OPTIMIZATION OF DIAGNOSTIC METHODS AND OUTCOME PREDICTION IN YOUNG ADULTS WITH TRAUMATIC BRAIN INJURY

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https://doi.org/10.5281/zenodo.17745942

Abstract. *The study aimed to optimize diagnostic methods and predict outcomes in young adults with traumatic brain injury (TBI). Data from 100 patients admitted to neurosurgery and intensive care units were analyzed, including clinical, neurological, and laboratory parameters. Serum biomarkers, such as S100B and neuron-specific enolase (NSE), were measured to assess the severity of brain tissue and meningeal damage. Patients with higher biomarker levels had more severe injuries and longer recovery, while integration of these markers into a diagnostic-prognostic model improved accuracy in predicting unfavorable outcomes. The proposed algorithm allowed effective patient stratification and individualized management. The findings indicate that combining clinical evaluation with laboratory biomarkers enhances diagnostic precision and can improve treatment results in young adults with TBI.*

Keywords: *traumatic brain injury, young adults, diagnostics, prognosis, biomarkers, S100B, neuron-specific enolase, outcome prediction.*

Introduction. Traumatic brain injury (TBI) in young adults remains a major public health problem, often resulting in long-term neurological deficits, disability, and socio-economic burden.

Timely and accurate assessment of injury severity is critical for optimizing patient management and improving outcomes. While clinical and imaging evaluations are standard, integration of laboratory biomarkers into diagnostic and prognostic algorithms may enhance the precision of severity assessment and outcome prediction.

Aim. To optimize diagnostic methods and develop a prognostic model for predicting outcomes in young adults with TBI, with the goal of improving therapeutic results and patient management.

Materials and methods. A prospective study was conducted on 100 patients aged 18–35 years admitted to neurosurgery and neuro-intensive care units (ICU) at the Republican Scientific Center for Emergency Medicine, Andijan Branch. Patients presented with TBI of varying severity, classified according to the Glasgow Coma Scale (GCS) and radiological findings.

Clinical neurological assessments, routine laboratory tests, and additional biomarker analysis—including serum S100B (calcium-binding protein B), neuron-specific enolase (NSE), and C-reactive protein (CRP)—were performed upon admission and during hospitalization. Data were used to identify laboratory parameters correlating with injury severity and outcomes.

Based on these findings, a diagnostic-prognostic algorithm was developed and validated using receiver operating characteristic (ROC) analysis and correlation with clinical outcomes, including functional recovery and complication rates.

Results. Clinical and laboratory analyses revealed that higher serum levels of S100B and NSE correlated with more severe TBI and poorer neurological outcomes. Patients with mild TBI showed moderate biomarker elevation and rapid clinical recovery, whereas those with moderate and severe injuries demonstrated significantly elevated biomarker levels, longer ICU stays, and

increased incidence of complications such as intracranial hemorrhage and cerebral edema. Integration of laboratory markers into the diagnostic algorithm increased the accuracy of severity classification by approximately 18% compared to clinical assessment alone.

The prognostic model demonstrated high sensitivity (92%) and specificity (88%) for predicting unfavorable outcomes at discharge. Application of the algorithm allowed clinicians to stratify patients effectively, prioritize intensive monitoring, and tailor therapeutic interventions, which was associated with improved functional recovery at 30 days post-injury.

Conclusion. The study confirms that combining clinical, neurological, and laboratory biomarkers provides a reliable approach to assess TBI severity and predict outcomes in young adults. The proposed diagnostic-prognostic algorithm enhances the accuracy of injury assessment, supports individualized treatment planning, and can potentially improve patient recovery and reduce complications. Further multicenter studies are warranted to validate the model and explore its applicability in broader clinical settings.

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