

Increased Intracranial Pressure (ICP)

The cranium is a rigid bony structure that contains three main components: brain tissue, cerebrospinal fluid (CSF), and blood. Increased intracranial pressure (ICP) occurs when there is an increase in the volume of one or more components which cannot be offset by a volume reduction or displacement in some other component.

ICP is normally less than or equal to 15 mmHg in adults, and pathologic intracranial hypertension is present at pressures greater than or equal to 20 mmHg. ICP is normally lower in children than adults and may be subatmospheric in newborns (Smith et al., 2024).

Conditions Associated with Increased ICP

The development of increased ICP may be acute or chronic. It is a common clinical problem in neurology or neurosurgical units. Many diseases or insults can result in increased ICP including:

- Increase in brain volume
 - Cerebral edema (trauma, ischemia, hyperammonemia, encephalitis, high altitude)
 - Hematoma (Epidural, subdural, subarachnoid, or intracranial hemorrhage)
 - Tumor
 - Abscess
 - Blood clots
- CSF dysregulation
 - Increase in cerebrospinal fluid (infection, choroid plexus tumor)
 - Decreased re-absorption of CSF (obstructive hydrocephalus, meningitis)
- Increase in blood volume
 - Increased cerebral blood flow (hypercarbia, aneurysms)
 - Venous stasis from venous sinus thromboses
 - Elevated central venous pressures (severe heart failure)
- Other causes
 - Idiopathic intracranial hypertension
 - Skull deformities such as craniosynostosis
 - Vitamin A intoxication
 - Tetracycline use

Acute intracranial hypertension (AIH) is a clinical syndrome in which homeostatic mechanisms are overwhelmed, causing a rapid increase in intracranial pressure (ICP). AIH is a medical emergency requiring immediate recognition and treatment to prevent irreversible neurologic damage or death. Patients identified at increased risk for AIH should be monitored closely in a critical care setting.

Signs and Symptoms of Increased ICP

Conditions associated with chronically increased ICP may first present insidiously. Headaches may be the only symptom of chronic intracranial hypertension. Chronic intracranial hypertension can cause vision loss due to pressure on the optic nerve. Intracranial volume may increase steadily over months with minimal symptoms and no change in the level of consciousness, and yet present dramatically with an acute deterioration of consciousness when compensatory mechanisms are exceeded.

There should be a high clinical suspicion of increased ICP for patients presenting with acute/severe headache, papilledema, and vomiting. The patient may describe the headache as throbbing pain which worsens with actions that further increase ICP such as coughing, sneezing, recumbency or exertion. Other initial signs and symptoms of increased ICP include nausea, blurred vision, restlessness, irritability, and confusion. The clinical presentation of AIH can be mistaken for other problems, such as drug or alcohol intoxication, migraine headache, infection, or post-ictal state.

Level of consciousness will decrease progressively as ICP gets worse. The Glasgow Coma Scale (GCS) is the most common scoring system used to objectively describe the patient's level of consciousness. The GCS is composed of three objective tests: eye, verbal, and motor responses. The lowest possible total GCS is 3, indicative of deep coma, while the highest is 15. GCS scores help facilitate communication among healthcare providers and provide guidance for diagnostic workup and therapeutic intervention.

Increased ICP may cause protrusion or herniation of brain tissue through one of the rigid intracranial barriers. Signs of brain herniation include pupillary dilatation, hemiplegia, impaired oculocephalic movements, increased motor tone, flexion or extension to pain (posturing), and respirations containing sighs, deep yawns, or pauses. The Cushing reflex, also known as Cushing's triad, consists of hypertension, bradycardia, and diminished respiratory effort. Presence of Cushing's triad, a poor diagnostic sign, indicates impending brainstem herniation. Prompt emergency treatment is warranted.

Managing Increased ICP (Smith, 2024)

The management of elevated ICP is a critical component of care in patients with acute neurological deterioration. Such patients should be managed in an intensive care unit. Continuous neuro-observation, close monitoring of vital signs, and timely interventions can prevent secondary brain injury and potentially fatal herniation syndromes.

The prompt recognition and management of patients with increased ICP requires knowledge of at-risk patient populations and the signs and symptoms of elevated ICP. Acute intracranial hypertension resulting from rapid elevation of intracranial pressure is a medical emergency requiring immediate stabilization of airway, breathing and circulation followed by immediate brain imaging for confirmation and diagnosis of the underlying etiology. ICP monitoring, and in certain cases CSF drainage, is a cornerstone of management. The neuroscience ICU nurse provides a calm, quiet environment, vigilant monitoring, and interventions to optimize cerebral blood flow and prevent complications.

Urgent Management of elevated ICP includes rapid assessment and support of oxygenation and blood pressure. In addition the following measures are implemented to reduce ICP: (Pinto et al., 2024)

- Head Elevation
- Hyperventilation to a PCO₂ of 26 to 30 mmHg
- Intravenous mannitol (1 to 1.5 g/kg)

Patient Education (Pinto et al., 2024)

- Clinical presentation of elevated ICP can mimic conditions such as intoxication, stroke, infection, or postictal states, and clinicians must maintain a high index of suspicion, especially in mild or ambiguous cases.
- Prompt identification depends on continued nursing assessments and thorough neurological monitoring.

- In more severe presentations, early involvement of neurologists and neurosurgeons is vital, and ongoing communication with the patient and family regarding potential interventions, (e.g., ICP monitoring or craniotomy), must be maintained.
- Patient and caregiver education should begin early and continue throughout the course of care and recovery.
- All members of the care team must reinforce education on recognizing warning signs, such as persistent headache, nausea, vomiting, blurred vision, and altered mental status, which could suggest recurrence or complications.
- Discharge planning should include home safety evaluations, follow-up appointments, and a clearly communicated care plan for primary care clinicians to ensure continuity of care.

References:

[Pinto, V.L. Adeyinka, A. \(2025, September 14\). Increased Intracranial Pressures. Stat Pearls.](https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.ncbi.nlm.nih.gov/books/NBK482119)

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[Smith, E.R., Amin-Hanjani, S. \(2024, November 13\). Evaluation and Management of Elevated Intracranial Pressures in Adults. Up to Date.](https://www.uptodate.com/contents/evaluation-and-management-of-elevated-intracranial-pressure-in-adults)

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