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Supplementary Materials

Early Functional Status and 90-Day Recovery Across CT Injury Patterns After Operative Pediatric Traumatic Brain Injury

Table S1. 90-day GOS-E Peds ascertainment and agreement for reconstructed assessments.

Cohort / group	Surviving patients with assigned 90-day status	Directly documented GOS-E Peds	Required reconstruction	Exact ordinal agreement	Agreement for GOS-E Peds 1–2 vs. ≥3
Complete acute cohort	48	39/48 (81.3%)	9/48 (18.8%)	8/9 (88.9%)	9/9 (100%)
Principal ≤16-year injury-pattern cohort	38	30/38 (78.9%)	8/38 (21.1%)	7/8 (87.5%)	8/8 (100%)
EDH-predominant	26	23/26 (88.5%)	3/26 (11.5%)	3/3 (100%)	3/3 (100%)
SDH/contusion-associated	12	7/12 (58.3%)	5/12 (41.7%)	4/5 (80.0%)	5/5 (100%)

A directly documented score was an explicit GOS-E Peds category recorded at the corresponding clinical assessment. Reconstruction was used only when an explicit score was unavailable but contemporaneous documentation was sufficient for classification. Reconstructed 90-day assessments were independently rated by two investigators and subsequently adjudicated. The single ordinal disagreement in the principal cohort was GOS-E Peds 3 versus 4; therefore, no reconstructed case crossed the prespecified GOS-E Peds 1–2 versus ≥3 threshold. Known deaths are not included in the survivor-denominator rows above because they were retained as category 8 by rule.

Table S2. Detailed injury mechanism, admission GCS components, pupillary findings, treatment timing, and operative characteristics by CT injury pattern in the principal ≤16-year cohort.

Characteristic	EDH-predominant (n = 28)	SDH/contusion-associated (n = 13)	p-value
Injury mechanism			
Fall	15/28 (53.6%)	3/13 (23.1%)	0.084
Traffic/transport	13/28 (46.4%)	9/13 (69.2%)	—
Sports-related	0/28 (0.0%)	1/13 (7.7%)	—
Mechanism detail (descriptive)			
Bicycle-related	2/28 (7.1%)	4/13 (30.8%)	—
Scooter-related	3/28 (10.7%)	0/13 (0.0%)	—
Motorcycle-related	2/28 (7.1%)	2/13 (15.4%)	—
Motor-vehicle occupant	3/28 (10.7%)	2/13 (15.4%)	—
Pedestrian–vehicle strike	3/28 (10.7%)	1/13 (7.7%)	—
Fall from height	4/28 (14.3%)	1/13 (7.7%)	—
Stairs fall	5/28 (17.9%)	1/13 (7.7%)	—
Household-equipment fall	4/28 (14.3%)	1/13 (7.7%)	—
Same-level fall	1/28 (3.6%)	0/13 (0.0%)	—
Other fall	1/28 (3.6%)	0/13 (0.0%)	—
Sports fall	0/28 (0.0%)	1/13 (7.7%)	—
Admission neurological examination			
GCS eye component, median (IQR)	4 (3–4)	3 (1–4)	0.023
GCS verbal component, median (IQR)	5 (4–5)	3 (1–5)	0.031
GCS motor component, median (IQR)	6 (6–6)	5 (2–6)	0.004
Both pupils reactive	25/28 (89.3%)	11/13 (84.6%)	0.716
One pupil nonreactive	1/28 (3.6%)	0/13 (0.0%)	—
Both pupils nonreactive	2/28 (7.1%)	2/13 (15.4%)	—
Treatment timing and referral			
Injury-to-surgery interval: <3 h	4/28 (14.3%)	4/13 (30.8%)	0.385
Injury-to-surgery interval: 3–6 h	9/28 (32.1%)	4/13 (30.8%)	—
Injury-to-surgery interval: 6–12 h	7/28 (25.0%)	4/13 (30.8%)	—
Injury-to-surgery interval: >12 h	8/28 (28.6%)	1/13 (7.7%)	—
Transferred from another institution	12/28 (42.9%)	4/13 (30.8%)	0.513
Intubated before receiving-center ED assessment	1/28 (3.6%)	4/13 (30.8%)	0.028
ED-to-incision time, min, median (IQR)	127 (82–220)	140 (73–300)	0.845
Operative characteristics			
Craniotomy	27/28 (96.4%)	7/13 (53.8%)	0.002
Craniectomy	1/28 (3.6%)	6/13 (46.2%)	—
Decompressive craniectomy	1/28 (3.6%)	6/13 (46.2%)	0.002

Values are median (IQR) or n/N (%). Wilcoxon rank-sum and Fisher's exact tests were used. For multi-category variables, one global p-value is shown on the first category row; sparse mechanism-detail subcategories are presented descriptively without separate inferential testing. CT, computed tomography; ED, emergency department; GCS, Glasgow Coma Scale; IQR, interquartile range.

Table S3. Detailed CT composition and adjudicated operative-target distribution within the SDH/contusion-associated injury pattern in the principal ≤16-year cohort (n = 13).

Descriptor	n/N (%)
CT composition	
Acute subdural hematoma present	4/13 (30.8%)
Cerebral contusion present	9/13 (69.2%)
Concomitant epidural hematoma present	4/13 (30.8%)
Traumatic subarachnoid hemorrhage present	9/13 (69.2%)
Intraventricular hemorrhage present	1/13 (7.7%)
Skull fracture present	11/13 (84.6%)
Depressed/displaced skull fracture	8/13 (61.5%)
Decompressive craniectomy	6/13 (46.2%)
Adjudicated principal operative target	
Acute SDH evacuation ± decompression	3/13 (23.1%)
Contusion-related decompression	1/13 (7.7%)
Combined treatment with SDH/contusional swelling as a substantive component	3/13 (23.1%)
Primarily EDH evacuation despite associated SDH/contusion pattern	2/13 (15.4%)
Primarily depressed-fracture elevation/reconstruction	4/13 (30.8%)
Operative-target summary	
Operation directly addressed SDH/contusional pathology, alone or in combined treatment	7/13 (53.8%)

CT findings are not mutually exclusive. Operative-target categories are mutually exclusive and reproduce the operative-report adjudication reported in the manuscript. The final summary row combines the three SDH-targeted, one contusion-targeted, and three combined procedures. CT, computed tomography; EDH, epidural hematoma; IVH, intraventricular hemorrhage; SDH, subdural hematoma.

Table S4. Exact GOS-E Peds distributions and transition matrices in the principal ≤16-year operative injury groups.

Assessment	GOS-E Peds category	EDH-predominant, n/N (%)	SDH/contusion-associated, n/N (%)
Discharge	1	22/28 (78.6%)	7/13 (53.8%)
Discharge	2	4/28 (14.3%)	0/13 (0.0%)
Discharge	3	0/28 (0.0%)	2/13 (15.4%)
Discharge	4	1/28 (3.6%)	0/13 (0.0%)
Discharge	5	0/28 (0.0%)	2/13 (15.4%)
Discharge	6	0/28 (0.0%)	1/13 (7.7%)
Discharge	7	0/28 (0.0%)	0/13 (0.0%)
Discharge	8	1/28 (3.6%)	1/13 (7.7%)
90 days	1	24/27 (88.9%)	7/13 (53.8%)
90 days	2	1/27 (3.7%)	2/13 (15.4%)
90 days	3	1/27 (3.7%)	2/13 (15.4%)
90 days	4	0/27 (0.0%)	0/13 (0.0%)
90 days	5	0/27 (0.0%)	0/13 (0.0%)
90 days	6	0/27 (0.0%)	1/13 (7.7%)
90 days	7	0/27 (0.0%)	0/13 (0.0%)
90 days	8	1/27 (3.7%)	1/13 (7.7%)
180 days	1	20/22 (90.9%)	6/11 (54.5%)
180 days	2	0/22 (0.0%)	1/11 (9.1%)
180 days	3	1/22 (4.5%)	2/11 (18.2%)
180 days	4	0/22 (0.0%)	0/11 (0.0%)
180 days	5	0/22 (0.0%)	1/11 (9.1%)
180 days	6	0/22 (0.0%)	0/11 (0.0%)
180 days	7	0/22 (0.0%)	0/11 (0.0%)
180 days	8	1/22 (4.5%)	1/11 (9.1%)

Percentages use the number of patients with an assigned GOS-E Peds status at the corresponding assessment as the denominator: EDH-predominant n = 28, 27, and 22 at discharge, 90 days, and 180 days, respectively; SDH/contusion-associated n = 13, 13, and 11. Category 8 represents death.

(B1) EDH-predominant: discharge → 90-day transition matrix

From \ To	1	2	3	4	5	6	7	8
1	21	0	0	0	0	0	0	0
2	3	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1

Paired observations: n = 27.

(B2) SDH/contusion-associated: discharge → 90-day transition matrix

From \ To	1	2	3	4	5	6	7	8
1	5	2	0	0	0	0	0	0

From \ To	1	2	3	4	5	6	7	8
2	0	0	0	0	0	0	0	0
3	1	0	1	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	1	0	1	0	0	0	0	0
6	0	0	0	0	0	1	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1

Paired observations: n = 13.

(C1) EDH-predominant: 90-day → 180-day transition matrix

From \ To	1	2	3	4	5	6	7	8
1	18	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1

Paired observations: n = 21.

(C2) SDH/contusion-associated: 90-day → 180-day transition matrix

From \ To	1	2	3	4	5	6	7	8
1	5	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0
3	0	0	2	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	1	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1

Paired observations: n = 11. Lower scores indicate better global function. Death (category 8) was treated as an absorbing state. Administrative censoring and unavailable assessments are detailed in Table S6.

Table S5. Sensitivity analyses for absence of good recovery at 90 days.

Analysis	EDH-predominant events/N (%)	SDH/contusion-associated events/N (%)	Exact OR (95% CI)	p-value	Absolute risk difference, pp (95% CI)
Primary ≤16-year analysis: GOS-E Peds ≥3	2/27 (7.4%)	4/13 (30.8%)	5.28 (0.63–68.02)	0.075	+23.4 (−0.8 to 50.8)
Full 0–18-year principal comparison	2/30 (6.7%)	4/14 (28.6%)	5.35 (0.65–67.84)	0.071	+21.9 (−0.4 to 48.4)
Excluding pre-ED intubation	2/26 (7.7%)	3/9 (33.3%)	5.61 (0.52–81.61)	0.095	+25.6 (−1.3 to 57.4)
Excluding polytrauma	1/20 (5.0%)	2/7 (28.6%)	6.89 (0.30–469.37)	0.156	+23.6 (−4.0 to 59.3)
Alternative endpoint: GOS-E Peds 5–8	1/27 (3.7%)	2/13 (15.4%)	4.52 (0.21–288.74)	0.242	+11.7 (−6.6 to 38.7)
Excluding depressed/displaced skull fractures	2/23 (8.7%)	1/5 (20.0%)	2.51 (0.04–60.51)	0.459	+11.3 (−13.1 to 54.2)

Events are patients outside the specified good-recovery range. Odds ratios are conditional exact estimates comparing the SDH/contusion-associated injury pattern with the EDH-predominant pattern; OR >1 indicates greater odds of the endpoint in the SDH/contusion-associated group. Absolute risk differences are expressed in percentage points (SDH/contusion-associated minus EDH-predominant) with Newcombe-type 95% confidence intervals. CI, confidence interval; ED, emergency department; GOS-E Peds, Glasgow Outcome Scale–Extended Pediatric Revision; OR, odds ratio; pp, percentage points.

Table S6. Follow-up eligibility, administrative censoring, and outcome availability at 90 and 180 days.

Assessment	Follow-up status	All acute cohort	Principal ≤16-year injury-pattern cohort	EDH-predominant	SDH/contusion-associated
90 days	Recorded survivor assessment	48	38	26	12
90 days	Known death retained as category 8	3	2	1	1
90 days	Mature eligible window without adequate documentation	1	1	1	0
90 days	Assessment window still open at database lock	0	0	0	0
90 days	Follow-up window not yet reached	1	0	0	0
90 days	**Assigned functional status available**	**51**	**40**	**27**	**13**
180 days	Recorded survivor assessment	41	31	21	10
180 days	Known death retained as category 8	3	2	1	1
180 days	Mature eligible window without adequate documentation	3	3	2	1
180 days	Assessment window still open at database lock	2	2	1	1
180 days	Follow-up window not yet reached	4	3	3	0
180 days	**Assigned functional status available**	**44**	**33**	**22**	**11**

Database lock: 30 August 2026. Patients whose target follow-up window had not yet matured, or remained open at database lock, were administratively not yet assessable and were not classified as lost to follow-up. Known in-hospital deaths were retained as GOS-E Peds category 8 at subsequent nominal time points.