

CRITICAL CARE ORDER SET

Traumatic Brain Injury

Trauma-bay-to-ICU management of moderate–severe TBI. Stop the secondary injury — avoid hypoxia and hypotension from the first minute, keep CO₂ and perfusion in range, and escalate ICP therapy in steps. Grade by post-resuscitation GCS, image early, and get neurosurgery in fast. Adapt every threshold to your protocol and the patient.

PATIENT -----	MRN -----	MECHANISM / TIME -----	POST-RESUS GCS (E_V_M_) -----
ALLERGIES -----	ANTICOAGULANT / ANTIPLATELET -----	ORDERING CLINICIAN -----	ATTENDING -----

01 Clinical assessment & severity grading

PRIMARY SURVEY Run the trauma primary survey first — **FAST** for internal bleeding, then GCS, pupils, and focal deficits. TBI = altered brain function or pathology from an external force. Grade by **post-resuscitation** GCS.

HISTORY & EXAM

- ☐ History — mechanism, medications, loss of consciousness, post-traumatic amnesia, post-traumatic seizures, helmet use, alcohol / drug use
- ☐ Trauma primary survey + **FAST** for internal bleeding
- ☐ GCS, pupils, and focal deficits (aphasia, facial droop, unilateral weakness). Score by category — e.g., **GCS 10, E3V3M4**; if intubated assign verbal **V1T**

SEVERITY BY POST-RESUSCITATION GCS

MILD

MODERATE

SEVERE

02 Imaging

CT HEAD & CERVICAL SPINE

- ☐ **Noncontrast CT head** once primary survey complete and hemodynamically stable — characterize hemorrhage location/size, mass effect, edema, **midline shift**, perimesencephalic cistern patency, vault / facial fractures, penetrating objects
- ☐ **CT cervical spine** in moderate–severe TBI (C-spine injury in up to **10%** of blunt TBI). A negative CT may miss ligamentous / cord injury — keep immobilized until cleared
- ☐ **Repeat head CT at 4–6 h** after injury to assess for stable vs worsening hemorrhage (and immediately for any deterioration)

CTA / CTV (OR MRA / MRV) — CONSIDER IF ANY PRESENT

- | | |
|--|--|
| ☐ Penetrating head / neck injury | ☐ Skull fracture over a venous sinus |
| ☐ Neurologic deficit unexplained by head CT | ☐ C-spine flexion / extension injury or transverse-foramen fracture |
| ☐ Petrous bone fracture | ☐ Le Fort II / III facial fractures |
| ☐ Suspected vascular cause (aneurysm rupture, stroke) | |

03 Resuscitation & stabilization

AVOID 2° The enemy is secondary injury — a single episode of **hypoxia or hypotension** worsens outcome. Protect SpO₂, BP, and CO₂ from the first minute.

- ☐ Spinal motion restriction (cervical collar); IV / IO access; achieve hemorrhage control and circulatory stabilization
- ☐ Maintain SpO₂ > **94%** and PaCO₂ **35–40 mmHg** (if no ETCO₂, ventilate adults at **10 breaths/min**)
- ☐ Blood-pressure floor — **SBP ≥ 110 mmHg** ages 15–49 or > 70; **SBP ≥ 100 mmHg** ages 50–69

- ☐ If post-resuscitation **GCS** ≤ 8 — consider rapid sequence intubation; identify suspected herniation
- ☐ Detect and correct systemic coagulopathy within the first hour. Consider **tranexamic acid** in select mild–moderate TBI within **3 h** of injury

HARMFUL **Steroids are contraindicated** — they increase mortality in severe TBI.

NO HYPOTHERMIA No benefit from prophylactic / therapeutic hypothermia — use TTM only to **prevent fever**.

04 Admission, monitoring & lines

LEVEL OF CARE

- ☐ Admit to **Neuro-ICU / ICU**, full ICU monitoring; document code status

MONITORING

- ☐ Continuous cardiac monitoring + pulse oximetry; NIBP **q15 min** $\times$ **2 h** then **q1 h** (or arterial line)
- ☐ Neuro checks (GCS, pupils, motor, brainstem reflexes) **q1 h** or more frequent per neurosurgery
- ☐ If ICP monitor / EVD placed — record ICP and CPP **q1 h** and with every intervention

LINES / ACCESS

- ☐ Peripheral IV $\times$ 2; consider arterial line, central venous catheter, Foley with urometer
- ☐ **OG (not NG)** tube if intubated — avoid nasal route with suspected cribriform plate / basilar skull fracture

05 Hemodynamic targets & fluids

TARGET SBP (BY AGE)

18–49 or $\geq 70 \rightarrow$ **SBP ≥ 110** · 50–69 $\rightarrow$ **SBP ≥ 100 mmHg**

MAP / ICP / CPP

MAP ≥ 65 –**70**; if monitored ICP < 22 , CPP **60–70 mmHg** (individualize)

FLUIDS

- ☐ Maintenance **0.9% NaCl or Plasma-Lyte** 50–100 mL/h to euvolemia; **avoid hypotonic fluids** (0.45% NaCl, D5W)
- ☐ Hypotension — **0.9% NaCl** 250–500 mL IV bolus, repeat PRN; blood products if hemorrhagic shock / anemia

VASOPRESSORS — only if volume-replete and still below target

- ☐ **Norepinephrine** start 0.02–0.05 mcg/kg/min IV, titrate q5–10 min; range 0.02–1 mcg/kg/min; phenylephrine / vasopressin adjunct per local practice

06 Airway, ventilation, oxygenation

INTUBATION INDICATIONS

- ☐ **GCS** $\leq$ 8, inability to protect airway, hypoxemia, hypercapnia, agitation preventing safe care, or need for deep sedation / paralysis for ICP control — maintain C-spine precautions throughout

INITIAL VENTILATOR SETTINGS (TITRATE)

- | | |
|--|--|
| ☐ Volume A/C; tidal volume 6–8 mL/kg PBW | ☐ RR to PaCO_2 35–40 mmHg (normocapnia) |
| ☐ PEEP 5–8 cm H_2O (balance oxygenation vs venous return / ICP) | ☐ FiO_2 to PaO_2 80–120 mmHg / $\text{SpO}_2 \geq 94\%$ |

NOT ROUTINE Hyperventilation only for acute ICP spikes — temporary PaCO_2 30–35 mmHg, as a PRN "ICP crisis" measure with neurosurgery / ICU sign-off.

07 Sedation, analgesia, agitation

SHORT-ACTING Prefer **short-acting agents with minimal hemodynamic effect** so hourly neuro exams stay possible and worsening is caught early.

ANALGESIA (FIRST-LINE)

- ☐ **Fentanyl** 25–100 mcg IV q30–60 min PRN, or infusion 25–200 mcg/h
- ☐ Alt — hydromorphone 0.2–0.5 mg IV q2–4h PRN; acetaminophen 650–1000 mg PO/NG/IV q6h (max 3–4 g/day)

SEDATION

- ☐ **Propofol** start 5 mcg/kg/min IV, titrate by 5–10 q5–10 min; usual 5–80 (up to 100 short-term); monitor hypotension / PRIS
- ☐ **Midazolam** bolus 1–2 mg IV, then 1–10 mg/h to RASS goal (e.g., –3 to –4 in ICP crisis)
- ☐ Avoid delirigenic meds (high-dose benzodiazepines) unless needed for ICP / seizures; restraints per policy if needed for safety

08 ICP management (ICP > 22 mmHg)

STEPWISE MEASURES

- ☐ Head of bed 30°, neck midline; avoid jugular outflow obstruction (no tight collar, lines, or dressings)
- ☐ **Drain CSF** via EVD if available; optimize analgesia and sedation; maintain normothermia and treat shivering
- ☐ Optimize cerebral perfusion — **CPP 60–70 mmHg** (children age-based, min 40–50); temporary hyperventilation to **PaCO₂ 35–38** for crises; continuous EEG and treat seizures

HYPEROSMOLAR THERAPY — PRN ICP / HERNIATION (CHOOSE PER NA & HEMODYNAMICS)

Mannitol

- ☐ **0.25–1 g/kg IV** over 10–20 min (start 0.5–1), repeat **q4–6h PRN**
- ☐ Osmolality **q4–6h** (hold if > 320); Na + creatinine q6–12h; strict I/O; avoid if hypotensive

Hypertonic saline

- ☐ **3% bolus 250 mL (2–5 mL/kg)** over 10–20 min; or infusion **20–30 mL/h**
- ☐ **23.4% 30 mL IV** over 10 min (central line) for severe crisis / herniation
- ☐ Na + Cl + osmolality **q4–6h** (goal Na often 145–155)

09 Neurosurgical consultation & surgical thresholds

CONSULT FOR MODERATE–SEVERE TBI OR ANY OF

- ☐ Skull fracture
- ☐ CSF leak — clear / serosanguinous fluid from ears or nares
- ☐ Lateralizing signs (unequal pupils, focal weakness)
- ☐ Cerebrovascular injury or C-spine injury

ICP MONITORING INDICATED WHEN

- ☐ GCS ≤ 8 with an abnormal head CT
- ☐ GCS ≤ 8 with normal CT **and ≥ 2 of:** age > 40 · motor posturing · SBP < 90 mmHg

SURGICAL THRESHOLDS — DECOMPRESSION / EVACUATION

Acute SDH	> 10 mm thickness or > 5 mm midline shift; or GCS ≤ 8 with SDH of any size + GCS decline ≥ 2 points or asymmetric / non-reactive pupils
Acute EDH	> 30 cm ³ , > 15 mm thickness, > 5 mm midline shift, or GCS ≤ 8
Cerebral contusions	Comatose with survivable injury + hemorrhage causing midline shift > 5 mm or herniation
Cerebellar hemorrhage	≥ 3 cm diameter, or mass effect / brainstem compression / hydrocephalus
Depressed skull fracture	Open fracture depressed greater than the thickness of the cranium

10 Seizure prophylaxis & treatment

7 DAYS Early post-traumatic seizure prophylaxis for **7 days** — **levetiracetam preferred** (alt phenytoin or lacosamide). It reduces early seizures only; no proven effect on late epilepsy.

PROPHYLAXIS

- ☐ **Levetiracetam** load **1000–1500 mg IV** once, then **500–1500 mg IV/PO q12h** (renal adjust)
- ☐ Alt — fosphenytoin / phenytoin load **15–20 mg PE/kg IV**, then **4–6 mg PE/kg/day** divided

ACUTE SEIZURE & EEG

- ☐ **Lorazepam 1–2 mg IV q2–5 min PRN** (up to 4 mg / 0.1 mg/kg); notify neurology / neurosurgery and ICU attending

- ☐ Continuous / intermittent **EEG** for AMS out of proportion, high NCSE risk, or unexplained ICP fluctuations

11 BP control & anticoagulation reversal

ANTIHYPERTENSIVES — for SBP above neurosurgery upper limit (e.g., > 160–180)

- ☐ **Nicardipine** start **2.5–5 mg/h IV**, titrate 2.5 mg/h q5–15 min, max **15 mg/h** (target SBP per neurosurgery, e.g., 120–160)
- ☐ Alt — **labetalol 10–20 mg IV q10 min PRN**, may increase to 20–80 mg per dose

ANTICOAGULATION REVERSAL — emergent neurosurgery + hematology input

- ☐ **Warfarin** — vitamin K **10 mg IV** + **4-factor PCC 50 units/kg** (max 5000) per protocol
- ☐ **DOACs** — idarucizumab (dabigatran) or andexanet alfa (Xa inhibitors), or PCC per protocol
- ☐ **Antiplatelets** — consider desmopressin **0.3 mcg/kg IV** over 15–30 min ± platelets in select cases

12 Temperature & glycemic control

TEMPERATURE

- ☐ Goal < **38 °C** — acetaminophen **650–1000 mg PO/NG/IV q6h PRN**; active cooling if refractory; avoid deep hypothermia outside protocols

GLYCEMIC CONTROL

- ☐ Target **140–180 mg/dL** (avoid hypoglycemia); POC glucose **q1–4 h**; IV insulin infusion or correctional SC scale per ICU protocol

13 DVT prophylaxis

- ☐ **SCDs to both legs**, continuous while in bed — from admission
- ☐ Pharmacologic (coordinate with neurosurgery, based on repeat imaging stability) — **enoxaparin 30 mg SC q12h** or **heparin 5,000 units SC q8–12h**

DELAY Avoid / delay pharmacologic prophylaxis with expanding intracranial hemorrhage, recent neurosurgery without clearance, or coagulopathy.

14 GI prophylaxis, nutrition, bowel

STRESS ULCER PROPHYLAXIS

- ☐ Pantoprazole 40 mg IV/PO daily or famotidine 20 mg IV/PO q12h (renal adjust)

NUTRITION

- ☐ If intubated — enteral feeding within 24–48 h if feasible; start 20 mL/h and advance to goal per protocol
- ☐ Swallow evaluation before oral intake in extubated patients

BOWEL REGIMEN

- ☐ Senna 8.6–17.2 mg qHS, docusate 100 mg BID; PRN PEG 17 g daily, bisacodyl 10 mg PR PRN

15 Infection prevention & routine care

- ☐ Daily reassess Foley and central-line necessity
- ☐ Chlorhexidine oral care if intubated; HOB elevation for VAP prevention
- ☐ Daily sedation vacation + neuro assessment **only if ICP controlled and neurosurgery agrees**

16 Consults, safety & documentation

DOCUMENTED NEUROSURGERY / NEUROLOGY PLAN

- ☐ Formal consult on admission
- ☐ ICP monitor / EVD placement plan
- ☐ Surgical decompression thresholds
- ☐ Anticoagulation / DVT prophylaxis timing; BP and CPP targets

SAFETY & DOCUMENTATION

- ☐ Restraints per local rules if needed to prevent device removal; fall & aspiration precautions

- ☐ Clear documentation of goals-of-care discussions with family

EDUCATIONAL USE ONLY

Not a substitute for clinical judgement. Verify doses, allergies, renal/hepatic function, and contraindications. Adapt all agents, BP / CPP targets, and surgical thresholds to your institutional trauma / neurocritical-care protocol and the individual patient.

Spreading knowledge

Improving outcomes