USING FUNCTIONAL MRI TO TRACK NEUROPLASTICITY AFTER COGNITIVE REHABILITATION POST TRAUMATIC BRAIN INJURY

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Theoretical Background

- Deficits in memory and working memory are a major complaint of patients after Traumatic Brain Injury (TBI).
- Working memory, a core executive function that stores & manipulates visual images or verbal information
- It is an important process for reasoning & the guidance of decision making & behaviour.
- Longstanding debate: Whether the cause of clinical complaints is truly organic?
- Functional MRI (fMRI) & connectivity data provides an evidence of these deficits.
- fMRI may help understand the neurobiological basis of Neuropsychological Rehabilitation (NR).

Methodology

27 consenting individuals after Mild or Moderate TBI were enrolled in the study between August 2014 to September 2016

Inclusion Criteria

- 18-45 yrs
- Education ranging from 0-17 yrs
- With Cognitive and/or PCS Complaints
- Treated Conservatively

Exclusion Criteria

- Contraindications to MRI, H/O neurosurgical intervention. Any previous H/O TBI, Previous H/O major psychiatric illness/substance abuse/mental retardation

Informed, written consent for Randomized Controlled Clinical Trial (CTR/2014/04/004555)

Intervention group (IG) n = 14
(Mean Age: 31.6 ± 8.1)

Control group (CG) n = 13
(Mean Age: 30.2 ± 7.4)

Baseline Neuropsychological Assessment

Post Concussive Symptoms, Cognitive Functioning, Quality of Life, Anxiety & Depression Symptoms

Literacy Free Neuropsychological Rehabilitation (6 Weeks)

Repeat Neuropsychological Assessment (After 6 Weeks)

Comparison of IG and CG

Results

AUDITORY 1- BACK WORKING MEMORY

- Post 6 weeks - no significant activation compared to baseline in the IG
- Post 3 months – left posterior cingulate showed significant activations as compared to baseline.

AUDITORY 2- BACK WORKING MEMORY

- Post 6 weeks - right middle temporal gyrus, right inferior frontal gyrus, right pre-central gyrus, right inferior parietal lobule showed significant activations as compared to baseline.

VISUAL MEMORY

- Post 6 weeks - right middle temporal gyrus, right inferior frontal gyrus, right pre-central gyrus, right inferior parietal lobule showed significant activations as compared to baseline.

Discussion

- Working Memory: Specific & focused frontal activations during intervention
- Significant improvements in the intervention group in areas responsible for interpretation of sensory information; mediating unconscious propropiocception; language & semantic memory processing; visual memory encoding, processing & retrieval; and decision making processes.

- Visual Memory:
  - Control Group: At 6 weeks, activations in areas responsible for perception & interpretation of sensory information, language, mathematical operations; posture & locomotion; semantic memory processing; processing visual memories; processing of sounds
  - Intervention Group: No significant activations post intervention

- Clinical Implications: Cognitive remediation improved the subjective, objective & neurobiological working memory of patients post TBI
- This intervention did not have any effect on the visual memory activations, nor on the neuropsychological outcome of the intervention group.
- Specific activations pre and post cognitive interventions can provide valuable information for cognitive recovery after brain injury, and may contribute to guide clinicians for specific biomarkers for rehabilitation.
- Due to the small sample size, results of the current pilot study should be interpreted as preliminary.

Functional imaging can not only provide the link between cognitive rehabilitation and plasticity in future, but also neuroplasticity after injury, in larger cohorts.

References


