


4TH ANNUAL
CHAIR SUMMIT

Master Class for Neuroscience Professional Development



MILD TRAUMATIC BRAIN INJURY AND POST-CONCUSSION SYNDROME: DIAGNOSIS, TREATMENT, AND CONTROVERSY

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Disclosures



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- ***Other Financial Interest:*** None
- ***Advisory Board:*** None

LEARNING OBJECTIVE

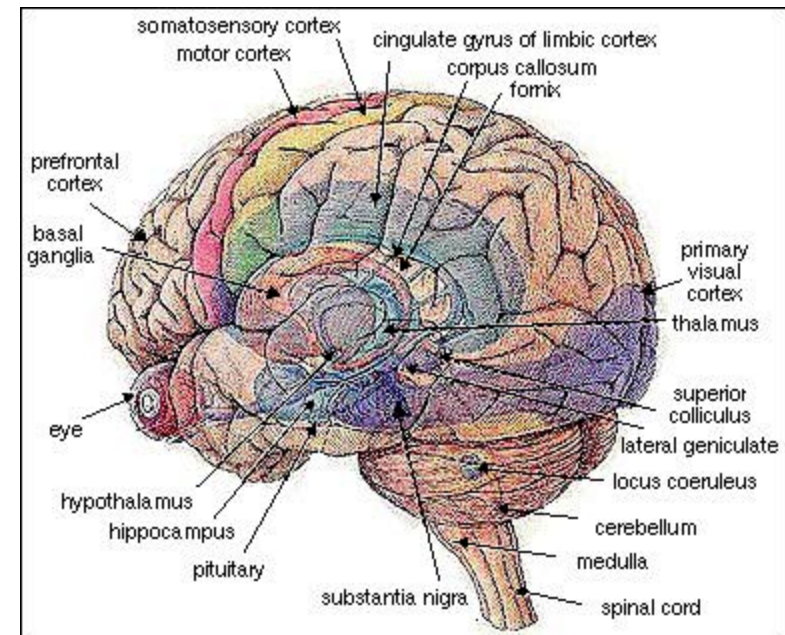
Explore some controversial aspects of the diagnosis and management of mild traumatic brain injury and prolonged post-concussion syndrome.



THE BRAIN IS OUR ORGAN



- More cells than stars
- It gets injured
 - Sports (3%)
 - Vehicular accidents (50%)
 - Falls (21%)
 - Violence (20%)
 - War



NIH Consensus Development Panel. *JAMA*. 1999;282(10):974-983.

EPIDEMIOLOGY



1. 1.2 million per year in U.S.
2. 80% MTBI
3. Men ages 15-24 (15% to 20% combat troops in current wars)
4. Children – accidents and abuse
5. TBI – most common neurologic disorder after HA/Herpes

Faul M, et al. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths, 2002-2006*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.

HUGE COSTS



- Financial
- Psychosocial
- Functional
- Psychiatric
- Interpersonal
- Physical



Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. *Report to Congress on Mild Traumatic Brain Injury in the United States: Steps to Prevent a Serious Public Health Problem*. Atlanta, GA: Centers for Disease Control and Prevention; 2003.

OUR ROLE AS PSYCHIATRISTS



- Do no harm
- Diagnose
- Treat (early)
- Forensic evaluations



ONE DEFINITION OF MTBI



A person who has had a traumatically induced physiological disruption of brain function as manifested by at least **one** of the following:

- Any LOC < 20 minutes, but...
- Any amnesia < 24 hours - best indicator, but...
- Any alteration in mental state at the time of the accident (i.e., feeling dazed, disoriented, confused) but...
- GCS 13-15
- Neurological exam (**initial** seizures, lesions, aphasias, gait disorders, anosmia)
- Imaging (MRI, CT)

American Congress of Rehabilitation Medicine. *J Head Trauma Rehab.* 1993;8(3):86-87.
Ruff RM, et al. *Arch Clin Neuropsychology.* 2009;24:3-10.

DIFFERENTIAL DIAGNOSIS



- PTSD
- Depression
- Substance abuse
- Anxiety disorder
- ADHD
- Malingering
- Sleep apnea
- Iatrogenic

De Kruijk JR, et al. *Brain Inj.* 2001;15(2):99-106.

MAJOR OVERLAPS



	PCS	PTSD	MAD	Chronic HA	Malingering	Sleep Apnea	Substance Abuse
Fatigue	X	X	X	X	X	X	X
Sleep Δ	X	X	X	X	X	X	X
Headache	X	?	X	X	X	X	X
Dizziness	X	-	?	-	X	-	X
Irritability	X	X	X	X	X	X	X
Anxiety	X	X	X	X	X	X	X
Depression	X	X	X	X	X	X	X
Personality Δ	X	X	X	?	X	X	X
Apathy	X	X	X	?	X	X	X
Concentration	X	X	X	X	X	X	X
Memory	X	X	X	?	X	X	X

PCS = post concussive disorder; MAD = major affective disorder

MECHANISMS OF INJURY



- Contusions
 - Contrecoup 2°
 - Sudden deceleration
 - Impact not required, but.....
 - Blast waves, positive and negative
- Traumatic axonal injury (TAI)
 - Injury proportional to force – **controversial**
 - Shearing – **controversial**
 - Mechanical – stretched neurons
 - Chemical

Dixon EC, et al. *J Head Trauma Rehab.* 1993;8(3):1-12.

Meaney DF, et al. *Clin Sports Med.* 2011;30(1):19-31.

NEUROTRANSMITTER CHANGES



- Glutamine¹
- Catecholamines²
- Serotonin³
- Acetylcholine³
- Norepinephrine³
- Others³



1. Hamill RW, et al. *Ann Neurol.* 1987;21(5):438-443.
2. Gaparovic C, et al. *J Neurotrauma.* 2009;26(10):1635-1643.
3. Arciniegas DB, et al. *Behav Neurol.* 2006;17(1):25-42.

SHORT-TERM EFFECTS OF MTBI



- Headache, fatigue, dizziness, photophobia, sleep, hyperacusis
- Attention
- Concentration
- Memory
- Irritability
- Depression
- Anxiety
- Relationships
- Work

MTBI = mild traumatic brain injury

Parikh S, et al. *Int Anesthesiol Clin*. 2007;45(3):119-135.

Silver JM, et al. *Am J Psychiatry*. 2009;166(6):653-661.

CLINICAL EVALUATION



- History – patient & others
 - Accident (LOC vs. amnesia vs. psychological vs. medications vs. pain)
 - Pre-accident and post-accident
- Standardized questionnaires (GOAT)
- Neurologic exam
- Neuroimaging
- Psychiatric exam
- Neuropsychological assessment
- Standardized academic testing and grades

G.O.A.T.

GALVESTON ORIENTATION AND AMNESIA TEST

The Galveston Orientation and Amnesia Test Harvey S. Levin, Ph.D., Vincent M. O'Donnell, M.A., & Robert G. Grossman, M.D.

Instructions: Can be administered Daily. Score of 78 or more on three consecutive occasions is considered to indicate that patient is out of post-traumatic amnesia (PTA).

Question	Error Score	Notes
What is your name?	-2	Must give both first name and surname.
When were you born?	-4	Must give day, month, and year.
Where do you live?	-4	Town is sufficient.
Where are you now:		
(a) City	-5	Must give actual town.
(b) Building	-5	Usually in hospital or rehab center. Actual name necessary.
When were you admitted to this hospital?	-5	Date.
How did you get here?	-5	Mode of transport.
What is the first event you can remember after the injury?	-5	Any plausible event is sufficient (record answer)
Can you give some detail?	-5	Must give relevant detail.
Can you describe the last event you can recall before the accident?	-5	Any plausible event is sufficient (record answer)
What time is it now?	-5	-1 for each half-hour error.
What day of the week is it?	-3	-1 for each day error.
What day of the month is it? (i.e. the date)	-5	-1 for each day error.
What is the month?	-15	-5 for each month error.
What is the year?	-30	-10 for each year error.
Total Error:		
Total Actual Score = (100 - total error) = 100 - _____ =		Can be a negative number.
76-100 = Normal / 66-75 = Borderline / <66 = Impaired		

Levin HS, et al. *J Nerv Ment Dis.* 1979;167(11):675-684.

RESEARCH TOOLS



- SPECT¹
- Computerized EEG¹
- Auditory evoked potentials²
- Diffusion tensor imaging (DTI)³
- S-100B, a neuroprotein⁴

1. Prabhu SP. *Clin Sports Med.* 2011;30(1):103-114.

2. Potter DD, et al. *Neuropsychologia.* 2001;39(13):1464-1472.

3. Matsushita M, et al. *J Neurosurg.* 2011 Mar 18. [Epub ahead of print].

4. Kovesdi E, et al. *Acta Neurochir (Wien).* 2010;152(1):1-17.

RISK FACTORS



- Stress at time of accident
- Post-accident depression/anxiety
- Social support
- Headache and dizziness
- Pre-accident psychiatric disorder

1. Alexander MP. *Neurology*. 1995;45(7):1253-1260.

2. Halliday J, et al. *Br J Hosp Med (Lond)*. 2008;69(5):284-289.

COURSE OF MTBI



- Athletes – baseline in 2-21 days
- MVA – recovered in 3 months
- “Worst is first”

ATHLETIC INJURIES



- NFL – 650 players with 887 concussions
 - No one failed to return to play
 - 56% in 1-6 days
 - 36% in 7-14 days
 - 6.5% in more than 14 days
 - No measurable effect on cognitive function after acute recovery

MILITARY INJURIES



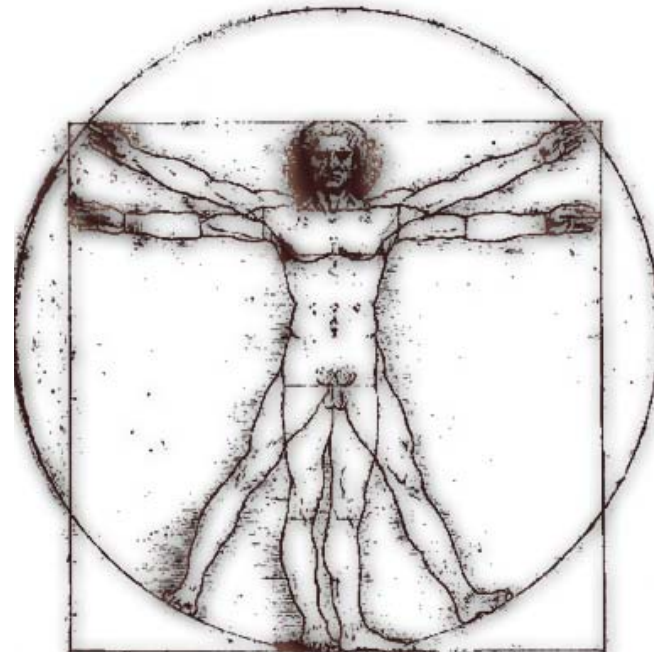
- TBI – a common injury
 - 15% to 20% MTBI in Iraq and Afghanistan
 - MTBI with LOC had more
 - Poor health
 - Missed work
 - Medical visits
 - PPCS symptoms
- Than soldiers with other injuries
- Adjusting for depression and PTSD
 - No differences except
 - Headache

Iverson GL. *Curr Opin Psychiatry*. 2005;18(3):301-317.

TREATMENT



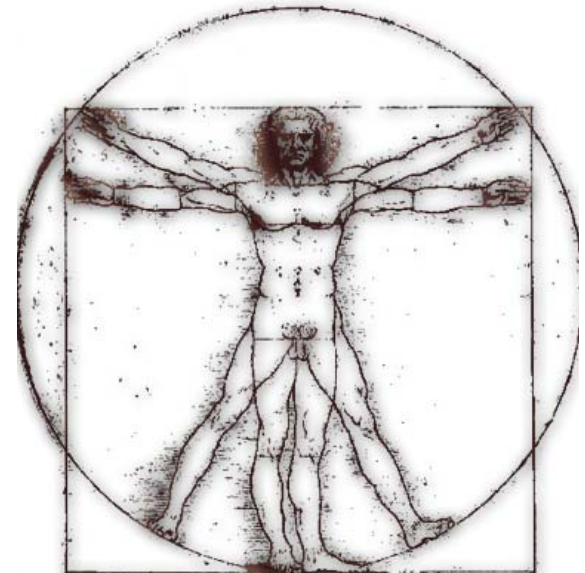
- **Do no harm**
- Realistic reassurance = evidence-based optimism
- Follow the patient
- Get neuropsychological assessment
- Education



TREATMENT



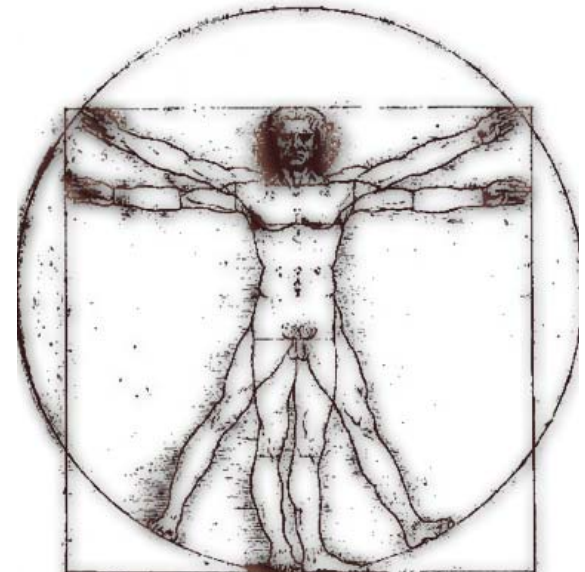
- Diagnose and Treat **Early**
 - Evaluate life stressors
 - Pain
 - Psychiatric disorders
 - Pre-existing and post
 - Occupational intervention
 - Back on the horse



TREATMENT



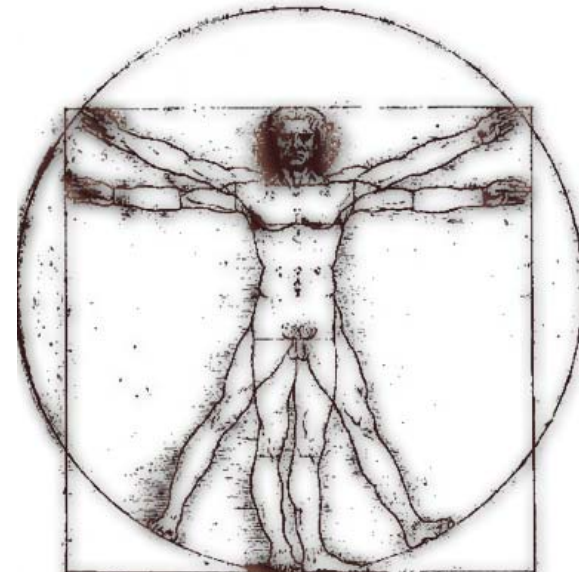
- Diagnose and Treat **Early** (cont.)
 - Family involvement
 - CBT
 - Great care with meds that impact and may worsen CNS function
 - Polypharmacology – +’s and –’s
 - Start low – go slow
 - Avoid narcotics
 - Side effect sensitivity



TREATMENT



- Depression
 - Sertraline
 - Citalopram
 - Concern
 - Bupropion and seizures
- Cognitive
 - Speed of information
- Memory
 - Donepezil



Silver JM, et al. *Am J Psychiatry*. 2009;166(6):653-661.

WHAT IS POST-CONCUSSION SYNDROME?



- Must have had
 - A “significant cerebral concussion”
- Three other symptoms x 3 months
 - Loss of consciousness
 - Amnesia
 - Seizures
- Or is it a psychological-psychosomatic extension of a previous brain injury?
- Or is it expectation plus?

APA. *DSM-IV-TR*. Arlington, VA: APA; 2000.

PREVALENCE OF PPCS



- 40% @ 3 months (Keshavan 1981)
- 16-50% @ 6 months (Bohnen 1992)
- < 6% @ 1 year (Alves 1993)

PPCS PREDICTIVE FACTORS



- Anxiety
- Chronic pain
- Depression
- Female
- Headache
- Litigation
- Lower SES
- Prior TBI
- Serious injury
- Social problems
- Substance abuse



Marble bust of the Roman Emperor Decius from the Capitoline Museum conveys an impression of anxiety on his brow and forehead.

Fenton G, et al. *Br J Psychiatry*. 1993;162:493-497.

Ettlin TM, et al. *J Neurol Neurosurg Psychiatry*. 1992;55(10):943-948.

Alexander MP. *J Head Trauma Rehab*. 1992;7:60-69.

TEST FOR MALINGERING

Amsterdam Short-Term Memory Test



MTBI Litigant	61%
MTBI Non-Litigant	29%

Schmand B, et al. *J Neurol Neurosurg Psychiatry*. 1998;64(3):339-343.

MTBI WITH ORTHOPEDIC CONTROLS



- Sample > 200
- Lithuania – litigation rare

		3 Months	12 Months
6 Core PCS Symptoms	MTBI	2	1
	Controls	3	1
3 Core PCS Symptoms	MTBI		78%
	Controls		47%

Mickeviciene D, et al. *Eur J Neurol.* 2004;11(6):411-419.

PPCS FOLLOWING MTBI



- Rare in prospective studies
- Seen equally in post-MTBI and non-brain injury trauma
- Usually no neuropsychological test evidence of organic brain disorder
- Not predicted by original peritraumatic amnesia

PERCEPTION/ EXPECTATION IMPACTS



- 25% of patients with concussion have some symptoms (but not necessarily from a concussion) persist at least a year
- “It is getting increasingly difficult...to find good scientific evidence that MTBIs are associated with demonstrable cognitive deficits where symptoms are due to the biologic effects of the injury in more than a small minority of patients who are more than three months post-injury.”

PERCEPTION/ EXPECTATION IMPACTS



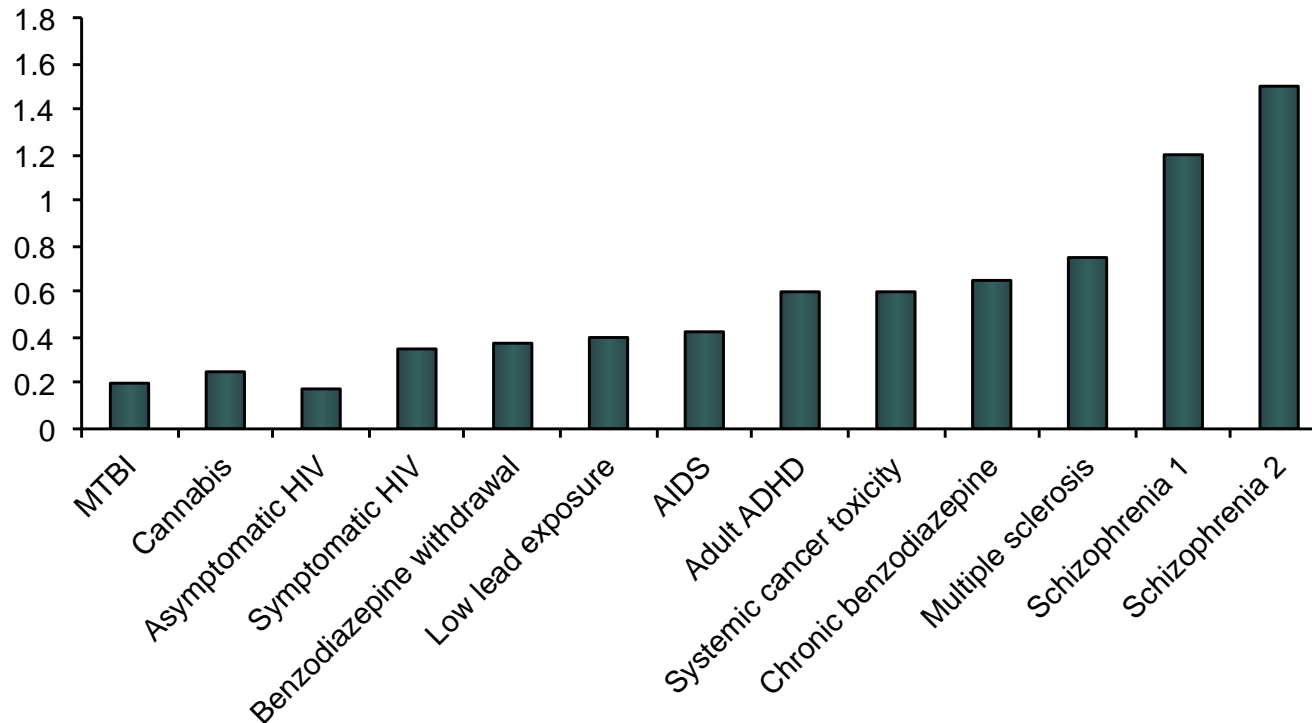
- “Post-concussion-like symptoms are common in healthy subjects and patients with no history of brain injury, outpatients seen for minor medical problems, in personal injury claimants, patients with PTSD, patients with orthopedic injuries, individuals with prior pain, and patients with whiplash.”
- “The effects of MTBI on neuropsychological functioning after the acute recovery period are considerably less than the effects of litigation, depression, or ADHD.”

EXPECTATION



- People never head-injured reported the usual, expected symptoms of MTBI correctly
 - Early and late experience reinforces expectation
 - Prior symptom levels underestimated

EFFECT SIZES ON MEMORY FUNCTIONING



Iverson GL. *Curr Opin Psychiatry*. 2005;18(3):301-317.

CONCLUSIONS

Presence of Cognitive Deficits



- HI → cognitive deficits
 - Cognitive deficits ≠ HI
- Must make sense
- Severity defined by injury characteristics
 - When they don't, think psychiatry etiology
- Symptoms improve

CONCLUSIONS



- MTBIs and PPCSs exist
- Real MTBIs have short-term impacts on cognition, emotions, neurologic function
- They are under-diagnosed and they are over-diagnosed
- Very heterogeneous
- They are very hard to accurately diagnose
- Need more than dazed and symptoms
- Need real traumatic insult to the brain
- Most heal during first week to three months

CONCLUSIONS



- Primary injury does not get worse over months
- First is worse!
- Head injury causes the presence of cognitive deficits but the presence of cognitive deficits does not necessarily mean head injury
- PPCS: Think “expectations”
 - Think rehabilitation
 - Think biopsychosocial
 - The field badly needs better diagnostic tools and treatments

GRATEFUL APPRECIATION TO MAJOR CONTRIBUTORS



- Thomas McAllister, MD
- John Povlishock, PhD
- Jonathan Silver, MD
- Stuart Yudofsky, MD

QUESTIONS AND ANSWERS



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