MILD TRAUMATIC BRAIN INJURIES
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BRAIN INJURIES

• IT IS NOT ONLY THE BRAIN INJURY IT IS THE BRAIN THAT WAS INJURED THAT NEEDS TO BE EVALUATED AS WELL!
BRAIN INJURIES

- MILD
- MODERATE
- SEVERE
<table>
<thead>
<tr>
<th></th>
<th>SEVERE</th>
<th>MODERATE</th>
<th>MILD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loss of Consciousness</strong></td>
<td>Greater than 24 hours</td>
<td>30 minutes to 24 hours</td>
<td>30 minutes or less</td>
</tr>
<tr>
<td><strong>Glasgow Coma Scale</strong></td>
<td>Below 8</td>
<td>9-12</td>
<td>13-15 (at 30 minutes)</td>
</tr>
<tr>
<td><strong>Posttraumatic Amnesia</strong></td>
<td>Prolonged</td>
<td>24 hours to 7 days</td>
<td>24 hours or less</td>
</tr>
</tbody>
</table>

#*DSM V Criteria*

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Positive</th>
<th>Negative for mass lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT or MRI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurologic Examinations</td>
<td>Positive</td>
<td>Positive</td>
<td>Normal or abnormal (slightly)</td>
</tr>
<tr>
<td>Complications/ Deteriorations</td>
<td>Usually</td>
<td>May be</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
</tbody>
</table>
Mureil Lezak (1995) recommends the following classification for Posttraumatic Amnesia (PTA) in her book *Neuropsychological Assessment, Third Edition*:

<table>
<thead>
<tr>
<th>PTA DURATION</th>
<th>BRAIN INJURY SEVERITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 minutes</td>
<td>Very mild</td>
</tr>
<tr>
<td>5-60 minutes</td>
<td>Mild</td>
</tr>
<tr>
<td>1-24 hours</td>
<td>Moderate</td>
</tr>
<tr>
<td>1-7 days</td>
<td>Severe</td>
</tr>
<tr>
<td>1-4 weeks</td>
<td>Very Severe</td>
</tr>
<tr>
<td>More than 4 weeks</td>
<td>Extremely Severe</td>
</tr>
</tbody>
</table>
ICD.9.CM (1979) has the criteria for a diagnosis of concussion are as follows:

8.50: "with no loss of consciousness which includes concussion with mental confusion or disorientation without loss of consciousness"

850.1 "with a brief loss of consciousness which would include loss of consciousness for an hour",

850.2 "with moderate loss of consciousness from one to twenty-four hours",

850.3 "with a prolonged loss of consciousness and return to pre-existing consciousness level"
"The syndrome occurs following head trauma (usually sufficiently severe to result in loss of consciousness) and includes a number of disparate symptoms such as headaches, dizziness (usually lacking the features of true vertigo), fatigue, irritability, difficulty in concentrating and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement, or alcohol. These symptoms may be accompanied by feeling of depression or anxiety, resulting from loss of self-esteem and fear of permanent brain damage. Such feeling enhance the original symptoms and a vicious circle results. Some patients become hypochondriacal, embark on a search for diagnosis and cure, and may adopt a permanent sick role. The etiology of these symptoms is not always clear, and both organic and psychological factors have been proposed to account for them. The nosological status of this condition is thus somewhat uncertain. There is little doubt, however, that this syndrome is common and distressing to the patient."
PROGNOSIS FOR MILD TRAUMATIC BRAIN INJURY: RESULTS OF THE WHO COLLABORATING CENTRE TASK FORCE ON MILD TRAUMATIC BRAIN INJURY

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We searched the literature on the epidemiology, diagnosis, prognosis, treatment and costs of mild traumatic brain injury. Of 428 studies related to prognosis after mild traumatic brain injury, 129 (29%) were accepted after critical review. These comprise our best-evidence synthesis on prognosis after mild traumatic brain injury. There was consistent and methodologically sound evidence that children’s prognosis after mild traumatic brain injury is good, with quick resolution of symptoms and little evidence of residual cognitive, behavioural or academic deficits. For adults, cognitive deficits and symptoms are common in the acute stage, and the majority of studies report recovery for most within 3–12 months. Where symptoms persist, compensation/litigation is a factor, but there is little consistent evidence for other predictors. The literature on this area is of varying quality and causal inferences are often mistakenly drawn from cross-sectional studies.

Key words: mild traumatic brain injury, epidemiology, prognosis, recovery.

J Rehabil Med 2004; suppl. 43: 84–105

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INTRODUCTION

The incidence of hospital-treated mild traumatic brain injury (MTBI) is high, 0.00–0.09/100,000 population per year, making this a public health problem, disproportionately among teenagers and young adults (1). The outcome and course of recovery after MTBI is important to patients, healthcare professionals, researchers and policymakers, and impacts on decisions about compensation after an injury. Knowledge about the usual course of recovery after MTBI allows clinicians to provide appropriate advice to patients, and to recognize when recovery is not taking place as expected. Identification of pre-morbid and injury-related factors affecting recovery after MTBI may also help clinicians to screen individuals who are at greatest risk for sub-optimal outcome. However, there is great variability in opinions and research findings about prognosis after MTBI, as well as great variability in the quality of research.

The most informative studies of prognostic factors and outcome after MTBI employ a longitudinal design, and identify a comprehensive and representative cohort of subjects with MTBI as soon as possible after the injury. These individuals should then be followed over time to identify time to recovery, and prognostic factors affecting recovery or symptom persistence. Both cohort and case-control studies can be used to identify and test the strength of the association between potential prognostic factors and outcome.

Strength of the evidence within longitudinal studies also needs to be considered. One paradigm that has been used for ranking evidence of prognostic factors in breast cancer and whiplash classifies cohort studies into a 3-level hierarchy of knowledge (2, 3). Phase I studies explore associations between potential prognostic factors and disease outcomes in a descriptive way. For example, a cohort study exploring the crude relationship between age and recovery after MTBI is considered a phase I study. Phase II studies are more extensive exploratory studies using controls, stratified analyses and/or multivariable analyses to focus on sets of prognostic factors. For example, if a study of the association between age and recovery after MTBI is stratified by other factors thought to be important (such as positive or negative intracranial findings), it would be classified as a phase II study, since the association between age and recovery has considered the confounding of intracranial abnormality. Phase III studies are confirmatory studies, where the goal is to confirm or refute the independence of the relationship between a particular prognostic variable and the outcome of interest. For example, a phase III study examining the strength and independence of the relationship between age (the exposure) and recovery after MTBI (the outcome of interest) would test that relationship while explicitly controlling for possible confounders of that relationship. A confounder is defined as a third factor that is associated with both the exposure and the outcome. It is not in the causal pathway between the exposure and the

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A Meta-Analysis of Neuropsychological Outcome After Mild Traumatic Brain Injury: Re-analyses and Reconsiderations of Binder et al. (1997), Frencham et al. (2005), and Perteb et al. (2003)

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2Oregon Health Sciences University, Portland, OR, USA
3University of North Carolina, Charlotte, NC, USA

The meta-analytic findings of Binder et al. (1997) and Frencham et al. (2005) showed that the neuropsychological effect of mild traumatic brain injury (mTBI) was negligible in adults 3 months post injury. Perteb et al. (2005) reported that verbal paired associates, coding tasks, and digit span yielded significant differences between mTBI and control groups. We re-analyzed data from the 23 studies used in the prior meta-analysis, correcting statistical and methodological limitations of previous efforts, and analyzed the chronicity data by chronicity timeframes. Three months post injury the effect size of −0.30 was not statistically different from zero and similar to that which has been found in several other meta-analyses (Hultsch et al., 1995; Schacter & Shimamura, 2007). The effect size 7 days post injury was −0.39. The effect of mTBI immediately post injury was impact on Verbal and Visual Memory 0.0077. However, 3 months post injury all domains improved to show non-significant effect size. These findings indicate that mTBI has no initial causal effect on neuropsychological functioning that continues quickly. The evidence of recovery in the present meta-analysis is consistent with previous conclusions of both Binder et al. and Frencham et al. Our findings may not apply to people with a history of multiple concussions or complicated mTBIs.

Keywords: Traumatic brain injury; Meta-analysis; Post concussion; Effect size calculations.

INTRODUCTION

Large-scale epidemiological studies have demonstrated that traumatic brain injury (TBI) is a common occurrence in the United States and throughout the world (see Kraus & Chu, 2005, for an epidemiological review). The most common severity is mild traumatic brain injury (mTBI), accounting for approximately 75% of all TBIs (Langlois et al., 2003). The average incidence of mTBI was estimated to be 505 per 100,000 in the United States (Bazarian et al., 2009), although this likely is an underestimate, as it is based on emergency department visits only. Many individuals...
The “Miserable Minority” Following Mild Traumatic Brain Injury: Who Are They and do Meta-Analyses Hide Them?

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2Pocono Practice, Susquehanna, PA, USA
3Wayne State University School of Medicine, Detroit, MI, USA

Rohling et al. (2014, Ruff, Camenisch, & Mueller, 1996) hypothesized that some mild traumatic brain injury (MTBI) patients will suffer chronic somatic symptoms and impairments identifying this subgroup as the “miserable minority.” However, several meta-analyses of the effects of MTBI have been published (e.g., Rohling et al., 2011) showing no significant cognitive impairment following recovery. Recently, Petaia, James, and Ruff (2009) suggested that meta-analyses might be obfuscating impairments in some MTBI patients, providing a hypothetical score distribution to illustrate this idea. One statistical analysis of their hypothetical figure and of several other potential distributions containing an impaired subgroup that varied as a function of effect size and base rate of occurrence did not support the existence of a miserable minority that is obscured in meta-analyses by the larger group of MTBI patients experiencing full recovery. Indeed, given our recent published MTBI effect size of 0.07 (Rohling et al., 2011), for an impaired subgroup to exist, the level of impairment would have to be greater than a tenth of a standard deviation, equivalent to a WMS-IV index score value of 1 point. As often seen with small, yet not more common on a test to diagnose patients would result in more than twice as positives than true positives. This greatly increases the risk of misdiagnoses in patients who are susceptible to misattribution, regression effects, and “diagnostic labels,” thereby increasing the risk of inappropriate illness.

Keywords: Mild traumatic brain injury, Miserable minority, Meta-analysis, Best-case/worst-case assumptions.

INTRODUCTION

Several comprehensive meta-analytic reviews of patients suffering a single, uncomplicated mild traumatic brain injury (MTBI) have reported effect sizes for long-term outcome (i.e., greater than 5 months post-trauma) that are not significantly different than zero (Behner, Curtin, Dwyer, Lebowitz, & Vanderploeg, 2003; Binder, Rohling, & LaRocque, 1997; Schoeben & Shapiro, 2006). Others have questioned the results of meta-analyses of MTBI, arguing that these analytic procedures can obscure the existence of impaired subgroups of persons suffering persistent chronic effects of MTBI (Petaia, James, & Ruff, 2009; Ruff & James, 2009).

The proposal of an impaired subgroup of MTBI dates back to the work of Ruff and colleagues (Ruff, Camenisch, & Mueller, 1996; Ruff et al., 1994), who coined the term “miserable minority” to define a subgroup of persons suffering...
Meta-Analytic Methods and the Importance of Non-TBI Factors Related to Outcome in Mild Traumatic Brain Injury: Response to Bigler et al. (2013)

Glenn J. Larabee, Laurence M. Binder, Martin L. Rohling, and Danielle M. Ploetz

Introduction

Portish, James, and Bigler (2009) reanalyzed prior meta-analytic data on neuropsychological outcome after mild traumatic brain injury (mTBI) published by us (Binder, Kohling, & Larabee, 1997) and others (French, Fox, & Mayherry, 2005), concluding that meta-analysis obscured the persistence of deficits for some persons. In response to Portish et al. (2009), we (Rohling et al., 2011) published a revised meta-analysis of data previously published by Binder et al. (1997) and French et al. (2005) on neuropsychological outcome following mTBI. In our revised analysis of the outcome studies included in Binder et al. (1997) and French et al. (2005), we incorporated a random effects model, considered overall neuropsychological effects as well...
28.1 %
BRAIN INJURY

- Diffuse Axonal Injury (DAI)
- Neurometabolic Cascade
- Single, uncomplicated MTBI will be resolved in 3 months
DSM-IV-TR 1994-2013

- Cognitive Disorder, NOS
- Postconcussional Disorder
- Mild Neurocognitive Disorder
DSM-V

Neurocognitive disorder due to Traumatic Brain Injury

Mild Neurocognitive Disorder

Major Neurocognitive Disorder
A. Neurocognitive Disorder Due to Traumatic Brain Injury (TBI) is caused by an impact to the head, or other mechanisms of rapid movement or displacement of the brain within the skull, as can happen with blast injuries. Meets criteria for either Mild or Major Neurocognitive Disorder. Cognitive presentation is variable. Difficulties with attention, executive ability and learning new information are frequent, particularly at the Mild Neurocognitive level. Often there is disturbance in social cognition.
B. The Neurocognitive Disorder *presents immediately after the occurrence of a TBI or immediately after recovery of consciousness* and persists for at least a week. A TBI is defined as brain trauma *with one or more* of the following: (1) loss of consciousness, (2) posttraumatic amnesia, (3) disorientation and confusion, or (4) neurological signs (e.g., positive neuroimaging, a new onset of seizures or a marked worsening of a preexisting seizure disorder, visual field cuts, anosmia, hemiparesis).
C. Degree of cognitive impairment is nearly always commensurate with the severity of the TBI. *Major Neurocognitive Disorder rarely results from mild TBI.*
A. Evidence of minor cognitive decline from a previous level of performance in one or more of the domains outlined above based on:

1. Concerns of the patient, a knowledgeable informant or the clinician that there has been a mild decline in cognitive function

AND
2. Mild decline in neurocognitive performance, *typically between 1 and 2 standard deviations* below appropriate norms (i.e., between the 3rd and 16th percentile) on formal testing, or equivalent clinical evaluation.
DON'T EVEN THINK ABOUT TOUCHING ME - I'M ON WORKMAN'S COMP.
Evaluate the Brain Injury
Evaluate the Brain That Was Injured
MALINGERING BASE RATES/PROBABILITIES BY DIAGNOSIS

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild brain trauma</td>
<td>41.24%</td>
</tr>
<tr>
<td>Fibromyalgia/chronic fatigue</td>
<td>38.61%</td>
</tr>
<tr>
<td>Pain/Somatoform Disorders</td>
<td>33.51%</td>
</tr>
</tbody>
</table>
Course Over Time of Traumatic Brain Injury vs. Progressive Degenerative Neurological Disorders

- **Mild Traumatic Brain Injury (LOC < 20 minutes)**
- **Severe Traumatic Brain Injury (LOC > 24 hours)**
- **Progressive Degenerative Neurological Disorders** (Parkinson’s Disease, Alzheimer’s Disease, Multiple Sclerosis, Sjögren’s Syndrome, etc.)

Brain Function and Abilities

Onset

Time →

0% (coma) ↑ → 3 months → 1 year → 2 years
NAN position paper

Symptom validity assessment: Practice issues and medical necessity
NAN Policy & Planning Committee


496 Smithtown Bypass, Ste. 304, Smithtown, NY 11787, USA
Accepted 28 February 2005

Abstract

Symptom exaggeration or fabrication occurs in a sizeable minority of neuropsychological examinees, with greater prevalence in forensic contexts. Adequate assessment of response validity is essential in order to maximize confidence in the results of neurocognitive and personality measures and in the diagnoses and recommendations that are based on the results. Symptom validity assessment may include specific tests, indices, and observations. The manner in which symptom validity is assessed may vary depending on context but must include a thorough examination of cultural factors. Assessment of response validity, as a component of a medically necessary evaluation, is medically necessary. When determined by the neuropsychologist to be necessary for the assessment of response validity, administration of specific symptom validity tests are also medically necessary.

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Keywords: Malingering; Symptom validity testing; Medical necessity; Neuropsychological assessment

Clinical neuropsychologists are responsible for making determinations about the validity of the information and test data obtained during neuropsychological evaluations. The manner in which such determinations are made may vary considerably depending on the context in which the evaluations are performed. Publications related to symptom validity assessment have increased substantially in recent years, with the development of measures, indices, and other strategies for assessing symptom validity seeming to have outpaced the development of

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E-mail address: sbushphdmp@medscape.com (S.S. Bush).

0887-6177/$ -- see front matter © 2005 Published by Elsevier Ltd on behalf of National Academy of Neuropsychology.
- Performance Validity Tests (PVT)
  Measures if someone is performing to actual abilities

- Symptom Validity Tests (SVT)
  Measures if someone is giving an accurate report of their symptom experience
PVT FAILURE

- Only after excluding those with PVT failure

Does neuropsychological tests performance detect presence/absence of brain damage

Does TBI group differ from psychiatric, pain or mTBI
FREQUENCY OF PVT FAILURE

40% in litigation/compensation seeking mTBI

54.3% in criminal defendants

48.5 in SSDI claimants

40% in toxic or environmental exposure
WHAT MTBI DOES NOT CAUSE

- Decline in intellect
- Stuttering
- Seizures
- Loss of long term memory
- Inconitence
- Loss of libido
WHAT MTBI DOES NOT CAUSE

- Dissociative periods
- Migraines
- Personality change
- Long term concentration problems
- Promiscuity
PLACE YOUR HAND ON DARWIN’S “ORIGIN OF THE SPECIES” AND REPEAT AFTER ME...

HOW ATHEISTS TESTIFY UNDER OATH.
INVESTIGATION AND DISCOVERY

- The Accident / Biomechanics
  - Minimum Threshold (80-100g)
    - Akin to hitting a brick wall at 25mph
  - Rotational Forces increase potential for mTBI
INVESTIGATION AND DISCOVERY

- The Accident Scene / Key Facts
  - Airbags/mechanics of the accident
  - Loss of Consciousness
  - Ability of Plaintiff to Recall Detailed Facts
  - Plaintiff’s Interactions with the Client/EMTs/Police/Witnesses and Family
INVESTIGATION AND DISCOVERY

- Emergency Room Records Contain Clues
  - LOC
  - Memory
  - Headaches
  - Vision
  - Sense of Smell
  - Glasgow Coma Scale (GCS)
INVESTIGATION AND DISCOVERY

- Other Medical Records
  - Primary Care (going back to birth, if possible)
  - Neuropsychological Testing (motivation)
  - CT
  - MRI
  - PET scans
  - SPECT
  - EEG
INVESTIGATION AND DISCOVERY

- Other Important Records
  - Employment Records
  - School/Education
  - Military
  - Pharmaceutical
  - Criminal
  - Social Security
INVESTIGATION AND DISCOVERY

- Investigative Techniques
  - Social Media
  - Surveillance
  - Interview Co-Workers/Neighbors
  - ISO/SIU
  - Master Trace
INVESTIGATION AND DISCOVERY

- Experts
  - Clinical Psychologist
  - Neurologist
  - Neuropsychologist
  - Biomechanical
INVESTIGATION AND DISCOVERY

- Plaintiff’s Deposition
- Preparation is Key!
- Videotape it!
THE END

LONG DAY...

KNOCKED MY ASS OUT