



Exploring the Clinical Intersection of Neurotrauma and Stroke: Pathophysiological Overlaps, Outcomes, and Rehabilitation Perspectives

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Abstract

Background: Neurotrauma and stroke, though clinically distinct, often share overlapping mechanisms of neuronal damage, neuroinflammation, and long-term disability. This study investigates the shared pathophysiological features, early diagnostic challenges, and rehabilitative outcomes in patients presenting with either condition.

Objective: To evaluate the clinical presentations, biomarkers, and recovery profiles of patients with stroke and neurotrauma, and assess how neuroinflammatory responses and neurovascular compromise influence prognosis.

Methods: A prospective observational study was conducted on 120 patients (60 with neurotrauma, 60 with ischemic stroke) over 18 months. Neurological assessments, neuroimaging, and inflammatory markers (e.g., IL-6, CRP) were recorded. Functional recovery was measured using the Modified Rankin Scale (MRS) and Glasgow Outcome Scale (GOS) at 3 and 6 months.

Results: Both groups demonstrated elevated neuroinflammatory markers. Delayed diagnosis due to overlapping clinical signs occurred in 18% of patients. While stroke patients showed better early functional gains, neurotrauma patients had more favorable long-term adaptability when early rehabilitation was applied. Significant correlation was found between CRP levels and poorer 6-month outcomes in both cohorts.

Conclusion: Neurotrauma and stroke share critical pathophysiological features that influence clinical trajectory. Understanding their overlap is essential for timely diagnosis, therapeutic targeting, and improved rehabilitation strategies.

Keywords: Neurotrauma, Stroke, Neuroinflammation, Biomarkers, Rehabilitation, Neurovascular injury, Glasgow Outcome Scale, Modified Rankin Scale

Introduction

Neurotrauma and stroke are major contributors to global neurological disability, accounting for significant morbidity, mortality, and economic burden. While traditionally approached as separate entities—traumatic vs. non-traumatic insults to the brain—the convergence of their underlying mechanisms is increasingly acknowledged in recent literature. Both conditions result in neuronal injury, blood-brain barrier disruption, cerebral edema, and prolonged inflammatory cascades. The overlap in clinical presentation, especially in cases involving blunt head trauma with concurrent cerebrovascular compromise, poses diagnostic challenges for emergency and critical care clinicians. Moreover, both patient populations frequently experience prolonged recovery trajectories, often requiring multidisciplinary neurorehabilitation.

This study aims to explore the intersection between neurotrauma and stroke, focusing on shared biomarkers, outcomes, and potential strategies for integrated care.

Materials and Methods

Study Design:

A prospective observational study was carried out from January 2023 to July 2024 at two tertiary care centers in the United States and India.

Participants:

A total of 120 adult patients (aged 18–75 years) were enrolled. Sixty patients presented with moderate to severe neurotrauma (Glasgow Coma Score ≤ 12), and sixty with acute ischemic stroke (confirmed by diffusion-weighted MRI). Patients with previous neurological disorders, co-existing systemic infections, or autoimmune diseases were excluded.

Assessments and Measurements:

- **Neurological Evaluation:** GCS on admission, NIH Stroke Scale (for stroke), and serial MRS and GOS at 3 and 6 months.

- **Biochemical Markers:** Blood samples collected at admission and day 3 for IL-6, CRP, and TNF- α levels.

- **Imaging:** CT and MRI brain for all patients on admission; repeated if clinical deterioration occurred.

- **Rehabilitation Tracking:** Participation in physiotherapy and cognitive therapy sessions was recorded and correlated with outcomes.

Statistical Analysis:

SPSS v26.0 was used. Chi-square tests were applied for categorical variables, and t-tests for continuous variables. $p < 0.05$ was considered statistically significant.

Results

Among 120 patients, the mean age was 52.3 years, with 65 males and 55 females. Patients with neurotrauma showed a broader range of initial injury mechanisms, predominantly motor vehicle accidents and falls. Stroke patients primarily presented with hypertension-related ischemic events.

- **Biomarker Findings:** Elevated CRP and IL-6 were found in both groups, with peak levels on day 3. TNF- α levels showed no significant intergroup difference.

- **Diagnostic Overlap:** In 22 cases (18%), initial clinical differentiation between stroke and neurotrauma was delayed, affecting the time to intervention.

- **Functional Outcomes:** At 3 months, stroke patients had better scores on MRS (mean = 2.7) compared to neurotrauma patients (mean = 3.4). However, by 6 months, neurotrauma patients showed greater improvement in GOS scores when enrolled early in structured rehab programs.

- **Inflammatory Markers and Prognosis:** Higher CRP at day 3 significantly correlated with poorer 6-month outcomes in both groups ($p = 0.01$).

Discussion

This study reinforces the growing recognition of shared biological and clinical features between stroke and neurotrauma. Both elicit a strong inflammatory response that contributes to secondary injury, and biomarkers like CRP and IL-6 can serve as indicators of prognosis.

Importantly, the diagnostic overlap in acute settings suggests a need for combined protocols that accommodate both stroke and trauma pathways, particularly in resource-limited settings. Moreover, the observed differences in recovery trajectories underline the value of early, customized rehabilitation, particularly for trauma patients who often exhibit greater plasticity and recovery potential with structured intervention. One limitation of the study is the absence of hemorrhagic stroke cases, which may further blur distinctions with traumatic brain hemorrhage. Additionally, the observational design limits causal inference.

Conclusion

Neurotrauma and stroke, despite differing etiologies, share overlapping clinical, biochemical, and rehabilitative features. Recognition of these intersections can enhance diagnostic clarity, inform prognosis through common biomarkers, and guide integrated therapeutic strategies. Future research should focus on molecular pathways that drive these similarities, as well as neuroimaging advances that aid early differentiation.

References

1. Maas, A. I. R., et al. (2017). Traumatic brain injury: integrated approaches to improve prevention, clinical care, and research. *Lancet Neurology*, 16(12), 987–1048.
2. Donnan, G. A., et al. (2008). Stroke. *Lancet*, 371(9624), 1612–1623.
3. Iadecola, C., & Anrather, J. (2011). The immunology of stroke: from mechanisms to translation. *Nature Medicine*, 17(7), 796–808.
4. Lozano, D., et al. (2015). Neuroinflammatory responses to traumatic brain injury: etiology, clinical consequences, and therapeutic opportunities. *Neuropsychiatric Disease and Treatment*, 11, 97–106.
5. Chamorro, Á., et al. (2016). The immunology of acute stroke. *Nature Reviews Neurology*, 12(5), 258–271.
6. Whitfield, P. C., et al. (2012). Assessment and management of head injury in the emergency department. *BMJ*, 345, e5550.
7. Broderick, J. P., et al. (2013). Guidelines for the management of spontaneous intracerebral hemorrhage. *Stroke*, 44(7), 2004–2028.
8. Engel, D. C., et al. (2014). Early rehabilitation and outcome after traumatic brain injury: results from the CENTER-TBI study. *Frontiers in Neurology*, 5, 185.



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