NGN NCLEX 2026 • CARD 18

Traumatic Brain Injury (TBI)

External mechanical force disrupts normal brain function. A time-sensitive neurological emergency where prevention of secondary injury determines survival.

NEUROLOGICAL | EMERGENCY | HIGH PRIORITY | NCJMM INTEGRATED

1 Definition / Overview

- **TBI** = Disruption of normal brain function from a bump, blow, jolt, or penetrating injury to the head.
- Classified by severity (GCS): **Mild** (13–15), **Moderate** (9–12), **Severe** (≤8 = intubate).
- Two stages of damage: **Primary injury** (at impact) and **Secondary injury** (hours-days later from swelling, hypoxia, hypotension). *Nursing goal = prevent secondary injury.*

TYPES OF TBI

Concussion
Mild TBI; transient LOC; no structural damage.

Contusion
Bruising of brain tissue (coup/contrecoup).

Diffuse Axonal Injury
Shearing of white matter; acceleration-deceleration.

Epidural Hematoma
ARTERIAL bleed (middle meningeal a.); rapid; classic *lucid interval*. **"Talk & die."**

Subdural Hematoma
VENOUS bleed; slower onset; common in elderly/alcoholics.

SAH / Intracerebral
Bleeding into subarachnoid space or brain parenchyma.

2 Pathophysiology (Simplified)

1. **PRIMARY INJURY:** External force damages brain tissue (contusion, laceration, hemorrhage, shearing).

2. Disruption of the blood-brain barrier → inflammatory response begins.

3. Cerebral edema develops → tissue swells inside a **fixed skull volume** (Monro-Kellie doctrine).

4. **Intracranial Pressure (ICP) rises** (normal = 5–15 mmHg).

5. Cerebral Perfusion Pressure drops (**CPP = MAP − ICP**; goal 60–70 mmHg).

6. **SECONDARY INJURY:** Ischemia + hypoxia → more swelling → **BRAIN HERNIATION → DEATH**.

3 Signs & Symptoms

EARLY / MILD

- Headache
- Dizziness, confusion
- Brief LOC
- Amnesia (retrograde or anterograde)
- Nausea / vomiting
- Photophobia
- **↓ LOC = EARLIEST sign of neuro deterioration**

LATE / SEVERE (↑ICP)

- **Cushing's Triad**: ↑BP (widened pulse pressure) + bradycardia + irregular respirations = LATE sign of herniation
- Fixed, dilated, unequal pupils ("blown pupil")
- Posturing: decorticate (flexion) / decerebrate (extension)
- Seizures
- Projectile vomiting
- CSF leak: **halo sign, Battle sign, raccoon eyes**

NCLEX PRIORITY ALERT

↓ LEVEL OF CONSCIOUSNESS is the EARLIEST and MOST SENSITIVE indicator of increased ICP. Cushing's Triad is a LATE sign — herniation is imminent!

Glasgow Coma Scale (GCS)

Score = Eye (4) + Verbal (5) + Motor (6) — Max 15 / Min 3

13–15	9–12	≤8
MILD TBI	MODERATE TBI	SEVERE — INTUBATE

4 Priority Nursing Interventions

🛟 ABCs + ICP CONTROL

AIRWAY & OXYGENATION

- ✓ Maintain patent airway; intubate if GCS ≤ 8
- ✓ Maintain SaO_2 > 95%, PaO_2 > 80 mmHg
- ✓ Avoid hypercapnia (↑CO_2 vasodilates brain → ↑ICP)
- ✓ Suction gently <10 sec; never via nose if CSF leak

POSITIONING

- ✓ **HOB 30°** (not flat, not Trendelenburg)
- ✓ Head in **midline/neutral** position
- ✓ Avoid neck & hip flexion (↓venous return)
- ✓ Log-roll if spinal precautions

NEURO MONITORING

- ✓ GCS + pupil checks every 1 hour
- ✓ Monitor ICP (goal 5–15 mmHg)
- ✓ Maintain CPP 60–70 mmHg
- ✓ Strict I&O; watch for SIADH / DI

ICP REDUCTION

- ✓ Quiet, dim environment
- ✓ **Space (don't cluster)** nursing care
- ✓ Avoid coughing, straining, Valsalva
- ✓ Maintain normothermia (fever ↑ cerebral demand)
- ✓ Seizure precautions (pad rails, suction ready)

🎯 NCJMM Clinical Judgment Framework

Apply the 2026 Clinical Judgment Measurement Model to any TBI item:

RECOGNIZE
↓LOC, unequal pupils, widening pulse pressure, CSF leak, posturing.

ANALYZE
Is this early (↓LOC, restless) or late (Cushing's, fixed pupils = herniation)?

PRIORITIZE
Airway first → HOB 30° midline → Mannitol/3%NS → notify provider stat.

EVALUATE
Reassess GCS, pupils, ICP, CPP, vital signs trend; document changes.

5 Pharmacology

Drug / Class	Mechanism	Key Nursing Considerations
Mannitol *(Osmotic diuretic)*	Pulls fluid from brain tissue into vasculature → ↓ICP.	Monitor serum osmolality (goal 300–320), watch for dehydration & electrolyte imbalance. Use in-line filter.
Hypertonic Saline *(3% NaCl)*	Creates osmotic gradient; reduces cerebral edema.	Central line preferred. Monitor Na^+ levels (risk of osmotic demyelination).
Phenytoin / Levetiracetam *(Anticonvulsant)*	Seizure prophylaxis (first 7 days post-injury).	Monitor drug level (phenytoin 10–20 mcg/mL). Assess for gingival hyperplasia, nystagmus.
Propofol / Fentanyl *(Sedation / analgesia)*	↓ cerebral metabolic demand; controls agitation.	Monitor BP (hypotension ↓CPP). Daily sedation vacation for neuro exam.
Barbiturates *(Pentobarbital)*	Induce coma for refractory ↑ICP.	Intensive monitoring; risk of hypotension & respiratory depression.
❌ CORTICOSTEROIDS	NOT recommended for TBI.	**Contraindicated — worsens outcomes and mortality in TBI.**
❌ MORPHINE / ASPIRIN	Avoid.	Morphine masks neuro changes; aspirin increases bleeding risk.

6 Complications & Management

⚠️ Acute Complications

- **Brain Herniation** (uncal / tonsillar) — fatal without immediate intervention
- **DI (Diabetes Insipidus):** polyuria, dilute urine (SG <1.005), ↑Na^+ → Tx: DDAVP
- **SIADH:** concentrated urine, ↓Na^+ → Tx: fluid restriction, 3% NS if severe
- **Cerebral Salt Wasting:** ↓Na^+ with hypovolemia → Tx: sodium & volume replacement
- **Seizures** (early or late post-traumatic)

🕒 Long-Term Complications

- Post-Concussion Syndrome (HA, dizziness, cognitive fog for weeks-months)
- Chronic Traumatic Encephalopathy (CTE) — repeated injury
- Hydrocephalus → may require VP shunt
- Cognitive deficits, memory loss, personality change
- Seizure disorder
- Depression, anxiety, PTSD

- 🚨 **Meningitis** (with CSF leak or open fracture)

7 NCLEX Test Traps

- ✗ **Trap:** Choosing Cushing's Triad as "early" sign. ➜ **Truth:** ↓LOC is EARLIEST; Cushing's is LATE (herniation imminent).
- ✗ **Trap:** Picking corticosteroids for TBI swelling. ➜ **Truth:** Steroids are CONTRAINDICATED in TBI (used for tumors, not trauma).
- ✗ **Trap:** Flat or Trendelenburg positioning. ➜ **Truth:** HOB 30° + head midline.
- ✗ **Trap:** Clustering care to let patient "rest." ➜ **Truth:** SPACE care — clustering spikes ICP.
- ✗ **Trap:** Suctioning via nose in suspected CSF leak. ➜ **Truth:** NEVER — risk of meningitis & intracranial entry.
- ✗ **Trap:** Confusing epidural vs subdural. ➜ **Truth:** Epidural = arterial, rapid, lucid interval. Subdural = venous, slow, elderly.
- ✗ **Trap:** Testing CSF with glucose strip only. ➜ **Truth:** Check for **halo sign** on gauze (blood in center, clear ring outside).
- ✗ **Trap:** Giving free water / hypotonic fluids. ➜ **Truth:** Worsens cerebral edema — use isotonic or hypertonic solutions.
- ✗ **Trap:** Administering morphine for pain. ➜ **Truth:** Masks neuro status; use acetaminophen or fentanyl (short half-life).

8 Patient Education

🏠 Discharge / Concussion Teaching

RETURN TO ED IMMEDIATELY IF:

- 🚨 Worsening or severe headache
- 🚨 Repeated vomiting
- 🚨 Confusion, difficulty waking
- 🚨 Seizures
- 🚨 One-sided weakness / numbness
- 🚨 Slurred speech or vision changes
- 🚨 Unequal pupils

HOME CARE INSTRUCTIONS:

- ✓ Rest — physical AND cognitive (no screens, schoolwork initially)
- ✓ No alcohol or sedatives ×24–48 hrs
- ✓ Wake q2h the first night (mild TBI)
- ✓ No driving until medically cleared
- ✓ Gradual return to activity (concussion protocol)
- ✓ Avoid **Second Impact Syndrome** — no sports until cleared

🚨 Clear drainage from nose / ears

✓ **Prevention:** helmets, seatbelts, fall precautions

✓ Follow-up with neurology as ordered

9 Memory Boosters & Mnemonics

🧠 TBI Memory Bank

"Cushing's Three" = LATE SIGN OF HERNIATION

- ↑ **BP** with widened pulse pressure
- ↓ **Heart rate** (bradycardia)
- ? **Respirations** irregular (Cheyne-Stokes)

"IRISHMAN" — ↑ICP Interventions

Inclined HOB 30° • **R**educe stimuli • **I**sotonic fluids
Seizure precautions • **H**ead midline • **M**annitol/3%NS
Avoid Valsalva • **N**eutral temp (normothermia)

Epidural vs Subdural — Quick Recall

Epidural = **E**xpress (fast) = **A**rterial = "Talk & Die" (lucid interval)
Subdural = **S**low = Venous = Elderly / anticoagulants

Basilar Skull Fracture Signs

🦝 **Raccoon Eyes** = periorbital bruising (anterior fossa)
🔴 **Battle Sign** = mastoid bruising behind ear (posterior fossa)
👶 **Halo Sign** = CSF leak (blood center, clear ring outside)

CPP Equation (GOAL: 60–70 mmHg)

$$CPP = MAP - ICP$$

If CPP < 60 → brain ischemia → DEATH

GCS ≤ 8 = INTUBATE

"Less than 8 — Intubate!" Cannot protect airway; severe TBI.

DI vs SIADH — Sodium & Urine

DI = Dry Inside → ↑Na^+, dilute urine, polyuria. Give DDAVP.
SIADH = Soaked Inside → ↓Na^+, concentrated urine, fluid retention. Restrict fluids.
