Posttraumatic Stress Disorder & Mild Traumatic Brain Injury

Richard Bryant
The Issue

- PTSD – MTBI is the major issue for PTSD today
- Troops from Iraq: 15% have MTBI
- Regarded as “signature injury” of war
- 40% of MTBI troops develop PTSD …. many more than no-MTBI (16%)
- Much attention on this issue
PTSD

- Criterion A: Stressor
- Criterion B: Reexperiencing
- Criterion C: Avoidance
- Criterion D: Arousal
- Criterion E: Duration
- Criterion F: Impairment
MTBI

- Knock to head
- Brief loss of consciousness
- PTA < 24 hours
- GCS = 13-15
How Can PTSD Develop After TBI?
Possible Mechanisms

- Fear conditioning
- Memory reconstruction
- Trauma following amnesia resolution
Fear Conditioning Models

- A prevailing model of trauma is that fear conditioning occurs during and after trauma.
- These models arise from earlier animal models of classical conditioning.
Classical Conditioning

- Learning that certain environmental stimuli predict harmful events.
Fear Conditioning Models

- Trauma = Unconditioned Stimulus
- Fear = Unconditioned Response
- Reminders = Conditioned Stimuli
- Reexperiencing = Conditioned Response
Neurobiology of conditioned fear

- The formation & storage of fear memories are mediated by the amygdala.
- The amygdala mediates a central state of fear.
Fear Conditioning & TBI

- Possible that conditioning occurs without full awareness of the traumatic experience
Severe TBI Study

- Assessed 96 severe brain injury patients
- Mean PTA = 37 days
- Assessment 6 months posttrauma
Incidence of Reexperiencing in PTSD Patients

- Memories
- Dreams
- Flash
- Distress
- Physical React
Acute Heart Rates & PTSD After Brain Injury

Bryant et al., 2004, *Psychosom Med*
Memory Reconstruction

- Case series indicate how TBI patients develop reexperiencing based on reconstructions of events
- Function same as normal intrusions
- Consistent with posttraumatic appraisals influencing PTSD development

Bryant & Harvey, 1998, *Applied Cog Psychology*
PTSD After MTBI

- What is the impact of MTBI on PTSD?
Injury Vulnerability Study

- Assessed 1150 patients across 4 hospitals in Australia
- Assessed in hospital, 3 months, 12 months
- Assessed for Axis 1 disorders
- Assessed functioning with WHOQOL
- Assessed for TBI (including PTA)
Adjusted Odds Ratio of Developing a Psychiatric Disorder if MTBI Present (controlling for ISS, Trauma Type)

- PTSD: 1.57*
- MDD: 1.38
- Agoraphobia: 1.50
- Panic Disorder: 1.34
- Social Phobia: 1.71*
- GAD: 1.75*
- Any Disorder: 1.50
Adjusted Odds Ratio of Impairment if MTBI Present (controlling for ISS, Trauma Type)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Physical</th>
<th>Social</th>
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</thead>
<tbody>
<tr>
<td>MTBI</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>MTBI/PTSD</td>
<td>10.6</td>
<td>9.7</td>
</tr>
<tr>
<td>MTBI/MDD</td>
<td>18.9</td>
<td>7.7</td>
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<tr>
<td>MTBI/Substance:</td>
<td>1.1</td>
<td>3.0</td>
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<td>MTBI/Anxiety:</td>
<td>7.5</td>
<td>6.6</td>
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<tr>
<td>MTBI/Any Dx:</td>
<td>3.2</td>
<td>2.2</td>
</tr>
<tr>
<td>No TBI/Any Dx:</td>
<td>4.9</td>
<td>2.8</td>
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</tbody>
</table>
Possible Mechanisms: Neural Compromise

- Much evidence that PTSD characterized by impaired medial prefrontal cortex
- This network critical in regulating emotions
- Damage to prefrontal networks common in MTBI
- This may render patients vulnerable to emotional disorders

Possible Mechanisms: Cognitive Compromise

- Appraisals and cognitive strategies are a big driver of PTSD and other disorders
- MTBI can lead to impaired cognitive resources
- Possible that MTBI patients do not engage in optimal cognitive resources
What About Trauma Memories?

- Gil et al (2007) reported that memory for traumatic experience inversely related to PTSD development
- We considered PTA in relation to PTSD
## Role of PTA

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Acute Assessment</th>
<th>3 Month</th>
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<tbody>
<tr>
<td>Intrusive Memories</td>
<td>-.18**</td>
<td>-.03</td>
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<td>Nightmares</td>
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<td>-.01</td>
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<tr>
<td>Flashbacks</td>
<td>-.10</td>
<td>-.01</td>
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<tr>
<td>Distress to reminders</td>
<td>-.10</td>
<td>-.10</td>
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<tr>
<td>Physiological reactivity</td>
<td>.05</td>
<td>-.02</td>
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</tbody>
</table>

$P < .001$
Implications

- Memory based symptoms are inversely related to PTA
- Nonetheless, PTSD is more common after MTBI
- It appears that increased rates of PTSD after MTBI do not involve greater trauma memories
Postconcussive Syndrome

- Dizziness
- Headaches
- Sensitivity to light
- Sensitivity to sounds
- Fatigue
- Concentration levels

Bryant et al., *J Inter’l Neuropsych Society*, 2009
What Predicts Postconcussive Symptoms?

- We studied 62 mTBI patients & 58 non-mTBI patients
- Assessed as in-patients on (a) pre-trauma, (b) neuropsych, and (c) PTSD measures
- Re-assessed at 3 months

Meares et al., *J Neurology Neurosurg. Psychiatry* 2008
Incidence of PCS

Acute:
- MTBI: 40%
- No TBI: 41%

3 Months:
- MTBI: 47%
- No TBI: 48%
What Predicts Persistent PCS?

- Pain
- PTSD
  (OR = 3.6)
Implications

- MTBI patients need to be monitored for stress reactions
- Do not confuse effects of MTBI with effects of stress
- Interaction of the two factors suggest that optimal intervention for PCS will focus on stress reactions
What About Treatment?

- CBT is most effective treatment of PTSD
- Does CBT work with MTBI?
Elements of Cognitive Behaviour Therapy

1. Anxiety management techniques
2. Cognitive therapy
3. Prolonged Exposure (Focus on intact memories)
4. Relapse Prevention
5. Follow-up assessment
Diagnostic Results

Bryant et al., 2003, *Am J Psychiatry*
Adjusting Treatment

- Cognitive models treatment response requires adequate working memory capacity & cognitive skills to manage fear reactions
- MTBI can impair cognitive capacity & skills
- Need to keep strategies simple, focused, and not reliant on abstract thinking or attentional focus
Exposure

- Patients do not have full memory of event
- Conduct exposure to whatever memories they do have
- Often rely on *in vivo* exposure techniques more than imaginal