Predicting Long-Term Personality Changes Following TBI

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Abstract

Traumatic Brain Injury (TBI) is an acquired neurological disorder caused by trauma to the brain. Those who have experienced a traumatic brain injury often report changes to their personality immediately and sometimes lasting for years after the initial injury. Personality changes like depression, anxiety, mood swings, emotional lability, and impulse control can negatively affect the patient's recovery. These changes are a result of the damage done to the frontal lobe and other parts of the brain; therefore, it is important to understand the structures and functions of the brain and how they are affected by a TBI.

Research has shown that some long-term effects of TBI can be predicted from symptoms and qualities exhibited by the patient shortly following the injury. Factors such as orientation or cognitive abilities immediately following injury and the post-traumatic amnesia period can be predictive of long-term effects of TBI.

Learning Outcomes:

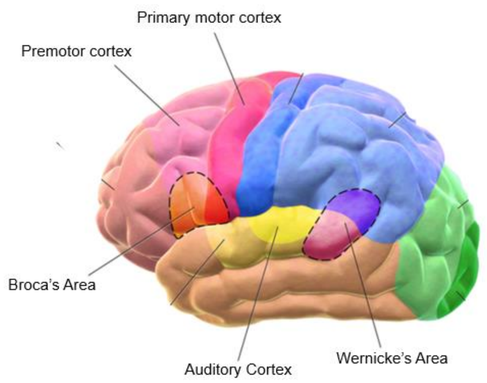
1. Understand the basic neurological structures and functions associated with TBI.
2. List short- and long-term effects of TBI on personality and cognitive abilities.
3. Discuss factors that may be predictive of long-term personality changes following TBI.

Background

Neuroanatomy/Physiology

The brain is segmented into four lobes: frontal, temporal, occipital, and parietal; the two most associated with speech and language are the frontal and temporal lobes. The frontal lobe is generally associated with personality. It is responsible for executive functions like attention, decision-making, and problem solving. Further, the frontal lobe includes Broca's area which is responsible for expressive language in any form (verbal, writing, AAC). In addition, the frontal lobe contains the motor cortex which signals the body to make intentional movements.

The temporal lobe is responsible for memory processing, emotional regulation, and hearing. It contains the primary auditory cortex which processes auditory information and distinguishes sounds from words. Next to the auditory cortex is Wernicke's area, the center for receptive language. In the temporal lobe, language is distinguished from noise by the auditory cortex and processed into meaningful messages by Wernicke's area.



TBI

A Traumatic Brain Injury (TBI) is the result of severe trauma to the head. It is an acquired neurological disorder that can affect cognitive, communication, and motor skills. Trauma to the brain results from either the *primary damage* caused by external forces; or *secondary damage* which develops from the primary damage hours to weeks after the incident. For example, edema or increased intracranial pressure.

There are two types of TBIs, open head and closed head. An open head injury is characterized by a fractured or penetrated skull caused by external forces in which the brain is exposed. These types of injuries are localized and have more predictable effects. Closed head injuries are caused by force to the skull in which there is no penetration. These injuries result in widespread damage and more unpredictable effects.

One common form of closed head injuries is *Acceleration-Deceleration* injuries. These occur when the head is quickly moved forward and backward causing the brain to impact against the opposite interior cranial wall.

The initial impact forward is referred to as *contrecoup* and the secondary impact of the occipital lobe against the back of the skull is *coup*. Acceleration-Deceleration injuries most commonly occur as a result of whiplash in a car accident.

Following the incident, a person with a traumatic brain injury would be in a period of impaired consciousness. The amount of time they are in a comatose state varies case by case. Once the person regains consciousness, they enter the *Post-Traumatic Amnesia (PTA)* phase. While in this stage of recovery, the patient would be severely confused and disoriented to their person, time, and location. They may have difficulty with their memory and make impulsive decisions regarding their safety. The rapid recovery phase takes place in the 3 to 6 months following the injury. During this time, the patient typically experiences significant progress towards regaining their cognitive and motor skills.

Diagnostic Information

*GCS = Glasgow Coma Scale

Severity Level	Time in coma	Time in PTA phase	Score on GCS
Mild	<30 min	<24 hrs	13-15
Moderate	≥30 min but <24 hrs	≥24 hrs	< 1 week
Severe	≥25 hrs	≥ 1 week	3-8

The loss of skills experienced by patients with TBI is dependent on the severity of the injury. TBI causes impairment in the following areas:

- *Cognitive impairment* - deficits in perception, attention, memory (short term more often than long term, working memory), executive functions (problem solving, self-awareness)
- *Communication* - aphasia, poor topic management, turn taking issues, difficulty processing implied/figurative language
- *Motor skills* - muscle paralysis (temporary/permanent), difficulty with movement of arms and legs, muscle-motor skills affecting swallowing

In addition to measurable deficits in cognitive, communication, and motor skills, patients who have experienced a Traumatic Brain Injury often report changes to their personality or behaviors. Depression, anxiety, and emotional lability or trouble managing emotions often affects people for short and long periods of time following the TBI. Patients and their families frequently report restlessness, problems with social behavior, or feeling unmotivated to complete tasks.

Lack of motivation or refusal to participate in speech and physical therapy activities can hinder progress, and frustrating feelings of depression and anxiety negatively affect the patient's recovery process.

Personality and behavioral changes are more common following a severe TBI than a mild injury. Symptoms are more likely to persist, and depression or anxiety associated with the loss of skills is common during the short-term recovery phase.

Research

Research has been conducted to investigate potential predictive factors of long-term personality changes following a Traumatic Brain Injury. Observable factors such as orientation, cognitive abilities in the ER, and the amount of time in the PTA phase have been studied to determine if they affect long term changes.

Initial orientation immediately following the TBI or while in the Emergency Room was observed in people with moderate to severe injury. Initial orientation includes the patient's awareness of their current location, the time, and their personal information (i.e., name, age, current background). Initial orientation and rate of change in orientation were observed to be predictive of personality changes. The patients involved in these studies who received poorer scores on orientation evaluations, presented with more significant symptoms and behavioral changes during recovery and 1-2 years post-injury.

Further, cognitive skills immediately following injury and while in the ER were evaluated. Cognitive skills such as reaction time to rapid information processing assessments and cognitive flexibility were observed shortly following a TBI. Lower scores on these evaluations were associated with more severe symptoms lasting a longer period of time, as well as feelings of depression and anxiety.

The amount of time in the Post-Traumatic Amnesia (PTA) phase of recovery was recorded and evaluated in multiple case studies. However, no significant correlation between this factor and personality changes was observed.

Conclusion

- It is important to understand the anatomy and physiology of the brain to best understand Traumatic Brain Injury.
- Being aware of localized injuries and the area of the brain they occur can be helpful in predicting short-term loss of skills.
- Personality changes such as depression, anxiety, and emotional lability can negatively affect the patient's recovery.
- Initial orientation can be predictive of long-term personality/behavioral changes.
- Cognitive skills immediately following the injury can be predictive of long-term symptoms and personality changes.
- The amount of time in the PTA phase of recovery is not predictive of long-term changes.

References