

## Traumatic Brain Injury Pathways

for Adult ED Patients Being Admitted to Trauma Service

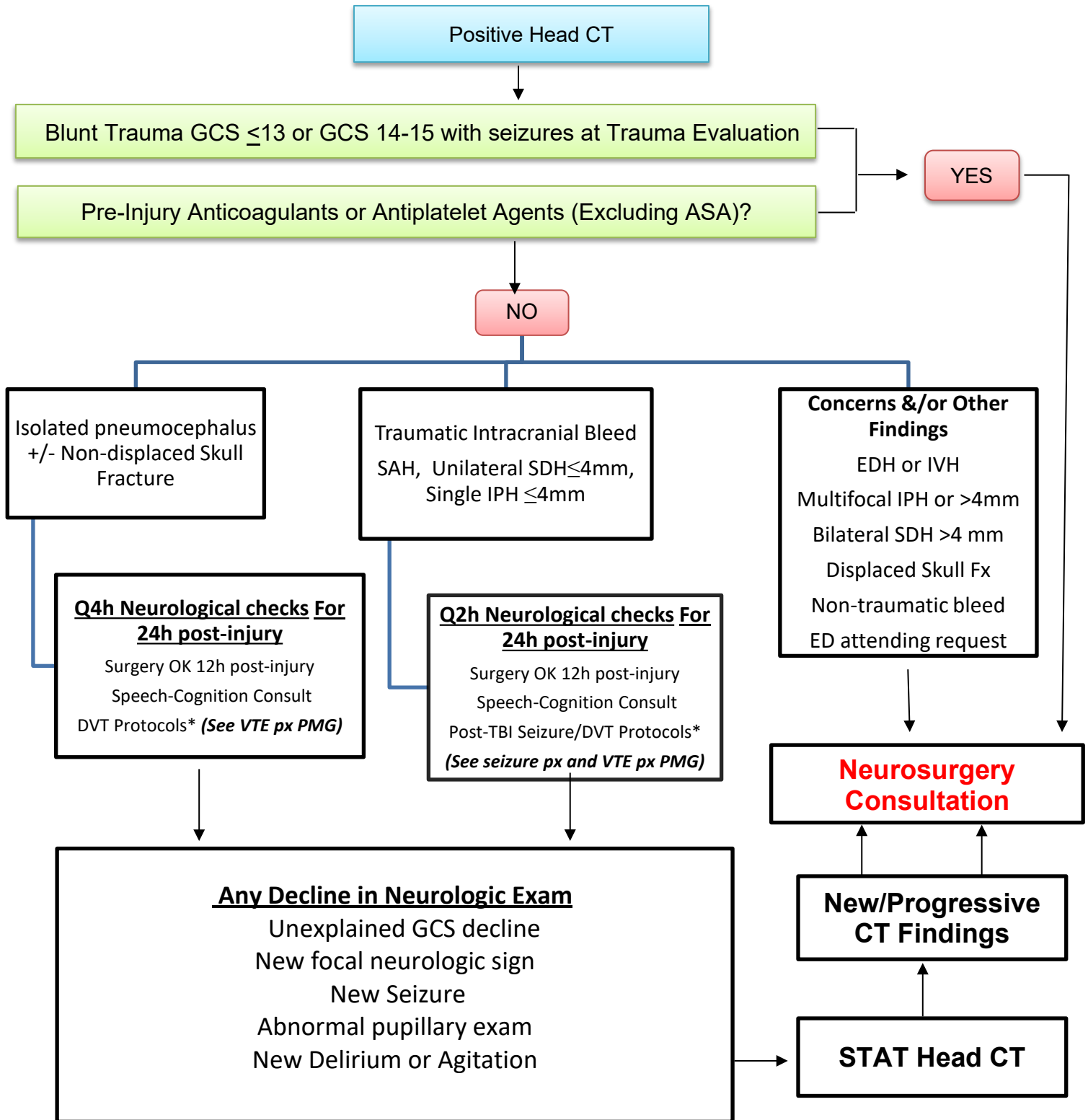
Revision Team	Specialty
Tyler W. Barrett, MD, MSCI	Emergency Medicine
Jill Streams, MD	Trauma
Bradley M. Dennis, MD	Trauma
Jennifer Beavers, PharmD	Pharmacy
Melissa Smith, RN MSN	Trauma Program Manager
Aaron Yengo-Kahn, MD	Neurosurgery
Jacob P. Schwarz, MD	Neurosurgery
Reid S. Thompson, MD	Neurosurgery

Presented at MDTC/TPOPPs:	06/27/2018
Last Discussed at MDTC/TPOPPs:	11/29/2023
Last Updated:	11/29/2023

### ABBREVIATIONS

CBC	Complete Blood Count
Cl	Chloride
CPP	Cerebral Perfusion Pressure
CSF	Cerebrospinal Fluid
CT	Computed Tomography
CVP	Central Venous Pressure
d	Day
DVT	Deep Venous Thrombosis
ED	Emergency Department
EEG	Electroencephalography
EDH	Epidural Hematoma
EVD	External Ventricular Drain
FFP	Fresh Frozen Plasma
GCS	Glasgow Coma Scale
h	Hour
HOB	Head of Bed
ICH	Intracerebral/Intraparenchymal Hematoma/Hemorrhage
ICP	Intracranial Pressure
INR	International Normalized Ratio
IPH	Intracerebral/Intraparenchymal Hematoma/Hemorrhage
MDTC	Multidisciplinary Trauma Conference
mL	Milliliter
Na	Sodium
NSU	Neurosurgery
PaCO <sub>2</sub>	Partial pressure of Carbon dioxide
PaO <sub>2</sub>	Partial pressure of Oxygen
PI	Process Improvement
PT	prothrombin time
PTT	partial thromboplastin time
Q	Every
SAH	Subarachnoid hemorrhage
SBP	Systolic Blood Pressure
SDH	Subdural Hemorrhage
TBI	Traumatic Brain Injury
TICU	Trauma Intensive Care Unit
TPOPPS	Trauma Program Operational Process Performance Committee

## Minimal Traumatic Brain Injury Pathway for Adult ED Patients Being Admitted to Trauma Service Only



\*DVT prophylaxis can be initiated at 24h post-injury

\*ASA can be resumed at 14 days postinjury. If need to resume ASA <14d, c/s neurosurgery

# Traumatic Brain Injury Pathway, GCS 9-15

**Positive CT Head**  
**in Adult ED Patient Being Admitted to Trauma Service**

GCS 14-15 Excluded from Minimal TBI Pathway  
or GCS 9-13 (any mechanism) on initial evaluation

## TRAUMA SERVICE ADMISSION

Consult Neurosurgery Consult  
Speech-Pathology  
7d Seizure prophylaxis protocol  
CBC, PT/INR, PTT  
Consider Reversal of  
Anticoagulant/Antiplatelet Use  
DVT Protocols (*See VTE px PMG*)

## Consider Repeat Imaging within 6-24h, if any of following:

- High Risk CT Features:
  1. SDH or IPH > 4 mm
  2. Epidural hemorrhage
- Clinical Deterioration
- Anticoagulant/Antiplatelet Use
- Consultant request

# Traumatic Brain Injury Pathway, GCS < 9

## ADULT ED PATIENT ADMITTED TO TRAUMA WITH POSITIVE HEAD CT

Consult Neurosurgery (*Trauma Attending & Neurosurgery Attending to have Direct Conversation for Major Diverging MultiTeam Plans*)

Consult Speech-Pathology

7d Seizure prophylaxis protocol; Arterial Blood Gas, CBC, PT/INR, PTT

Intubation - Keep PaCO<sub>2</sub> 35-40, PaO<sub>2</sub>>60

HOB > 60 degrees (or reverse Trendelenberg until Spine cleared)

SBP > 90 mm Hg

Consider FFP (and/or K-Centra) for target INR<1.7

Consider DDAVP for pre-injury antiplatelet use

Consider Platelet transfusion only for NSGY interventions

Maintain Euvolemia; Optimize Sedation and Analgesia

Low threshold for Hyperosmolar Therapy

DVT Protocols (*See VTE px PMG*)

If ICP Monitor Placed

CPP < 60

1<sup>st</sup> line: Phenylephrine  
2<sup>nd</sup> line: Norepinephrine

ICP > 20

Drain CSF if EVD

ICP > 20

ICP > 20

CPP < 60

### Hyperosmolar Therapy

3% NaCl (Bolus +/- Gtt)

CVP high: Mannitol bolus q6h

CVP low: 3% NaCl bolus q6h

Q6h BMP, Osm

Max: Na 160, Osm 320

- Contact TICU Attending or fellow
- Contact Neurosurgery (decompressive craniectomy vs. PB coma)
- Monitor intraabdominal pressures
- Consider pentobarbital coma (req Neurology c/s with continuous EEG)
- Consider Palliative Care c/s

Persistent ICP > 20 and/or CPP < 60

## REFERENCES

### Mild-Moderate TBI

- Haydel. Clinical decision instruments for CT scanning in minor head injury. *JAMA* (2005) vol. 294 (12) pp. 1551-3
- Haydel. The Canadian CT Head Rule. *Lancet* (2001) vol. 358 (9286) pp. 1013-4
- Haydel et al. Indications for computed tomography in patients with minor head injury. *N Engl J Med* (2000) vol. 343 (2) pp.100-5
- Jagoda. Mild traumatic brain injury: key decisions in acute management. *Psychiatr Clin North Am* (2010) vol. 33 (4) pp. 797-806
- Joseph B, Pandit V, Haider AA, et al. Improving Hospital Quality and Costs in Nonoperative Traumatic Brain Injury: The Role of Acute Care Surgeons. *JAMA Surg* (2015) vol 150(9) pp. 866-72
- Menon et al. Position Statement: Definition of Traumatic Brain Injury. *Arch Phys Med Rehabil* (2010) vol. 91 (11) pp.1637-1640
- Thurman and Guerrero. Trends in hospitalization associated with traumatic brain injury. *JAMA* (1999) vol. 282 (10) pp.954-7

### Severe TBI

- Agyabeng-Dadzie K, Hunter JE, Smith TR, Jordan M, Safcsak K, Ibrahim JA, Cheatham ML, Bhullar IS. Antiplatelet Agent Reversal Is Unnecessary in Blunt Traumatic Brain Injury Patients Not Requiring Immediate Craniotomy. *Am Surg*. 2020 Jul;86(7):826-829. doi: 10.1177/0003134820940248. PMID: 32916072.
- Barletta JF, Abdul-Rahman D, Hall ST, Mangram AJ, Dzandu JK, Frontera JA, Zach V. The Role of Desmopressin on Hematoma Expansion in Patients with Mild Traumatic Brain Injury Prescribed Pre-injury Antiplatelet Medications. *Neurocrit Care*. 2020 Oct;33(2):405-413. doi: 10.1007/s12028-019-00899-x. PMID: 31898177.
- Carney N, Totten AM, O'Reilly C, et al. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. *Neurosurgery*. 2017 Jan 1;80(1):6-15. doi: 10.1227/NEU.0000000000001432. PMID: 27654000.
- El-Swaify ST, Refaat MA, Ali SH, Abdelrazek AEM, Beshay PW, Kamel M, Bahaa B, Amir A, Basha AK. Controversies and evidence gaps in the early management of severe traumatic brain injury: back to the ABCs. *Trauma Surg Acute Care Open*. 2022 Jan 5;7(1):e000859. doi: 10.1136/tsaco-2021-000859. PMID: 35071780; PMCID: PMC8734008.
- Feinstein et al. Resuscitation with pressors after traumatic brain injury. *J Am Coll Surg* (2005) vol. 201 (4) pp. 536-45
- Frontera JA, Lewin JJ 3rd, Rabinstein AA, et al. Guideline for reversal of antithrombotics in intracranial hemorrhage: a statement for healthcare professionals from the Neurocritical Care Society and Society of Critical Care Medicine. *Neurocrit Care*. 2016;24:6-46.
- Furay E, Daley M, Teixeira PG, Coopwood TB, Aydelotte JD, Malesa N, Tellinghuisen C, Ali S, Brown LH, Brown CVR. Goal-directed platelet transfusions correct platelet dysfunction and may improve survival in patients with severe

traumatic brain injury. *J Trauma Acute Care Surg.* 2018 Nov;85(5):881-887. doi: 10.1097/TA.0000000000002047. PMID: 30124626.

- Holzmacher JL, Reynolds C, Patel M, Maluso P, Holland S, Gamsky N, Moore H, Acquista E, Carrick M, Amdur R, Hancock H, Metzler M, Dunn J, Sarani B. Platelet transfusion does not improve outcomes in patients with brain injury on antiplatelet therapy. *Brain Inj.* 2018;32(3):325-330. doi: 10.1080/02699052.2018.1425804. Epub 2018 Jan 17. PMID: 29341793; PMCID: PMC6112855.
- Jehan F, Zeeshan M, Kulvatunyou N, Khan M, O'Keeffe T, Tang A, Gries L, Joseph B. Is There a Need for Platelet Transfusion After Traumatic Brain Injury in Patients on P2Y12 Inhibitors? *J Surg Res.* 2019 Apr;236:224-229. doi: 10.1016/j.jss.2018.11.050. Epub 2018 Dec 20. PMID: 30694760.
- Lloyd-Donald P, Spencer W, Cheng J, Romero L, Jithoo R, Udy A, Fitzgerald MC. In adult patients with severe traumatic brain injury, does the use of norepinephrine for augmenting cerebral perfusion pressure improve neurological outcome? A systematic review. *Injury.* 2020 Oct;51(10):2129-2134. doi: 10.1016/j.injury.2020.07.054. Epub 2020 Jul 25. PMID: 32739152.
- Lokhandwala AM, Asmar S, Khurram M, Chehab M, Bible L, Castanon L, Ditillo M, Joseph B. Platelet Transfusion After Traumatic Intracranial Hemorrhage in Patients on Antiplatelet Agents. *J Surg Res.* 2021 Jan;257:239-245. doi: 10.1016/j.jss.2020.07.076. Epub 2020 Aug 27. PMID: 32862051.
- Marshall et al. Pentobarbital coma for refractory intra-cranial hypertension after severe traumatic brain injury: mortality predictions and one-year outcomes in 55 patients. *J Trauma* (2010) vol. 69 (2) pp. 275-83
- Miles MVP, Hicks RC, Parmer H, Brown C, Edwards A, Stewart K, Gao L, Maxwell R. Traumatic brain injury patients with platelet inhibition receiving platelet transfusion demonstrate decreased need for neurosurgical intervention and decreased mortality. *J Trauma Acute Care Surg.* 2022 Apr 1;92(4):701-707. doi: 10.1097/TA.0000000000003516. PMID: 35320155.
- Patel MB, Guillaumondegui OD. Severe Traumatic Brain Injury: Medical and Surgical Management. Section: Head Injury. In: Papadakos P, Gestring M, editors. *Encyclopedia of Trauma Care.* Heidelberg, Berlin: Springer-Verlag; 2015. p. 1711–6.
- Vella M, Crandall MA, Patel MB. Acute Management of Traumatic Brain Injury. *Surgical Clinics of North America.* 2017; 97(5):1015-1030. PMCID: PMC5747306.
- Wakai et al. Mannitol for acute traumatic brain injury. *Cochrane Database Syst Rev* (2007) (1) pp. CD001049
- Yorkgitis BK, Tatum DM, Taghavi S, Schroepfel TJ, Noorbakhsh MR, Philips FH, Bugaev N, Mukherjee K, Bellora M, Ong AW, Ratnasekera A, Nordham KD, Carrick MM, Haan JM, Lightwine KL, Lottenberg L, Borrego R, Cullinane DC, Berne JD, Rodriguez Mederos D, Hayward TZ 3rd, Kerwin AJ, Crandall M. Eastern Association for the Surgery of Trauma Multicenter Trial: Comparison of pre-injury antithrombotic use and reversal strategies among severe traumatic brain injury patients. *J Trauma Acute Care Surg.* 2022 Jan 1;92(1):88-92. doi: 10.1097/TA.0000000000003421. PMID: 34570064.