



REHABILITATION FOLLOWING A MILD TRAUMATIC BRAIN INJURY: A TEAM APPROACH

Neuropsychologists frequently conduct neuropsychological evaluations to determine the neurobehavioural status of persons following minor injuries to the head with mild traumatic brain injury. Typically these persons experience some type of injury to the head with either brief or no loss of consciousness. They report changes in physical and mental functioning adversely affecting their normal adaptation. The neuropsychologist is asked to evaluate these patients and address several questions: Is there evidence of neurobehavioral dysfunction? If so, what are the causes of the dysfunction? What are the practical effects of impairments upon real-world functioning? What treatments and rehabilitation are indicated?

Well trained clinical neuropsychologists knowledgeable in the relevant research and clinically experienced with mild traumatic brain injury are uniquely qualified to tackle these questions, and play a key role in diagnosis and management. The neuropsychologist's knowledge of brain functions, neurobehavioral problems associated with neurologic and psychiatric disorders, mild traumatic brain injury, as well as neuropsychological assessment methods provide special contributions. A major strength is neuropsychological testing. Neuropsychological tests allow a quantification of brain functioning not found in other clinical disciplines. The work of the neuropsychologist often leads to a quantified understanding of the person and provides direction for treatments.

This role is however fraught with pitfalls potentially leading to misdiagnosis, misunderstanding of the person, and mismanagement. A number of challenges confront the neuropsychologist working with patients having mild traumatic brain injury. Those challenges include: A limited knowledge base, misconceptions, biases, overlapping disorders, overlapping symptoms, limited technology, and motivation. This article discusses these challenges and suggests ways to avoid these diagnostic pitfalls.

LIMITED KNOWLEDGE BASE

Although clinicians regularly see person's suffering from the sequelae of mild traumatic brain injury and know that major problems can result from minor injury, this remains a controversial matter. There is mounting medical research evidence that mild brain injury in animals and humans has pathophysiological correlates, but the details remain elusive. Current evidence suggests possible anatomical and physiological disruption following mild traumatic brain injury. Whether or not this brain damage is permanent and can be reliably measured in individual cases is uncertain. While knowledge in this area is increasing, more is unknown than known.

Clinical neuropsychological research of mild traumatic brain injury is far from complete. There is evidence of poor performance on some neuropsychological tests following the injury with most persons returning to normal neuropsychological test performances within several months. A small subset of people with mild traumatic brain injury, probably about 10 percent of those injured, have more complicated outcomes with persistent reported and measured symptoms. The research to this date has not answered the question of the cause of these persistent symptoms and complicated outcomes. Whether persistent symptoms are due to structural alterations, changes in brain chemistry, pre-injury vulnerabilities, adjustment reactions, or other causes is unknown.

This limited knowledge base poses a significant challenge to diagnosis. When doctors are confronted with clinical problems demanding specific diagnosis and treatment while lacking the necessary scientific knowledge base, the door for misdiagnosis is flung wide open. The diagnostician is left in a quandary. If you don't know the clinical entity, how are you going to find it? What diagnostic tools are you going to use? How are you going to treat it without knowing the causes? Without clear answers to these questions, the clinician is adrift with speculation blown by beliefs that may or may not be based on facts.

MISCONCEPTIONS AND BIASES

A limited knowledge base leads to projected misconceptions and biases. In ambiguous situations diagnosticians draw more heavily from their intuition, internal fantasies, and biases than from real facts. This often obscures the realities of the observed phenomenon. The belief system of the diagnostician affects the approach to studying the patient, the evaluation methods used, and the conclusions drawn. The more the beliefs are linked to facts and the realities of the patient, rather than projected biases, the higher the probability of an accurate diagnosis and appropriate treatments.

Neuropsychologists vary in their beliefs about mild traumatic brain injury. Some are very sceptical. They believe that it is questionable or impossible to injure the brain permanently from mild trauma. They see persistent symptoms as due to other factors such as pre-morbid personality, emotional reactions, psychiatric disorders, litigation, malingering, etc. Other neuropsychologists believe that the brain can be injured initially or permanently from mild trauma. They see patients with mild traumatic brain injury as suffering symptoms due to brain injury and having understandable reactions to their injuries. Other neuropsychologists believe that the brain is probably initially injured, but any persistent symptoms are probably driven by other factors such as pre-injury psychology, pain, psychological reaction, litigation, etc.

These beliefs have a potential of skewing diagnostic observations and interpretation. The nonbelieving neuropsychologist is biased to not openly study and understand the reality of the person with mild traumatic brain injury and is prone to rule out the true nature of the injury. The believing neuropsychologist is biased to not see the complicated causations contributing to the person's problems and often becomes an advocate rather than a thorough objective diagnostician ruling out all the possible contributions to the patient's problems. Both biases

can lead to misdiagnosis. The believer is prone to the error of diagnosing brain injury where there isn't and the nonbeliever is prone to the error of not diagnosing brain injury where there is. Both diagnostic errors have significant consequences for the patient, families, treating/managing professionals, and those liable for damages.

OVERLAPPING SYMPTOMS AND DISORDERS

The common mental problems reported by patients with mild traumatic brain injury usually include: poor attention and concentration, impaired short-term memory, and poor regulation of emotions especially reactivity and depression. These symptoms are not specific to mild traumatic brain injury. Although not well researched, these symptoms can be associated with a variety of neurologic and psychiatric disorders. In particular, persons suffering from pain, depression and post-trauma stress disorders may have similar symptoms. The diagnostic dilemma is obvious. If a person reports these symptoms and they are manifested on neuropsychological measures, how does the neuropsychologist know what disorder is the culprit? If attention, short-term memory, and emotional lability were unequivocally linked to mild traumatic brain injury, diagnosis would be straight forward, but it isn't. This overlapping of symptoms and disorders makes differential diagnosis challenging and increases the potential for misdiagnosis.

LIMITED TECHNOLOGY

The neurobehavioral sequelae of mild traumatic brain injury push neuropsychological technology to its limits. The accuracy of neuropsychological tests alone to discriminate between normal variation and neurologic disorders is generally around 70 to 80 percent when comparing normal controls to a well-defined mixed neurologic group. There is considerable overlap in the neuropsychological test performances of these two groups. In the normal group, there will be persons who perform poorly on the test and in the neurologic group there will be persons who perform very well. The tests discriminate best when there are extreme differences in the scores. That is, the accuracy of correct classification with tests is best when comparing the more severely impaired neurologic patient and an average or above average normal person. The worst classification accuracy is obtained with milder neurologic conditions like mild traumatic brain injury. Simply stated, neuropsychological tests work best with more obvious brain disorders.

Another challenge is the trade off in neuropsychological measurement between test sensitivity and test selectivity. There is a constant struggle between the two. If you create a very sensitive test, your accuracy of classification goes down because the sensitive measure is trying to not leave anyone out. On the other hand, if you create a very selective test, the classification accuracy goes up, but you miss a lot of persons who have a milder form of the disorder. In mild traumatic brain injury the neuropsychological measures need to detect subtle or mild sequelae, so the tests have to be very sensitive. This need for sensitivity results in reduced accuracy of classification.

Further complicating the technology to measure the neurobehavioral sequelae of mild traumatic brain injury (poor attention, poor short-term memory, and emotional lability) is the fact that these functions are complicated and are considerably variable in normal persons. Additionally, these functions involve complicated concepts (e.g. attention) that are hard to define, and difficult to measure. For example, to this date, neuropsychologists do not have an adequate agreed upon model of attention/concentration from which they can develop thorough convincing assessment tools to discriminate between normal and mildly impaired patients.

Yet another limitation of neuropsychological tests is the inability of the testing situation and test demands to replicate complicated real-world demands. The test-world and the real-world are often quite different. The test situation is usually very protected, structured, free from distractions, and presents single focused demands. On the

other hand, the real-world is often very unstructured, full of distractions, and presents multiple simultaneous demands. Real-world situations often stress the person's attention, memory, and executive abilities in ways that are never adequately tapped by tests. Additionally, summary test scores are simplistic. They reduce a person's performance over a span of time to a single test score that can overlook important details of a person's total performance behaviour. What is overlooked often includes impairments that are problematic in certain life situations. In other words, test scores don't always reveal the entire story of person's real life problems.

MOTIVATION

Motivation is central to accurate neuropsychological assessment. Neuropsychologists are measuring human performance on tests to make inferences about the condition of the brain. It is imperative that patients put forth their best efforts. Anything that interferes with a best effort, interferes with making accurate inferences about brain condition. It is incumbent that the neuropsychologist get maximum effort from the patient so that the test data can be accurately interpreted. Diligence on the part of the neuropsychologist in administering tests and the full cooperation of the patient are essential. Anything that interferes with this maximum effort brings in question the validity of the test data.

A number of factors potentially affect the motivation of someone with a mild traumatic brain injury. These persons often suffer acute or chronic pain. Pain can be very wearing on the mind and distract from maximum performance on neuropsychological tasks. Psychological reactions and mental status related to more severe depression or stress can drain energy and interfere with maximum output on tests. Preoccupation over physical and mental problems as seen in somatoform disorders may interfere with full attention and maximum performance. In some cases involving litigation, motivation may be adversely affected by financial gain. To draw reliable conclusions about the neurobehavioral condition of the brain, the neuropsychologist has to insure that these issues are not interfering with test performances.

The motivation of the neuropsychologist is another challenge to accurate diagnosis. If the neuropsychologist is locked-in to strong beliefs based upon limited knowledge, limited experience with patients with mild traumatic brain injury, and is driven by financial incentives rather than a dedicated open-minded study of the person, the information observed and the interpretations made will be biased, misconceived, and misconstrued. The conclusions made by biased clinicians may end up saying more about the condition of the clinician than the true condition of the patient. A disbeliever bias motivated by legal defense hire may never see brain impairment even when it exists. A believer bias motivated by legal plaintiff hire may see brain impairment in all patients even when it doesn't exist. The neuropsychologist must be constantly aware of potential motivations that distract from objectively studying the realities of the patient. A lack of awareness increases the probability of misdiagnosis.

AVOIDING MISDIAGNOSIS

Well trained clinical neuropsychologists knowledgeable in the relevant research and clinically experienced with patients with mild traumatic brain injury are uniquely qualified to play a key role in the diagnosis and management of the patient with mild traumatic brain injury. Knowledge of brain functions, of the neurobehavioral problems of both neurologic and psychiatric patients, of mild traumatic brain injury and of assessment methods provides a special contribution, but efforts must be made to avoid the pitfalls of misdiagnosis.

The following guidelines are recommended to neuropsychologists to aid accurate diagnosis and avoid misdiagnosis:

- Become knowledgeable about mild traumatic brain injury before trying to assess it or casting judgements upon it.
- Become aware of your biases and challenge them. Remember that all involved (patient, family, medical doctors, neuropsychologists, attorneys, you, etc.) have biases that may or may not be based upon fact, but will filter and color perceptions regarding the patient.
- Recognize the limitations of the knowledge base and technology used with MTBI patients while also recognizing that limited knowledge doesn't equal nonexistence of the patient's problems.
- Approach each case in an open and objective manner dedicated to a thorough study of each person.
- Use a *comprehensive assessment process* that includes: a review of relevant medical records, interview and direct observations of the patient, interview of significant others, a comprehensive battery of neuropsychological tests sensitive to the sequelae of mild traumatic brain injury, tests checking motivation, tests for psychiatric symptoms, tests to study personality traits and their interaction with injury, normative analysis that uses relevant norms, and clinical analysis that considers clinical knowledge and experience.
- Use a validated comprehensive neuropsychological battery with a proven capacity to discriminate the presence and absence of brain dysfunction, and the types of problems experienced by MTBI patients. The battery should especially include: measures sensitive to attention, short-term memory, and emotion functions.
- Include measures of test taking motivation, but do not rely solely on such measures to conclude the presence of poor motivation. Look for other existing indicators. Remember that brain impairment can coexist with poor motivation.
- Don't rely solely on neuropsychological test data to form a diagnostic opinion. Such reliance negates too much other necessary important data/information needed to form a diagnostic conclusion.
- Do not rely solely on a single self-reported inventory, such as the MMPI, in determining pre/post injury personality traits or current psychiatric status. These instruments are artificially elevated by neurobehavioral symptoms related to brain problems and easily result in psychiatric misdiagnosis.
- Be careful to not over blame "personality factors" for the real problems experienced by MTBI patients. Injury always interacts with a personality. Try to understand how the reaction to injury is affected by personality traits rather than blaming the personality for the neurobehavioral symptoms.
- Do careful differential diagnosis considering all the factors potentially contributing to poor performances on tests. Rule out or in: premorbid abilities, premorbid adaptation, pain syndromes, somatoform disorder, posttraumatic stress disorder, affective disorder, major mental illness, drug effects, malingering, etc.
- Form diagnostic opinions on an integration of *all* the information and *converging evidence* rather than limited information or a single focus.
- Avoid quick single conclusions regarding the cause of the person's problems. During the interpretation process, entertain multiple hypotheses in trying to understand and determine the best explanation of the person's problems. Consider a constellation of factors rather than a single factor as an explanation.
- Don't be rigid and absolute in your diagnostic judgments. Since medical and neuropsychological knowledge of this patient group is limited, avoid being over confident or absolute. When dealing with what we do not clearly know, we must avoid thinking that we know clearly. Our conclusions should be written in pencil rather than ink.

Through thoughtful application of a comprehensive evaluation process, neuropsychologists make a significant contribution to the study, diagnosis and treatment of MTBI persons. The pitfalls of limited knowledge, misconceptions, biases, overlapping symptoms, overlapping disorders, limited technology, and motivation pose significant challenges to effective neuropsychological assessment, but they are not insurmountable. Despite the hurdles, with an understanding of the pitfalls, an open-minded dedication, a commitment to thoroughness, and a

responsible use of existing technology, the neuropsychologist can avoid misdiagnoses, make accurate diagnoses, lend a deeper compassionate understanding, and lend more effective management to the person who lives with the sequelae of mild traumatic brain injury.

SUGGESTED READINGS

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