

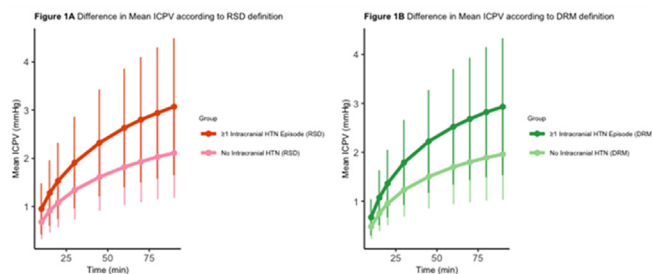
neurosurgical patients, but there is controversy surrounding using a solely ICP-based paradigm to guide management. ICP variability (ICPV) may be a useful predictor of neurological outcomes in addition to ICP, as an indirect measure of intact cerebral pressure autoregulation. However, current literature shows conflicting associations between ICPV and mortality. Thus, we investigated the effect of ICPV on intracranial hypertensive episodes and mortality using the eICU Collaborative Research Database v2.0U.

Methods: 1,815,676 ICP readings from 868 patients with neurosurgical conditions were included. ICP variability from 10 to 90 minutes was computed using two methods: rolling standard deviation (RSD) and absolute deviation from the rolling mean (DRM). Episodes of intracranial hypertension was defined as at least 25 minutes of ICP >22mmHg in the subsequent 30-minute window. The effects of mean ICPV on presence of intracranial hypertension and mortality was assessed using multivariate logistic regression. Recurrent Neural Network with Long Short-Term Memory was used for time-series forecasting predictions of episodes of intracranial hypertension.

Results: Higher mean ICPV was significantly associated with the presence of intracranial hypertension in both ICPV definitions (RSD-OR: 2.82, 95% CI: 2.07–3.90, $P<0.001$; DRM-OR: 3.93, 95% CI: 2.77–5.69, $P<0.001$). ICPV was significantly associated with mortality in patients with intracranial hypertension (RSD-OR: 1.28, 95% CI: 1.04–1.61, $P=0.026$, DRM-OR: 1.39, 95% CI: 1.10–1.79, $P=0.007$). In machine learning models, both definitions of ICPV achieved good results, with the best F1 score of 0.673 (± 0.045) and AUC of 0.979 (± 0.031) achieved for the DRM definition over 30 minutes.

Conclusions: ICPV may be useful as an adjunct for prognostication of intracranial hypertensive episodes and mortality in neurosurgical critical care. Further research on predicting intracranial hypertensive episodes with ICPV may help clinicians react expeditiously to ICP changes.

Optional Image



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AUGMENTATIVE CRANIOTOMY: A NEW TECHNIQUE FOR THE TREATMENT OF INTRACRANIAL HYPERTENSION

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Emerging Therapies to Enhance TBI/SCI Outcome (Trauma Parallel Session), September 25, 2023, 4:50 PM - 6:20 PM

Background: Patients with severe, post-traumatic cerebral edema and massive hemispheric ischemic and hemorrhagic stroke are burdened with a highly unfavorable prognosis, despite intensive medical-reimaging treatment, reaching in-hospital mortality of about 89% of cases. Decompressive craniectomy is an effective and recognized treatment for intracranial hypertension. However, it is associated with a high rate of complications closely related to removing the bone operculum. Moreover, subsequent cranioplasty surgery is associated with high costs and a high rate of postoperative complications.

Methods: Between September 2020 and May 2021, at Policlinico Umberto I University Hospital - Sapienza University of Rome, 21 patients came to the

Emergency Department following severe head trauma or suffering from ischemic and/or massive hemorrhagic stroke underwent augmentative craniotomy in an emergency setting.

Results: In the present pilot study, we describe an innovative treatment in which the skull volume is expanded, without removing the craniotomy operculum and avoiding subsequent bone repositioning surgery, using the innovative RIALTO® craniotomy operculum suspension system (NTplast, Rome, Italy).

The design steps and preclinical studies are described. Data from a preliminary clinical series are presented that confirmed the efficacy of this treatment in reducing intracranial hypertension and demonstrated that this technique is associated with a reduced complication rate compared with the traditional method.

Conclusions: This preliminary analysis demonstrates that augmentative craniotomy using the RIALTO® device is a safe procedure that does not significantly increase surgical time compared with traditional decompressive craniectomy.

Early data, which must be extensively verified with an upcoming trial being activated, appear to produce a substantially better prognosis in treated patients.

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EVALUATING THE RELIABILITY OF NEUROLOGICAL PUPILLARY INDEX AS A PROGNOSTIC MEASUREMENT OF IN-ICU MORTALITY IN NEUROCRITICAL CARE PATIENTS

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Emerging Therapies to Enhance TBI/SCI Outcome (Trauma Parallel Session), September 25, 2023, 4:50 PM - 6:20 PM

Background: Neurological pupil index (NPI) is a novel method of assessing pupillary size and reactivity using pupillometry to reduce human subjectivity. This retrospective observational study aims to evaluate the use of NPI as a potential prognostic tool in a broad population of neurocritical care patients by observing the correlation with in-hospital mortality

Methods: The authors recorded NPI and clinical data of Intensive Care Unit patients at "NOCSAE" Hospital of Baggiovara, Modena, Italy, from August 2019 to February 2022.

The population has been stratified for diagnosis: traumatic brain injury (TBI), subarachnoid hemorrhage (SAH), spontaneous intracerebral hemorrhage (ICH), ischemic stroke (STROKE), elective neurosurgical operation (ELECTIVE), cardiac arrest (CA).

The mean NPI (detected on both eyes), the standard deviation of the measurements were calculated.

Pearson's correlation test was used to calculate statistical significance and strength of association between continuous variables. Fischer's exact test was used to calculate the statistical significance of the correlation between dichotomous variables. The Youden index was used to determine cutoff values for creating 2x2 contingency tables. We evaluated the correlation between NPI and in-hospital mortality for different diagnosis (Fig.1)

Results: A total of 278 patients has been enrolled.

We observed a very strong statistically significant correlation between NPI AVG value and mortality for TBI and ICH, a strong correlation statistically significant for STROKE, ELECTIVE and CA.

We initially use NPI value 3 as the cutoff but Using Youden's index in the overall population NPI between 3,16 e 3,4 provided the best result.

Conclusions: In our population the pupillometry is more effective at identifying patients with good outcome (ICU discharge) compared to patients with poor outcome (ICU mortality), suggesting that NPI can be a good prognostication tool for neurological diseases.

The analysis also revealed a different grade of correlation between in-hospital mortality and average NPI based on pathology.

Optional Image

NPI \geq 3 and NPI $<$ 3 PREDICTIVE VALUE IN-ICU MORTALITY/DISCHARGE

	Sensitivity*	Specificity ^o	PPV	NPV	P-value
ICH	81.3%	95.9%	92.9%	88.7%	< 0,0001
TBI	66.6%	92.5%	60.0%	94.2%	0,0002
Ischemic Stroke	100.0%	85.7%	37.5%	100.0%	0,0066
Cardiac Arrest	31.3%	100.0%	100.0%	65.6%	0,01
SAH	50.0%	94.1%	33.3%	97%	0,1619
ELECTIVE Surgery	50.0%	90.9%	33.3%	95.2%	0,2391

*True Positive, Unfavourable outcome

^o True Negative

PPV= Positive Predictive Value

NPV= Negative Predictive Value

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EARLY VERSUS LATE CRANIOPLASTY AFTER DECOMPRESSIVE CRANIECTOMY IN TRAUMATIC BRAIN INJURY

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Emerging Therapies to Enhance TBI/SCI Outcome (Trauma Parallel Session), September 25, 2023, 4:50 PM - 6:20 PM

Background: Decompressive craniectomy (DC) plays a clinically relevant role in the last resort treatment of patients with traumatic brain injury (TBI). After a DC, neurosurgeons are faced with the question when to reconstruct the bone defect (cranioplasty). There are no widely accepted guidelines to facilitate this decision. The current study aims to compare the effectiveness of early cranioplasty (\leq 90 days) to late cranioplasty ($>$ 90 days) following DC in TBI in terms of functional outcome (Glasgow Outcome Scale-Extended score, GOSE) complications, and quality of life (Quality of Life after Brain Injury scale, Qolibri) 12 months after DC.

Methods: Patients with TBI who received a DC and subsequent cranioplasty were included from the Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI) and the Neurotraumatology Quality Registry (Net-QuRe) studies. These prospective, multicenter, observational cohort studies included 5091 patients from 2014 to 2020. Timing was associated with GOSE in a multivariable ordinal regression model and propensity score matching (PSM).

Results: Of the 173 patients included, 73 patients received early cranioplasty and 100 patients late cranioplasty. In multivariable regression and PSM, no difference in GOSE (adjusted odds ratio (aOR) 0.87 [95% CI 0.61-1.21] and aOR 0.88 [95% CI 0.48-1.65] respectively) between the two groups was found. Early cranioplasty was strongly associated with hydrocephalus as compared to the late cranioplasty group (aOR 3.95 [95% CI 1.19-15.53]). Adjusted analysis yielded no statistically significant differences between seizure rate and Qolibri scores. In a subgroup of patients who underwent any major extracranial intervention (ECI), early cranioplasty was associated with a favorable functional outcome (aOR 1.85 [95% CI 1.39-2.65]).

Conclusions: This study found no difference in functional outcome and quality of life between early cranioplasty and late cranioplasty among patients that received a DC for a TBI. Cranioplasty performed 90 days after initial DC may minimize hydrocephalus risk. Early cranioplasty may be beneficial in patients who underwent a major ECI in terms of functional outcome.

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POST INTENSIVE CARE SYNDROME IN PATIENTS SUSTAINING A TRAUMATIC BRAIN INJURY

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Emerging Therapies to Enhance TBI/SCI Outcome (Trauma Parallel Session), September 25, 2023, 4:50 PM - 6:20 PM

Background: Post-intensive Care Syndrome (PICS) is defined as new or worsening physical, cognitive, or mental impairments following critical illness or treatment in the intensive care unit (ICU). Robust evidence on the occurrence of PICS in patients after traumatic brain injury (TBI) is still missing. This study aims to assess the presence of PICS and its risk factors in a large, prospectively collected TBI database.

Methods: 496 patients from the Collaborative European NeuroTrauma Effectiveness Research in TBI (CENTER-TBI) core study treated on an ICU were enrolled. The 3-, 6- and 12-month outcome was assessed using the Short Form 36 (SF-36) and the Rivermead Post Concussion Symptoms Questionnaire (RPQ-13). PICS \geq 1 was defined by a change in either the SF-36 physical component score (PCS) \geq 10 points, the SF-36 mental component score (MCS) \geq 10 points or any worsening of the RPQ-13 between the 3-, 6- and 12-month follow-up. PICS \geq 2 was defined as a combination of any of those changes.

Results: 121 (43.2%) patients developed PICS. Patients with PICS were predominantly male (72%), had a median age of 43 (13 - 84) years and mostly suffered from mild TBI (47.5 %). Cranial and extracranial surgeries were performed in 27% and 32% respectively. Correlation analysis showed associations between the length of in-hospital stay and worsening of PCS ($r=-0.164$, $p=0.01$), MCS ($r=-0.145$, $p=0.01$) and RPQ-13 ($r=0.167$) after 12 months. Similarly, associations between the duration of mechanical ventilation and worsening in PCS ($r=-0.146$, $p=0.01$), MCS ($r=-0.140$, $p=0.01$) and RPQ-13 ($r=0.132$, $p=0.01$) were observed.

Conclusions: Our findings shed light on the not well-known occurrence of PICS in TBI patients treated on the ICU. Factors associated with PICS such as the hospital length of stay and the duration of mechanical ventilation should be considered and patients at risk closely monitored.

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PROGNOSTIC FACTORS ON CLINICAL OUTCOME IN PATIENTS WITH EPIDURAL HEMATOMA

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Post-Traumatic Hydrocephalus (Trauma Parallel Session v.2), September 26, 2023, 8:30 AM - 10:00 AM

Background: Epidural hematomas (EDH) have an overall incidence of 8.2% in traumatic brain injury (TBI) patients. Neurological deterioration can occur rapidly thus early diagnosis and appropriate evacuation is essential. Current guidelines advocate emergency surgery when the EDH $>$ 30cm³ regardless of the GCS, and if GCS is $<$ 9 with anisocoria. The value of prognostic factors, especially time from incident to surgery, has been inconsistent in the literature. Our study aimed to evaluate the impact of clinical and radiological factors on outcome after EDH in a large patient cohort.

Methods: Adult patients with traumatic EDH managed at a tertiary neurosurgical department between January 2011 and March 2022 were included. Clinical data was sourced from electronic medical records. CT scans were reviewed (OsiriX MD 13.0.1) and statistical analyses performed (R Studio V1.4). TBI severity was classified as mild (GCS 13-15), moderate (GCS 9-12) and severe (GCS 3-8).