- Lower education levels
- And other pre-morbid or co-morbid conditions
Cognitive Difficulties and Impact

Cognitive Challenges

- Memory
- Attention
- Social communication
- Reaction time
- Processing speed
- Executive Functions
  - Behavior – decision making, motivation, impulse control

Possible impact

- Difficulty with daily activities
  - “I can’t keep up with my life – I can’t even remember where I put my phone”
- Relationship strain
  - “My wife and I are fighting constantly – she keeps nagging me and telling me I can’t remember anything”
- Difficulty with work re-integration
  - “My boss is so frustrated with me – I’m just not the same”
- Shift in identity and role in family, community
  - “My kids are constantly reminding me of stuff I’m supposed to do – I feel like I can’t just be a dad anymore”

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When to Refer

- What to listen for:
  - Cognitive complaints related to memory, attention, or executive functions:
    - “I forgot my appointment again”
    - “I only remember to take my meds every couple of days”
    - “I lose track of what people are talking about during conversation”
    - “Wait, we talked about this in our last session?”

- If cognitive complaints persist past 30-90 days, refer for functional cognitive assessment (DoD/VA Clinical Practice Guideline for the Management of Concussion – Mild Traumatic Brain Injury, 2016)

- Who is most appropriate referral specialty?
  - Neuropsychology/Rehabilitation Psychology
  - Speech-Language Pathology
  - Occupational Therapy
Key Principles of Cognitive Rehabilitation

1. **Collaborative**
   - Functional and meaningful
   - Focused on patient’s goals
   - Interdisciplinary

2. **Compensatory strategies and education**
   - Compensatory strategies:
     - E.g. using smartphone calendar to manage appointments
     - Educate and promote realistic expectations for recovery

3. **Patient-centered**
   - Match techniques and devices to person/situation
   - Practice in real-life contexts
   - Address multifactorial complexities

www.asha.org

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Cognitive Rehabilitation Activity: Brain Dump

- **Brain Dump** – write down everything that you will need to do over the next few weeks to months (e.g. medical, social, family-related, etc.)
- It doesn’t need to be organized, just write it all down!
**Brain Dump, continued**

<table>
<thead>
<tr>
<th></th>
<th>High Priority (today or tomorrow): Enter into calendar</th>
<th>Medium Priority (within a week or so)</th>
<th>Low Priority (within a month or so)</th>
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Busy mind ➔ Brain Dump ➔ Prioritize ➔ Reminders ➔ Productivity!

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Is Cognitive Rehabilitation Effective?

- Significant expansion of literature in recent years
- Five recent well-controlled studies of CR with service members and veterans have been published since 2011:
  - These studies found that CR had a **positive benefit** for those with mild TBI and persisting post-concussion symptoms (PPCS).

Chen et al., 2011; Nelson et al., 2013; Novakovic-Agopian et al., 2011; Riegler et al., 2013; Twamley et al., 2014
Cognitive Rehabilitation - takeaways

- Most individuals will not need a course of cog rehab
- Education and reassurance is key
- Refer for more thorough evaluation by cog rehab specialist if symptoms do not resolve within 30-90 days
- If needed, cog rehab should be collaborative, patient-centered, and focus on education and compensatory strategies
## Existing DoD/VA Cog Rehab resources

<table>
<thead>
<tr>
<th>Document</th>
<th>Published by</th>
<th>Year Published</th>
<th>Available at</th>
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</table>
Progressive Return to Activity (PRA) – Clinical Recommendation

- Developed and released Jan 2014 for clear guidance on progressive return to activity following mTBI after the mandatory recovery period
- Separate products for PCM and for the Rehabilitation Providers
- Promotes standardization of care following mTBI
# Stages of Progressive Activity

<table>
<thead>
<tr>
<th>Rehabilitation Stages</th>
<th>Description</th>
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<tbody>
<tr>
<td>Stage 1</td>
<td>Rest (minimum 24 hours)</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Light Routine Activity</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Light Occupation-oriented Activity</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Moderate Activity</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Intensive Activity</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Unrestricted Activity</td>
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Key features of the CR:
- Provide six stages of progression from rest to pre-injury activity
- Utilize the Neurobehavioral Symptom Inventory (NSI) for evaluating symptoms
- After an **education intervention for all patients**, those with few and mild symptoms are managed by a Primary Care Manager and follow a self-guided staged recovery
- Patients who are more symptomatic or who fail to progress are referred to rehabilitation providers for a more intensive, clinician-directed, daily-monitored recovery
- List key activities for participation and activities to avoid at each stage
- Requires a regression to the previous stage for one day if there is any increase in the number or severity of symptoms
- Gives guidelines for progression, regression and referral
Return to Activity Educational Brochure

Stage 2: Light Routine Activity - All activities no longer than 30 minutes
- You may wear a uniform and boots.
- Walk and stretch
- May ride a stationary bike at a slow pace with low resistance
- Do light housework
- Use the computer
- Play simple games, such as cards

**DO NOT!!!**
- drink alcohol
- drive
- play video games
- do resistance training or repetitive lifting
- do sit-ups, push-ups or pull-ups
- go to crowded areas where you may be bumped into

Stage 3: Light Occupation-oriented Activity
- May perform these activities no longer than 60 minutes
- Lift and carry objects less than 20 pounds
- Take a brisk walk
- Ride in car and look around.
- Use an elliptical machine or stair climber
- Perform light military tasks such as cleaning equipment

Stage 4: Moderate Activity
- You may wear PPE.
- May perform these activities no longer than 90 minutes
- Take a brisk walk
- Do light resistance training
- Participate in non-contact sports
- Perform moderate job-related tasks
- Climb, crawl or jog

**DO NOT!!!**
- drink alcohol
- participate in combatives or contact sports
- drive

Stage 5: Intensive Activity
- May perform these activities no longer than 40 minutes
- Play video games, foosball, putting and ping pong
- Play strategy games such as chess or sudoku
- Shop for groceries
- Perform target practice
- Drive in a simulator

**DO NOT!!!**
- drink alcohol
- participate in combatives or contact sports
- drive

Stage 6: Unrestricted Activity
- Return to pre-injury activities

Patients should discuss this brochure with their provider to ensure they understand the recovery process.

What is a Concussion?
A concussion is a head injury from a hit, blow or jolt to the head that:
- Briefly knocks you out (loss of consciousness), or
- May affect your ability to remember information before, during or after the event (post-traumatic amnesia), or
- Makes you feel dazed, like you had your bell rung (alteration of consciousness)
A concussion is also known as mild traumatic brain injury (mTBI). This brochure will help you recover as quickly and safely as possible. Each stage is designed to help you gradually return to your normal routine, while your brain heals. You may have to stay at one stage longer than another if your symptoms do not go away or return when you try to do more activities. Everyone is different. Do not rush your progress.

For more materials or copies: DVIC.dcoe.mil  Email questions or feedback to info@dvic.org

DVIC is the TBI operational component of The Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury. January 2014

"Medically Ready Force...Ready Medical Force"
PRA - takeaways

- Structured return to activity protocol has been developed and leads to safer return to normal activities.
- Recent evidence shows that prolonged bed rest is not recommended and should not be used.
- This CR was used with great success in Concussion Care Centers in Afghanistan with >90% Return to Duty.

“Medically Ready Force...Ready Medical Force”
Summary

ASK ME Campaign

- 21.8 Millions Veterans*

- 9 millions Veterans are registered with VA and only 6 million receive care from VA

- The American Medical Association has urged health care providers to ask patients if they have served in the military and to include that experience in their records.

* 2014 US Census date
Resources

Free Apps (Apple IOS/Android)

http://t2health.dcoe.mil/

www.dvbic.dcoe.mil