"Together, We Can Go Further"
KSES 2026
The 33rd Annual International Congress of the Korean Shoulder and Elbow Society
March 27(Fri) ~ 28(Sat), 2026
BEXCO, Busan, Korea

- Abstract No. : F-0218
- Category : Shoulder
- Detail Category : trauma , arthroplasty

Neuro-Muscular Complications After Trauma: Exploring Neuroplasticity and Functional Reorganization

Gurdit Singh [1] , Jaspinder Kaur [2] , Sanjeev Kumar [1]
Department of Physiotherapy, University Institute of Allied Health Sciences (UIAHS), Chandigarh University, Mohali, 140413 Punjab (INDIA) , India[1]
Department of Neurorehabilitation, DAV Institute of Physiotherapy & Rehabilitation (DAVIPTR), Jalandhar, 144008 Punjab, INDIA , India[2]

Introduction and Background

Traumatic musculoskeletal injuries—including fractures, ligament tears, and crush injuries—often produce long-lasting neuro-muscular complications. These complications arise not only from structural damage but also from changes within the central nervous system. Emerging research highlights that trauma triggers cortical reorganization, influencing motor control, proprioception, and muscle activation patterns. Neuroplasticity therefore plays a crucial role in determining recovery trajectories. Understanding how brain–muscle connectivity adapts after injury is essential for designing effective rehabilitation strategies.

Material and Method

This observational study included **187 participants** undergoing rehabilitation after upper- or lower-limb trauma. Functional MRI was performed to assess cortical activation and sensorimotor network changes. Surface electromyography (EMG) measured neuromuscular activation timing during voluntary movement. Proprioceptive performance was evaluated using joint-position sense tests. Data were analyzed to examine relationships between cortical reorganization, activation delays, and functional impairment. Rehabilitation interventions included proprioceptive retraining and task-specific motor practice.

Results

Trauma patients demonstrated significant alterations in brain–muscle connectivity, with fMRI revealing increased reliance on secondary motor areas. EMG analysis showed delayed activation of key stabilizing muscles, indicating impaired neuromuscular coordination. Participants with reduced proprioceptive accuracy exhibited higher levels of cortical reorganization and slower functional recovery. Following targeted rehabilitation, improvements were observed in proprioceptive performance, reduced EMG activation delays, and partial normalization of cortical activation patterns.

Conclusions

The study shows that neuro-muscular complications after trauma are strongly linked to neuroplastic changes within the sensorimotor system. Cortical reorganization, proprioceptive deficits, and delayed neuromuscular activation collectively contribute to persistent weakness and balance impairment. Rehabilitation strategies that prioritize proprioceptive retraining and task-specific practice can effectively enhance neural recovery and functional outcomes. Integrating neuroplasticity-based interventions should be considered essential in modern trauma rehabilitation.