

## UAB TRAUMATIC BRAIN INJURY GUIDELINES

Updated September 2022

### Objectives:

1. Establish a standard of care for blunt traumatic brain injured patient in regards to admission, imaging, and neurosurgical consultation

### Background:

Traumatic Brain Injury (TBI) accounts for \$92 billion in health care costs with 2.9 million emergency department (ED) visits and 224,000 hospital admissions due to TBI (1). Most centers mandate repeat head CTs, neurosurgery consults, and hospital admission (often to the ICU) for all patients with TBI and ICH. Obviously, with such a large disease burden and extensive evaluation, this had made traumatic brain injury a natural target for improvements in resource utilization.

The Brain Injury Guidelines (BIG) are a comprehensive guideline for the management of traumatic brain injury based on history, physical, exam, and radiographic findings. Through this algorithm, selected patients do not require a repeat head CT, a neurosurgery consult, or even an admission – allowing for the effective utilization of healthcare resources. It was found that implementation of the BIG at a single Level I trauma center resulted in an average hospital cost reduction of \$4,772 per patient, while at the same time observing no differences in rates of mortality, progression on RHCT scans neurosurgical interventions, and 30-day readmissions (4).

The original Brain Injury Guidelines were published in 2014 in JTACS as a single institution retrospective cohort of 1232 patients (2,3). Patients classified as BIG 1 had 0% clinical or radiographic progression. Those patients classified as BIG 2 had a 2.6% incidence of radiographic progression, with 0% progressing clinically. By utilizing this care algorithm in which BIG1 required a 6-hour period of observation only and BIG2 required a 24-hour observation period only, it was found that repeat CT imaging was reduced by 28%, admissions by 10%, and neurosurgical consultation by 35%.

Subsequently, these guidelines have been validated in 2022 by the AAST in a prospective, observational multi-institutional trial across 10 institutions and 2432 patients (5). Patients classified as BIG 1 had a 1.3% incidence of radiographic progression, with 0% progressing clinically. Those patients classified as BIG 2 had a 7.1% incidence of radiographic progression, with 0.7% progressing clinically, though no patient required NSG intervention. The incidence of upgrade from BIG 2 to BIG 3 was 2.4%. Again, this study found that the BIG care algorithm decreased hospitalization, CT scan utilization, and neurosurgical consultation by 26%. There have been concurrent modifications of the brain injury guidelines which further extends on intoxication, coagulopathy, and applies subarachnoid hemorrhage parameters (6). These have also been validated in a multicenter retrospective analysis (7).

After review of our own data at UAB, we have found a similar age, ISS, and distribution of BIG categories as well as similar distribution of injuries. Our data also agrees with the prior published data in regards to clinical and radiographic progression for BIG 1 and BIG 2. We have found a potential for reduction in unnecessary HCT, admissions, and neurosurgical consult equal to if not greater than prior published.

### Clinical Practice Guideline:

	BIG 1	BIG 2	BIG 3
Neuro Exam (Abnormal = <u>Best</u> GCS <15 at time of classification, or focal deficit)	Normal	Normal	Abnormal
Intoxication (EtOH > 80 mg/dl, Suspicion of any non-EtOH substance abuse)	No	No/Yes	No/Yes
Coagulopathy [Pharmacological (anticoagulation, antiplatelets), Non-pharmacological (Abnormal TEG, cirrhosis, INR>1.4, thrombocytopenia <100)]	No	No	Yes
Skull fracture	No	Non-displaced	Displaced
Subdural Hematoma	≤4mm	5-7mm	≥8mm
Epidural Hematoma	≤4mm	5-7mm	≥8mm
Intraparenchymal Hemorrhage	≤4mm and 1 location	5-7mm and/or 2 locations	≥8mm and/or multiple locations
Subarachnoid Hemorrhage	"Trace" = ≤3 sulci	"Localized" =Single hemisphere	"Scattered" Bi-hemispheric
Intraventricular Hemorrhage	No	No	Yes
Midline Shift	No	No	Yes

All measurements/exact verbiage according to FINAL HCT

Patients must meet all criteria for categorization into BIG 1 or BIG 2. Failure to meet even 1 criterion (in BIG 1 or BIG 2) categorizes the patient into the BIG 3 category



Repeat HCT	No	No	Yes @6 Hours
Neurosurgical Consultation	No	No	Yes
Hospitalization	6 hour observation	Yes, 24 hour observation	Yes
Neurocheck Frequency	Q2	Q4	Q1 (until otherwise specified by NSG)
Discharge Criteria	GCS 15 (or baseline), Neuro Intact	GCS 15 (or baseline), Neuro Intact	NA

Exclusion: All transfers with a TBI get a repeat HCT on arrival regardless of prior BIG score. Based on HCT obtained at UAB, follow above guidelines. These patients will also require an over-read of film from outside hospital.

### **Any patient with a change in neurologic examination will require a STAT HCT and Neurosurgical Consultation**

#### Note: Open Skull Fractures

Should receive antibiotic ppx with rocephin

- Open, Non-displaced skull fracture = BIG 2. This would fall under the management of trauma.
- Open, displaced skull fractures = BIG3 = NSG consult.
  - In the absence of CSF leak or dura breach (as determined by NSG) if our NSG team recommends closure by the trauma team, this is appropriate.
  - In the setting of CSF or dural breach, we will anticipate that this will be managed by neurosurgery.

Appropriate closure will consist of 1L of irrigation and closure within 6 hours of injury.

#### **Literature:**

1. Centers for Disease Control and Prevention (2021). *Surveillance Report of Traumatic Brain Injury-related Hospitalizations and Deaths by Age Group, Sex, and Mechanism of Injury—United States, 2016 and 2017*. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services.
2. Joseph B, Friese RS, Sadoun M, et al. The BIG (brain injury guidelines) project: defining the management of traumatic brain injury by acute care surgeons. *J Trauma Acute Care Surg*. 2014
3. Joseph B, Aziz H, Pandit V, Kulvatunyou N, Sadoun M, Tang A, et al. Prospective validation of the brain injury guidelines: Managing traumatic brain injury without neurosurgical consultation. *J Trauma Acute Care Surg*. 2014
4. Joseph B, Pandit V, Haider AA, Kulvatunyou N, Zangbar B, Tang A, et al. Improving hospital quality and costs in nonoperative traumatic brain injury: the role of acute care surgeons. *JAMA Surg*. 2015;150(9):866-72.
5. Joseph B, Obaid O, Dultz L, et al. Validating The Brain Injury Guidelines (BIG): Results of An AAST Prospective Multi-Institutional Trial [published online ahead of print, 2022 Mar 28]. *J Trauma Acute Care Surg*. 2022
6. Khan AD, Elseth AJ, Brosius JA, Moskowitz EE, Liebscher SC, Anstadt MJ, et al. Multicenter Assessment of the Brain Injury Guidelines and a Proposal of Guideline Modifications. *Trauma Surg Acute Care Open*. 2020
7. Khan AD, Lee J, Galicia K, et al. A Multicenter Validation of the Modified Brain Injury Guidelines (mBIG): Are They Safe and Effective? [published online ahead of print, 2022 Apr