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**“Ischemia and Seizures Negatively Impact Neurorecovery After Traumatic Brain Injury ”**

**Background:** Trauma is the leading cause of pediatric morbidity and mortality in the United States. Previously, we showed that severely injured patients have significant improvement in the pediatric Functional Independence Measure (WeeFIM) score following inpatient rehabilitation (IPR). Although the initial management of traumatic brain injury (TBI) is well-documented, less is known about neurorecovery after severe TBI.

**Methods:** We performed a retrospective review of pediatric and adolescent trauma patients ( $\leq 18$  years old) admitted to an accredited pediatric IPR after sustaining severe TBI between January 1, 2018, and December 31, 2023. Outcome variables include WeeFIM scores for cognition, mobility, and self-care, measured at rehabilitation admission and discharge.

**Results:** 122 patients (86 males) met inclusion criteria, with an average age of  $8.7 \pm 5.7$  years at injury. 71 children (58%) identified as Black. Top mechanisms of injury included motor vehicle collisions (48), gunshot wounds (22), nonaccidental trauma (22), and all-terrain vehicle crashes (7). 29 patients had an ischemic component of TBI, 105 had hemorrhage, and 40 had documented seizure activity after trauma. The average Glasgow Coma Scale (GCS) score at presentation was  $5.9 \pm 3.2$ . Hospital length of stay (LOS) was  $26.5 \pm 24.5$  days, and IPR LOS was  $37.2 \pm 25.1$  days. The duration of coma averaged  $8.7 \pm 8.6$  days.

Patients who sustained blunt injury were more likely to identify as White (39% vs 13.6%,  $p=0.01$ ) and had lower initial GCS ( $5.6 \pm 2.9$  vs  $7 \pm 4$ ,  $p=0.04$ ). Initial cognitive WeeFIM scores were lower in blunt compared to penetrating injury ( $10.5 \pm 7.3$  vs  $13.5 \pm 8.4$ ,  $p=0.04$ ) but improved to be similar at discharge ( $16.3 \pm 9.5$  vs  $18.4 \pm 10$ ,  $p=0.18$ ). However, memory cognitive WeeFIM scores were lower in blunt at both admission ( $2 \pm 1.5$  vs  $3 \pm 1.9$ ,  $p=0.004$ ) and discharge ( $3.2 \pm 1.8$  vs  $4.1 \pm 1.8$ ,  $p=0.02$ ). Patients who sustained ischemic injury were generally younger ( $6.6 \pm 5.2$  years vs  $9.5 \pm 5.7$  years,  $p=0.002$ ). Cognitive WeeFIM scores were lower in ischemic injury at both admission ( $8.2 \pm 5.8$  vs  $11.9 \pm 7.8$ ,  $p=0.01$ ) and discharge ( $12.7 \pm 9.5$  vs  $18.2 \pm 9.2$ ,  $p=0.003$ ). Patients who experienced seizures had similar cognitive scores to those without seizures at admission ( $10.2 \pm 7.9$  vs  $11.4 \pm 7.4$ ,  $p=0.20$ ) but lower cognitive scores at discharge ( $14.9 \pm 10.4$  vs  $18.0 \pm 9.0$ ,  $p=0.045$ ).

**Conclusion:** Blunt mechanism, ischemic injury, and seizures associated with TBI appear to significantly impact neurorecovery. These findings emphasize the importance of targeted rehabilitation to address the specific needs of pediatric TBI patients.