NEUROLOGICAL SYSTEM • ONCOLOGY

Brain Tumors

Primary & metastatic intracranial neoplasms — pathophysiology, ICP management, and priority NGN clinical judgment for the 2026 NCLEX test plan.

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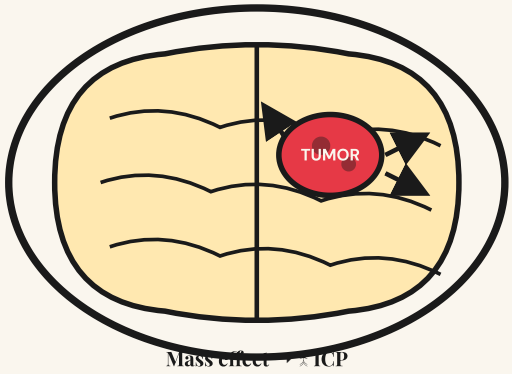
1 Definition & Overview

WHAT IT IS & WHY IT MATTERS

- **Brain tumor =** abnormal, uncontrolled growth of cells within the brain or central spinal canal.
- Skull is a **closed compartment** — even a benign tumor can be deadly because there is **no room to expand**.
- Classified as **primary** (originating in brain tissue) or **metastatic / secondary** (spread from lung, breast, melanoma, kidney, colon).
- WHO grading: **Grade I** (least aggressive) → **Grade IV** (most aggressive, e.g., glioblastoma multiforme).
- Outcome depends on **type, location, size, and grade** — not benign vs. malignant alone.



TUMOR MASS DISPLACES BRAIN TISSUE IN A CLOSED CRANIAL VAULT

Common Brain Tumor Types

PRIMARY

Glioma / Glioblastoma

Arises from glial cells. GBM (grade IV) is most aggressive primary brain tumor in adults.

PRIMARY

Meningioma

From meninges. Usually benign & slow-growing. More common in women.

PRIMARY

Pituitary Adenoma

Visual field defects, hormone imbalance (e.g., Cushing's, acromegaly).

PRIMARY

Acoustic Neuroma

CN VIII. Hearing loss, tinnitus, balance problems.

METASTATIC

Metastatic Tumors

From lung, breast, melanoma, kidney, colon. **Most common** overall.

PEDIATRIC

Medulloblastoma

Cerebellum. Most common malignant brain tumor in children.

2 Pathophysiology

STEP-BY-STEP MECHANISM

The skull is a rigid box containing **brain tissue + blood + CSF** (Monro-Kellie doctrine). When a tumor adds volume, something else must give — or pressure rises.

1. Abnormal cell proliferation → **mass formation** in brain parenchyma
↓
2. Tumor + surrounding **cerebral edema** compress adjacent brain tissue
↓
3. Tumor may **obstruct CSF flow** (ventricles/aqueduct) → hydrocephalus
↓
4. Disrupts blood-brain barrier → more edema → **↑ intracranial pressure (ICP)**
↓
5. Cortical irritation → **seizures**; focal compression → **focal neuro deficits**
↓
6. Uncontrolled ICP → **brain herniation** → brainstem compression → **DEATH**

⚠ Key concept

Normal ICP = **5–15 mmHg**. Sustained ICP **> 20 mmHg** requires immediate intervention. The brain has **limited compensatory capacity** — once exhausted, decompensation is rapid.

3 Signs & Symptoms

EARLY VS. LATE + RED FLAGS

EARLY (Subtle)

- **Headache** — worse in morning, with cough/Valsalva
- **Morning N/V** — often without nausea preceding it
- Subtle **personality / behavior changes**
- **Visual disturbances** (blurred, diplopia)
- Mild cognitive changes, memory lapses
- New-onset **seizure in an adult > 20**
- Papilledema on fundoscopic exam

LATE (↑ ICP)

- **Decreased LOC** — earliest reliable late sign
- Projectile vomiting (no nausea)
- **Pupillary changes** — unilateral dilation, sluggish reaction
- Posturing — **decorticate → decerebrate**
- Cheyne-Stokes / irregular respirations
- Severe headache unrelieved by analgesics
- Coma, then **herniation**

CUSHING'S TRIAD — Late, Ominous Sign of ↑ ICP

All three together signal **imminent brainstem herniation**. Call provider **STAT**.

Hypertension	Bradycardia	Irregular Respirations
Widening pulse pressure (high systolic, normal/low diastolic)	Slow, bounding pulse	Cheyne-Stokes, apneustic, ataxic

RED FLAG findings

Stop and escalate if you see: Cushing's triad • new posturing • blown/fixed pupil • **sudden drop in GCS** • new seizure activity • bradycardia with HTN • projectile vomiting. These mean **herniation is near**.

Focal Deficits by Tumor Location

LOBE / SITE	HALLMARK FINDINGS
Frontal	Personality change, judgment loss, Broca's aphasia (L), contralateral motor weakness
Parietal	Sensory deficits, neglect, agnosia, left-right confusion
Temporal	Wernicke's aphasia (L), memory impairment, auditory hallucinations, complex partial seizures
Occipital	Visual field defects, visual hallucinations, cortical blindness
Cerebellum	Ataxia, nystagmus, dysmetria, balance disturbances

LOBE / SITE	HALLMARK FINDINGS
Brainstem	Cranial nerve deficits, hemiparesis, altered respirations — **life-threatening**
Pituitary	Bitemporal hemianopsia, hormonal changes (Cushing's, DI, SIADH, acromegaly)

4 Priority Nursing Interventions

ABC FRAMEWORK + SAFETY

🔵 A — Airway

- **Maintain patent airway** — keep at bedside: suction, oral airway, BVM
- Suction **< 10–15 sec** at a time (longer = ICP spike)
- **Hyperoxygenate** before/after suction
- Prepare for intubation if GCS ≤ 8

🟢 B — Breathing

- Monitor **RR, pattern, SpO_2**
- Cheyne-Stokes / ataxic = brainstem involvement 🚨
- Maintain **$PaCO_2$ 35–38 mmHg** (hypercapnia → cerebral vasodilation → ↑ ICP)
- SpO_2 ≥ 95% — hypoxia worsens edema

🔴 C — Circulation

- **HOB elevated 30°**, neck midline/neutral
- Avoid extreme hip flexion (↑ intra-abdominal pressure → ↑ ICP)
- Maintain **CPP > 60 mmHg** (CPP = MAP - ICP)
- Treat HTN cautiously — drops in MAP drop CPP

🧠 D — Neuro

- **Neuro checks q1–2h**: GCS, pupils, motor, sensory
- LOC = **earliest reliable indicator** of ↑ ICP
- Seizure precautions — pad rails, suction ready
- Avoid restraints (cause straining → ↑ ICP)

🚫 Avoid Anything That Raises ICP

DO NOT

- ✗ Position with **hip flexion** or head turned to one side
- ✗ Cluster **all care at once** (causes ICP spikes)
- ✗ Allow **Valsalva** (straining, sneezing, vigorous coughing)
- ✗ Restrict fluids excessively (causes hypotension → ↓ CPP)
- ✗ Give **morphine** as first-line (masks neuro status, depresses respirations)
- ✗ Use hypotonic IVF (**D5W**) — worsens cerebral edema

DO

- ✓ Maintain **HOB 30°**, neutral alignment
- ✓ **Space care**; allow rest between activities
- ✓ Provide **stool softeners** to prevent straining
- ✓ Maintain **quiet, dimly lit** room — minimize stimuli
- ✓ Use **isotonic fluids** (0.9% NS)
- ✓ Pre-medicate before painful procedures

Post-Craniotomy Positioning

TUMOR LOCATION	POSITION	RATIONALE
Supratentorial (above tentorium)	HOB elevated 30°; **NOT** on operative side	Reduces ICP; prevents pressure on operative site
Infratentorial (cerebellum, brainstem)	Flat or HOB elevated 10–20°; **NOT** on back	Avoids pressure on brainstem and surgical site
After large tumor removal	Position with **operative side UP**	Prevents shift and bleeding into cavity

5 Pharmacology

DRUG CLASS COMPARISON

DRUG / CLASS	MECHANISM	KEY SIDE EFFECTS	NURSING CONSIDERATIONS
Dexamethasone (Decadron) *Corticosteroid*	Reduces cerebral edema by stabilizing capillary membranes	Hyperglycemia, infection risk, GI bleeding, mood changes, fluid retention	Monitor BG q6h, S/S infection (may mask fever), **never abrupt stop** — taper
Mannitol (Osmitrol) *Osmotic diuretic*	Pulls fluid from brain tissue into vasculature → ↓ ICP	Hypotension, dehydration, electrolyte imbalance, pulm edema	**Use in-line filter**, monitor I&O, lung sounds, serum osmolality (target 300–320 mOsm/L)
Phenytoin (Dilantin) *Anticonvulsant*	Stabilizes neuronal membranes — prevents seizures	Gingival hyperplasia, ataxia, nystagmus, rash (SJS)	Therapeutic level **10–20 mcg/mL**; IV in **NS only** (precipitates in D5W); rate < 50 mg/min
Levetiracetam (Keppra) *Anticonvulsant*	Modulates synaptic vesicle protein → ↓ seizure activity	Drowsiness, mood/behavior changes, dizziness	Preferred for brain tumor seizure prophylaxis — fewer interactions than phenytoin
Ondansetron (Zofran) *Antiemetic*	5-HT_3 receptor antagonist	Headache, constipation, **QT prolongation**	Baseline ECG; avoid with other QT-prolonging meds
Acetaminophen (Tylenol) *Analgesic*	Central pain modulation; antipyretic	Hepatotoxicity (> 4 g/day)	First-line for HA — **avoid ASA/NSAIDs** (bleeding risk, especially post-op)
Temozolomide (Temodar) *Alkylating chemo*	DNA alkylation; oral chemo for GBM	Myelosuppression, N/V, hepatotoxicity	Monitor CBC, give on empty stomach with antiemetic, neutropenic precautions
Docusate (Colace) *Stool softener*	Reduces straining (Valsalva) → prevents ICP spikes	Mild — rare cramping	**Routine** in ↑ICP patients; encourage fluids

NCLEX pearl

Phenytoin + IV fluids: only compatible with **0.9% NS**. Mixing with D5W = precipitation. Push slowly — rapid IV push can cause cardiac arrhythmias / hypotension.

6 NCLEX Test Traps

WRONG VS. RIGHT THINKING

✗ WRONG	✓ RIGHT
"Give morphine for the headache."	Use **acetaminophen** first. Opioids depress respirations and mask neuro status — both worsen ↑ ICP.
"Restrict fluids to prevent edema."	Maintain **euvolemia with isotonic fluids**. Hypotension drops CPP and worsens ischemia.
"Cushing's triad means we have time — give a PRN and recheck in 30 min."	Cushing's triad is a **LATE, ominous** sign. Call provider **NOW** — herniation is near.
"Suction for as long as needed to clear secretions."	Suction **< 10–15 seconds**, hyperoxygenate first. Longer suctioning spikes ICP.
"Cluster all morning care to give the patient a long rest period."	**Space activities**; rest between each. Stacked stimulation = cumulative ICP rise.
"Position infratentorial post-op patient with HOB up at 45° on back."	Infratentorial = **flat or 10–20°, not on back** — protects brainstem and operative site.
"Use D5W to maintain hydration."	D5W is **hypotonic** once dextrose is metabolized — water moves into brain cells → worse edema. Use **0.9% NS**.
"Decreased LOC is a late sign — keep watching."	**Change in LOC is the EARLIEST reliable** sign of ↑ ICP — act on it immediately.

7

Patient & Family Education

DISCHARGE TEACHING

🏠 Activity & Daily Living

- **Avoid heavy lifting** (> 10 lbs), straining, bending
- No driving until cleared (typically **6 months seizure-free**)
- Avoid contact sports / activities with fall risk
- Rest periods; gradual return to normal activity
- Wear **medical alert bracelet**

💊 Medications

- **Never stop steroids abruptly** — taper as ordered
- Take anticonvulsants on schedule — do not skip doses
- Use stool softeners to prevent Valsalva
- Avoid ASA / NSAIDs — bleeding risk
- Carry medication list at all times

🚨 When to Call Provider

- New or worsening **headache**
- New **vision changes**, weakness, slurred speech
- Seizure activity
- Persistent N/V
- Fever > 101°F, drainage at incision
- Confusion, personality changes (family observes)

💜 If Receiving Treatment

- **Radiation:** wash skin gently with mild soap, no lotions with metal, wear soft hat/scarf
- **Chemo:** watch for infection (neutropenic precautions), nausea control
- Adequate **protein & calories**; small frequent meals
- Connect with **support groups** (American Brain Tumor Association)
- Consider **advance directives** early

8 Memory Mnemonics

QUICK RECALL

CUSHING'S Triad

Late sign of ↑ ICP — **brainstem herniation imminent**

- **C** – **C**ushing's = late, ominous
- **↑** – Systolic BP rises (**widening pulse pressure**)
- **↓** – Bradycardia (slow, bounding pulse)
- **~** – Irregular respirations (Cheyne-Stokes)

BRAIN Tumor Cues

Early warning signs to watch for

- **B** – **B**ehavior / personality change
- **R** – **R**estlessness, decreased LOC
- **A** – **A**phasia or focal deficits
- **I** – **I**mbalance, ataxia
- **N** – **N**ausea/vomiting + morning headache

ICP UP Triggers

Things that raise ICP — **AVOID**

- **I** – **I**somotic D5W & hypotonic fluids
- **C** – **C**oughing, sneezing, straining (Valsalva)
- **P** – **P**rolonged suctioning (> 15 sec)
- **U** – **U**ncontrolled pain, agitation, fever
- **P** – **P**oor positioning (hip flex, head turn, prone)

HOB Positioning

Quick post-op craniotomy rule

- **30°** – **Supra**tentorial (cerebral cortex)
- **FLAT** – **Infra**tentorial (cerebellum/brainstem) → 10–20°
- **UP** – Operative side **UP** after large tumor removal
- **NEUTRAL** – ways keep neck midline

CPP Formula

Cerebral Perfusion Pressure

- **=** CPP = **MAP − ICP**
- **✓** Target: **> 60 mmHg**
- **!** < 50 = ischemia; < 30 = neuronal death

A-B-C-D Brain Tumor Priority

Order of nursing assessment

- **A** – **A**irway: patent, suction ready
- **B** – **B**reathing: rate, pattern, SpO_2
- **C** – **C**irculation: CPP > 60, HOB 30°
- **D** – **D**isability: GCS, pupils, motor — q1–2h

9 NCJMM Clinical Judgment Scenario

NEXT GENERATION 6-STEP MODEL

CASE SCENARIO

Mr. R, 58-year-old male

Admitted from ED with 3-week history of **worsening morning headaches**, two episodes of **projectile vomiting without nausea**, and a witnessed **generalized tonic-clonic seizure** at home. Wife reports he's been "not himself" — irritable, forgetful, and bumping into things on his right side. MRI confirms a **left frontoparietal glioblastoma multiforme (Grade IV)** with surrounding edema. Admission VS: BP 158/72, HR 58, RR 18 irregular, T 99.0°F, SpO_2 96% RA, GCS 13 (E3 V4 M6).

STEP 1

Recognize Cues

Relevant findings to flag:

- Morning headache + projectile vomiting (no nausea) → **classic ↑ ICP**
- New-onset seizure in adult > 20 — **brain tumor until proven otherwise**
- Personality / cognitive change → frontal lobe involvement
- Right-sided neglect → **left** parietal lesion
- BP 158/72 (wide pulse pressure 86), HR 58, irregular RR → **early Cushing's triad** 🚨
- GCS 13 — decreased LOC, baseline for trending

STEP 2

Analyze Cues

Findings cluster around **increased intracranial pressure from tumor mass + cerebral edema**. The wide pulse pressure with bradycardia and irregular respirations suggests **early Cushing's response** — brainstem is being stretched. Seizure activity and focal deficits confirm cortical irritation and lobar compression. The patient is **compensating but unstable**; further deterioration is imminent without intervention.

STEP 3

Prioritize Hypotheses

- **#1 (Highest priority):** Increased ICP with risk for brain herniation
- **#2:** Risk for recurrent seizures and injury
- **#3:** Ineffective cerebral tissue perfusion
- **#4:** Risk for aspiration (altered LOC + vomiting)
- **#5:** Anticipatory grief / coping (GBM prognosis)

STEP 4

Generate Solutions

- Elevate **HOB 30°**, neck neutral; avoid hip flexion
- Initiate continuous **cardiac & SpO_2 monitoring**; q1h neuro checks

- Anticipate orders: **dexamethasone IV**, **mannitol IV**, anticonvulsant load (Keppra or phenytoin), **0.9% NS** infusion
- Seizure precautions — pad rails, suction at bedside, O_2 ready
- NPO until aspiration risk reassessed
- Quiet, low-stimulation environment; cluster **not** care
- Notify provider STAT for Cushing's triad; prepare for possible **ICP monitor / EVD** placement and craniotomy

STEP 5

Take Action

- Position HOB 30°, midline alignment ✓
- Administer **dexamethasone 10 mg IV** per order — reduces tumor edema
- Administer **mannitol 1 g/kg IV via filter** — strict I&O, monitor osmolality
- Load **levetiracetam IV** for seizure prophylaxis
- Suction PRN **< 15 sec**, hyperoxygenate before/after
- Pre-medicate before any stimulation; provide acetaminophen for HA
- Place stool softener on schedule; teach to **avoid Valsalva**
- Maintain SpO_2 ≥ 95%, $PaCO_2$ 35–38 mmHg
- Provide emotional support to patient and wife; consult palliative care / chaplain as appropriate

STEP 6

Evaluate Outcomes

Expected outcomes (intervention is working):

- GCS stable or improving (≥ 13)
- **Resolution of Cushing's triad** — BP, HR, RR normalize
- No additional seizure activity
- Pupils equal, round, reactive — no new focal deficits
- Pain controlled, no vomiting, no straining
- SpO_2 ≥ 95%, $PaCO_2$ in target range
- Patient/family verbalize understanding of plan and prognosis

If outcomes NOT met (declining LOC, blown pupil, new posturing, persistent Cushing's triad): escalate immediately — herniation may be occurring. Prepare for emergent imaging and surgical decompression.