

Increased Icp and Herniation

A plain-English guide for you and your family

WHAT IS HAPPENING

Your skull is a hard box that cannot stretch. Inside sit three things: brain tissue, blood, and cerebrospinal fluid (clear liquid that cushions the brain). Normally these three balance each other, and pressure stays steady. But if a tumor grows, the brain swells from injury or infection, fluid builds up because it cannot drain, or a blood clot forms, that extra volume has nowhere to go. Pressure inside the skull climbs. At first the body compensates—it squeezes out some fluid and blood to make room—so you might feel only a dull headache or mild confusion. But once that safety margin runs out, pressure spikes. The rising pressure pushes the brain downward toward the only opening at the base of the skull, squeezing the brainstem (the stalk that controls breathing, heart rate, and consciousness). You will see a severe headache that wakes you at night, projectile vomiting (especially in the morning), blurred vision from a swollen optic nerve, growing drowsiness, one pupil larger than the other, and sometimes a slow heart rate paired with high blood pressure. These signs mean the brain is in crisis. If pressure keeps climbing, the brainstem herniates—gets pushed through that opening—and breathing stops. This is a medical emergency. The team must lower pressure fast with medicine or surgery, because once herniation happens the window to save brain function closes in minutes.

What you might feel

- Headache that gets worse and worse
- Throwing up without feeling sick to the stomach first
- One pupil gets bigger than the other, or both pupils stop reacting to light
- Vision gets blurry or dims, sometimes seeing double
- Confusion, trouble staying awake, or falling into a coma
- Body suddenly gets stiff with arms bent inward or stretched out straight (posturing)
- Breathing becomes slow, irregular, or stops and starts in strange patterns
- Blood pressure shoots up while heart rate drops (Cushing's triad with abnormal breathing)
- Seizures

Call the doctor right away if...

- One pupil suddenly much bigger than the other or not reacting to light
- Stiff posturing (arms bent in tight or stretched out straight)
- Glasgow Coma Scale dropping (person less awake, less responsive)
- Cushing's triad: high blood pressure, slow heart rate, and abnormal breathing
- Sudden severe headache with projectile vomiting

What the care team will do

- Keep the head of the bed at 30 degrees and the neck straight in midline position without flexion or rotation
- Check pupils and Glasgow Coma Scale score every 15 to 60 minutes and report any change immediately
- Give 3% hypertonic saline continuous IV infusion or 23.4% saline bolus as ordered and monitor serum sodium every 4 to 6 hours
- Maintain PaCO₂ between 30 and 35 mmHg by adjusting ventilator rate if the patient is intubated
- Keep the patient sedated with propofol or other IV sedatives and give IV pain medicine like fentanyl to keep them calm
- Monitor the external ventricular drain if present and drain cerebrospinal fluid to keep intracranial pressure below 20 mmHg
- Prevent fever and treat temperatures above 38°C with IV acetaminophen or cooling blankets
- Avoid suctioning the endotracheal tube unless absolutely necessary and pre-oxygenate with 100% oxygen before suctioning

Medicines you may be given — and why

Hypertonic saline 3% (IV infusion) or 23.4% (bolus)

Hypertonic saline is much saltier than normal blood. When you drip it into the bloodstream, it pulls water OUT of the swollen brain tissue and into the blood vessels. The brain shrinks just enough to lower the pressure inside the skull. Think of sprinkling salt on a wet sponge — the salt draws the water out.

Mannitol 20% (IV bolus)

Mannitol is a sugar alcohol that the body cannot soak into cells. When you give it into the bloodstream, it pulls water out of swollen brain tissue and into the blood. Then the kidneys flush that extra water out as urine. It shrinks the brain quickly and lowers skull pressure fast.

Propofol (IV infusion)

Propofol calms the entire brain by boosting GABA (the brain's main shut-off chemical), which slows brain cell activity. When the brain is less active, it uses less oxygen and energy. Blood vessels in the brain tighten slightly, and blood volume inside the skull drops. All of this lowers intracranial pressure. It also keeps the patient deeply asleep so they do not move, cough, or fight the breathing tube, which would spike pressure.

Controlled hyperventilation (mechanical ventilation with target PaCO₂ 30-35 mm Hg)

Breathing faster than normal lowers the level of carbon dioxide (CO₂) in the blood. When CO₂ drops, blood vessels in the brain tighten and narrow. This cuts the volume of blood inside the skull and lowers intracranial pressure. This works very fast but only for a short time and must be used carefully.

Where this information comes from

- Brain Trauma Foundation Guidelines for Management of Severe TBI
- Neurocritical Care Society
- American Association of Neurological Surgeons
- AHA/ASA Stroke Guidelines

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