

PROPOSAL FOR MULTI-INSTITUTIONAL IMPLEMENTATION OF THE BRAIN INJURY GUIDELINES

INTRODUCTION: Traumatic Brain Injury (TBI) is an important clinical entity in acute care surgery without well-defined guidelines for diagnosis and evaluation. The Emergency Department (ED) sees more than 1 million visits for traumatic brain injury annually, majority of which are characterized as “mild” TBI not requiring an immediate neurosurgical intervention.^{1,2} The current treatment plan for an intracranial hemorrhage (ICH) is an initial head computed tomography (CT) followed by series of repeat head CTs (RHCT) and a mandatory neurosurgical consultation.³⁻⁶ However, this current standard of consulting neurosurgery on every TBI patient with an Intra-cranial hemorrhage (ICH) is changing.³⁻⁶ Additionally, the use of repeat head CT scan for all TBI is being questioned with recent studies demonstrating use of RHCT only in non-examinable patients.⁷⁻⁹

We performed a retrospective study and formed the Brain Injury Guidelines with collaboration with the neurosurgeons at our institution for the acute management of TBI **(Figure 1)**.¹⁰ We defined an optimal therapeutic plan for the management of TBI based on the patient history, physical examination, and head computed topographic scan finding. In a retrospective review of matched cohort of patients we demonstrated acute care surgeons can independently manage patients with mild TBI and ICH without a neurosurgical consultation.¹⁰ We implemented BIG guidelines at our institution in March 2012. We prospectively evaluated the implementation of BIG 1 category and found that, implementation of BIG 1 category allows for better clinical and hospital resource utilization.¹¹ Additionally, acute care surgeons were able to independently care for patients with ICH <4 mm (BIG 1 category) without the need for in-patient neurosurgical consultation. To validate and compare the safety and utility of our guidelines, we plan to perform a prospective observational study to analyze the outcomes of the current standard of care for the management of mild TBI with small ICH at multiple institutions. The goal will be to collect prospective observational data and then move forward with a prospective implementation at a later time.

STUDY PROTOCOL

- Patients with an intra-cranial hemorrhage on initial CT will be evaluated by the trauma team. A detail history will be collected recording the following information:

Patient demographics (age and sex), patient's medication history (anti-platelet and anti-coagulation therapy), vitals on presentation, Glasgow Coma Scale on presentation, intoxication (alcohol use), and mechanism of injury. (see data collection sheet)

- Patients meeting with normal neurological examination, not on any anti-platelet or anti-coagulation medications, and minuscule findings on initial head CT scan ($ICH \leq 4\text{mm}$ and no skull fracture) will be categorized into the BIG 1 and will be enrolled in the study (**Figure1**).
- A detail neurological examination will be performed. Details of neurological examination will be recorded. An abnormal neurological examination is defined as altered mental status, focal neurological deficits, and abnormal pupillary examination.
- Findings of initial head CT scan will be recorded i.e. size and type of the ICH and/ skull fracture.
- Patients will be managed according to institutional standard practice of neurological consultation and routine repeat head CT scan.
- Findings of repeat head CT scans will be recorded i.e. new findings, or worsening of the scan as compared to previous scan. Also total number of scans.
- Patients will be followed during the hospital stay and up to 30-days post discharge for readmission rate and need for repeat head CT scan.
- Patients will be evaluated in the clinic within 30 days post discharge for assessing symptoms of head injury (**attached is follow up form**). Patients not following up in clinic, outcomes will be assessed by a phone call or follow up records for 30 days to see readmission.
- This study has been approved by the Institutional Review Board at the University of Arizona, College of Medicine and allowed to be performed without consent of the patient. (**Attached is the IRB approval**)

Figure 1 – Brain Injury Guidelines

Brain Injury Guidelines			
Variables	BIG 1	BIG 2	BIG 3
LOC	Yes/No	Yes/No	Yes/No
Neurologic examination	Normal	Normal	Abnormal
Intoxication	No	No/Yes	No/Yes
CAMP	No	No	Yes
Skull Fracture	No	Non-displaced	Displaced
SDH	$\leq 4\text{mm}$	5 - 7 mm	$\geq 8\text{ mm}$
EDH	$\leq 4\text{mm}$	5 - 7 mm	$\geq 8\text{ mm}$
IPH	$\leq 4\text{mm}$, 1 location	5 - 7 mm, 2 locations	$\geq 8\text{ mm}$, multiple locations
SAH	Trace	Localized	Scattered
IVH	No	No	Yes

BIG, brain injury guidelines; CAMP, Coumadin, Aspirin, Plavix; EDH, epidural hemorrhage; IVH, intra-ventricular hemorrhage; IPH, intra-parenchymal hemorrhage; LOC, loss of consciousness; NSC, neurosurgical consultation; RHCT, repeat head computed tomography; SAH, subarachnoid hemorrhage; SDH, subdural hemorrhage

References

1. CDC IPaC. Traumatic Brain Injury,
<http://www.cdc.gov/traumaticbraininjury/statistics.html>. Accessed 12th January 2014.
2. Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control. Report to Congress on mild traumatic brain injury in the United States: steps to prevent a serious public health problem. Atlanta (GA): Centers for Disease Control and Prevention; 2003.
3. Huynh T, Jacobs DG, Dix S. Utility of neurosurgical consultation for mild traumatic brain injury. *Am Surg* 2006 Dec;72(12):1162-5; discussion 1166-7.
4. Rhodes M, Lester M, Morrow M. Selective neurosurgical consultation for trauma. *J Trauma* 1993;35:979.
5. Klein Y, Donchik V, Jaffe D, et al. Management of patients with traumatic intracranial injury in hospitals without neurosurgical service. *J Trauma*. 2010 Sep; 69(3):544-8.
6. Wu C, Orringer DA, Lau D, et al. Cumulative incidence and predictors of neurosurgical interventions following nonsevere traumatic brain injury with mildly abnormal head imaging findings. *J Trauma Acute Care Surg*. 2012 Nov;73(5):1247-53.
7. Brown C.V., Weng J, Oh D, et al. Does routine serial computed tomography of the head influence management of traumatic brain injury? A prospective evaluation. *J Trauma*. 2004; 57(5):939-43.
8. Joseph B, Aziz H, Pandit V, et al A Prospective Three Year Study of Repeat Head Computed Tomography in Traumatic Brain Injury. *Journal of American College of Surgeons*. [Accepted, Due for Print 2014].
9. Aziz H, Rhee P, Pandit V, et al. Mild and moderate pediatric traumatic brain injury: replace routine repeat head computed tomography with neurologic examination. *J Trauma Acute Care Surg*. 2013 Oct; 75(4):550-4.

10. Joseph B, Friese R.S, Sadoun M et al. The Brain Injury Guidelines Project: Defining the management of Traumatic Brain injury by Acute Care Surgeons. J Trauma Acute CareSurg, (Accepted Due for print 2014)
11. Joseph B, Aziz H, Sadoun M et al. The Acute Care Surgery Model: Managing Traumatic Brain Injury without an Inpatient Neurosurgical Consultation. J Trauma Acute Care Surg. 2013 Jul;75(1):102-5
12. Joseph B, Aziz H, Pandit V et al Prospective Validation of the Brain Injury Guidelines: Managing Traumatic Brain Injury Without Neurosurgical Consultation. (Abstract presented at the Annual Meeting of the Western Association for the Surgery of Trauma, 2014).