

OREGON GUIDANCE FOR MANAGEMENT OF PATIENTS WITH MINOR BRAIN INJURIES *IN SITU*

Background

Traumatic brain injury (TBI) is associated with a high rate of morbidity and mortality and places a significant demand on the Oregon State Trauma System and our patients. Management of TBI accounts for up to 10% of total healthcare costs in the United States, and inter-hospital transfers often result in high costs to patients^{1,2}. The Brain Injury Guidelines (BIG) have emerged as a way to appropriately risk stratify patients with TBI and identify those at very low risk of progressive neurological deterioration³. Managing patients with TBIs according to the BIG criteria has been demonstrated to be safe and, for minimally injured patients (i.e. BIG 1), does not require direct evaluation by neurological surgeons⁴⁻⁷. These guidelines aim to outline a safe approach to managing patients with mild TBIs at their hospital of presentation (i.e. *in situ*) and remove the perceived imperative to transfer these patients to a hospital with neurosurgical capabilities.

Guidelines

1. Risk Stratification:

The criteria for BIG classification are detailed in Joseph et al (2022) and reproduced below³. Each patient evaluated in the Oregon Trauma System should be assigned a BIG classification based on their imaging findings and clinical presentation.

Brain Injury Guidelines (BIG)			
Variables	BIG 1	BIG 2	BIG 3
Loss of Consciousness (LOC)	Yes/No	Yes/No	Yes/No
Neurologic Examinations	Normal	Normal	Abnormal
Intoxication (impairment)	No	No/Yes	No/Yes
Anti-coagulant or Anti-Platelet Use	No	No	Yes
Skull Fractures	No	Non-displaced	Displaced
Subdural Hematoma	≤ 4 mm	5-7 mm	≥ 8 mm
Epidural Hematoma	≤ 4 mm	5-7 mm	≥ 8 mm
Intraparenchymal Hemorrhage	≤ 4 mm 1 Location	5-7 mm 2 Locations	≥ 8 mm Multiple Locations
Subarachnoid Hemorrhage	Trace	Localized	Multiple Locations
Intraventricular Hemorrhage	No	No	Yes
Therapeutic Plan			
Hospitalization	No Observation (6 hrs.)	Yes	Yes
Repeat Head CT (RHCT)	No	No	Yes
Neurosurgical Consult	No	No	Yes

2. Management of patients with a BIG 1 injury:

Patients with a TBI stratified to BIG 1 do not *necessarily* require transfer to a trauma center with complex critical care and neurosurgical expertise. The risk of injury progression in this group of patients is exceptionally low and must be balanced against the health, financial and social risks inherent in inter-hospital transfer.

- As detailed above – a patient with a BIG 1 injury does NOT require repeat head CT, does NOT require neurosurgical consultation and published data supports that they can be safely discharged from the hospital after 6 hours of observation.
- Individual hospitals may augment this 6-hour observation period with additional observation or repeat imaging based on local resources.
- If unclear which BIG category is most appropriate for a patient, consultation with the receiving trauma center is advised.
- If a patient has other injuries or extenuating social or medical issues not covered in the BIG guidelines, it is still reasonable to consider transfer. This should be approached in consultation with the receiving trauma center on an individualized basis.
- If a patient with a BIG-1 TBI is deemed safe for discharge, referral to rehabilitation services for post-TBI recovery is advised (e.g. PT, OT, speech therapy, cognitive rehab).

3. Management of patients with BIG 2 and BIG 3 injuries:

- These are potentially complex injuries and warrant transfer to a trauma center with complex critical care and neurological surgery expertise.
- Any anti-coagulant use or pre-existing coagulopathy should be considered for transfer to a trauma center with complex critical care and neurological surgery expertise AS WELL AS immediate correction of the coagulopathy before transfer.

Rationale

1. BIG is designed to provide a mechanism to provide safe and cost-effective care. Published literature and many Oregon trauma centers' individual experiences emphasize that patients with a TBI who are correctly stratified to BIG1 rarely require neurosurgical intervention or more than a short period of clinical observation.
2. Given the significant logistical, interpersonal and financial costs associated with a trauma transfer, this guideline outlines which patients may be safely observed at their presenting hospital and not necessarily transferred to a large trauma hospital.
3. BIG is designed to augment the current care for a trauma-activated patient and other injuries should be addressed using current standards of practice. It may be that additional injuries warrant transfer, independent of the TBI severity, and established transfer practices and guidelines would continue to apply in this circumstance.
4. It is important to emphasize that this is a *guideline* and there is a wide range of individual patient variability that may not be completely covered in this guideline. In these

circumstances, a discussion with the receiving trauma center is encouraged and care should be individualized to the patient.

References

1. Hoyt DB, Holcomb J, Abraham E, Atkins J, Sopko G, Working Group on Trauma R. Working Group on Trauma Research Program summary report: National Heart Lung Blood Institute (NHLBI), National Institute of General Medical Sciences (NIGMS), and National Institute of Neurological Disorders and Stroke (NINDS) of the National Institutes of Health (NIH), and the Department of Defense (DOD). *J Trauma*. Aug 2004;57(2):410-5. doi:10.1097/00005373-200408000-00038
2. Follette C, Halimeh B, Chaparro A, Shi A, Winfield R. Futile trauma transfers: An infrequent but costly component of regionalized trauma care. *J Trauma Acute Care Surg*. Jul 1 2021;91(1):72-76. doi:10.1097/TA.0000000000003139
3. Joseph B, Obaid O, Dultz L, et al. Validating the Brain Injury Guidelines: Results of an American Association for the Surgery of Trauma prospective multi-institutional trial. *J Trauma Acute Care Surg*. Aug 1 2022;93(2):157-165. doi:10.1097/TA.0000000000003554
4. Joseph B, Aziz H, Pandit V, et al. Prospective validation of the brain injury guidelines: managing traumatic brain injury without neurosurgical consultation. *J Trauma Acute Care Surg*. Dec 2014;77(6):984-8. doi:10.1097/TA.0000000000000428
5. 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*. Jul 2013;75(1):102-5; discussion 105. doi:10.1097/TA.0b013e3182946667
6. 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*. Apr 2014;76(4):965-9. doi:10.1097/TA.0000000000000161
7. Joseph B, Haider AA, Pandit V, et al. Changing paradigms in the management of 2184 patients with traumatic brain injury. *Ann Surg*. Sep 2015;262(3):440-8; discussion 446-8. doi:10.1097/SLA.0000000000001418