

Increased Intracranial Pressure (ICP)

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اولین دوره
پرستار متخصص
سر درد و دردهای صورت

The first nurse specialist
course on
headache and facial pain



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Introduction

- The cranium contains :
 - brain tissue (1400 g)
 - blood (75 mL)
 - CSF (75 mL)
- The volume and pressure of these three components are usually in a state of equilibrium and produce the ICP
- Normal ICP =10 to 20 mm Hg

Introduction

- Increase in ICP is a serious medical problem
- The pressure itself can damage the brain or spinal cord by pressing on important brain structures and by restricting blood flow into the brain

Introduction

- Causes of increased ICP :
 - rising in CSF pressure
 - increased pressure in brain matter
 - bleeding into the brain
 - bleeding into the fluid around the brain
 - swelling within the brain matter

Pathophysiology

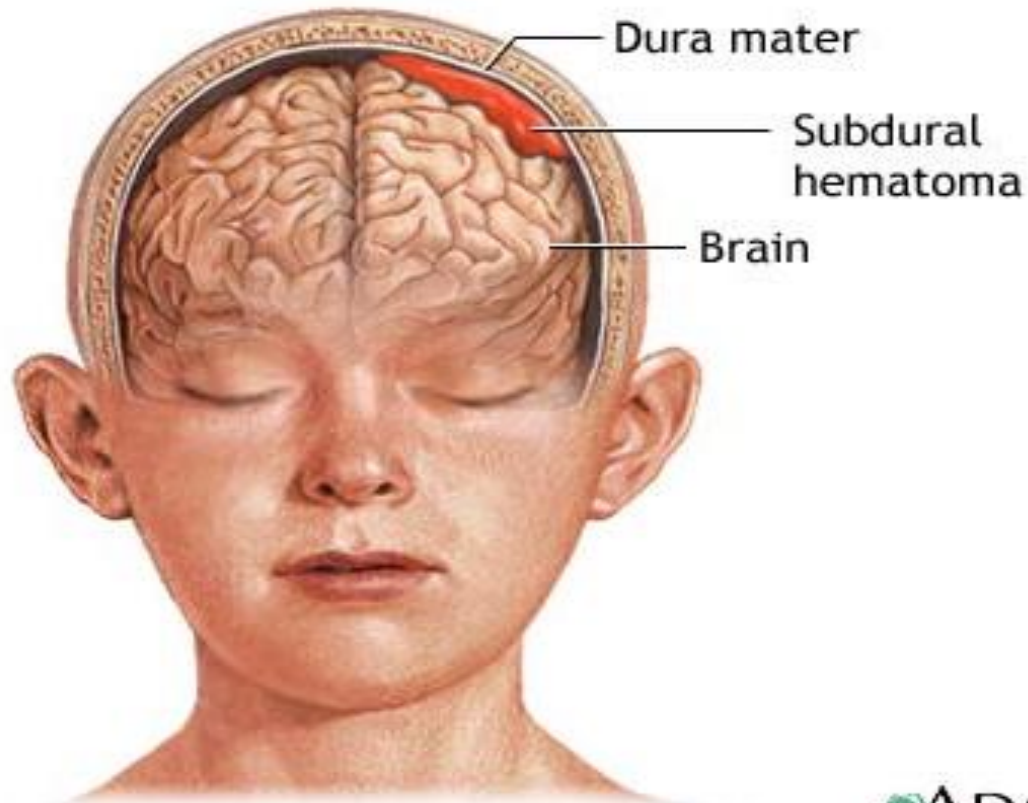
- Increased ICP is a syndrome that affects many patients with acute neurologic conditions. An elevated ICP is most commonly associated with **head injury**, secondary effect in other conditions, such as **brain tumors**, **subarachnoid hemorrhage**, and **toxic and viral encephalopathy**.
- Increased ICP from any cause decreases cerebral perfusion, stimulates further swelling (edema), and shifts brain tissue through openings in the rigid dura, resulting in brain herniation (next slide), a frequently fatal event.



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ADAM.

Subdural hematoma develops when blood vessels that are located between the membranes covering the brain (the meninges) leak blood after an injury to the head. This is a serious condition since the increase in intracranial pressure can cause damage to brain tissue and loss of brain function.

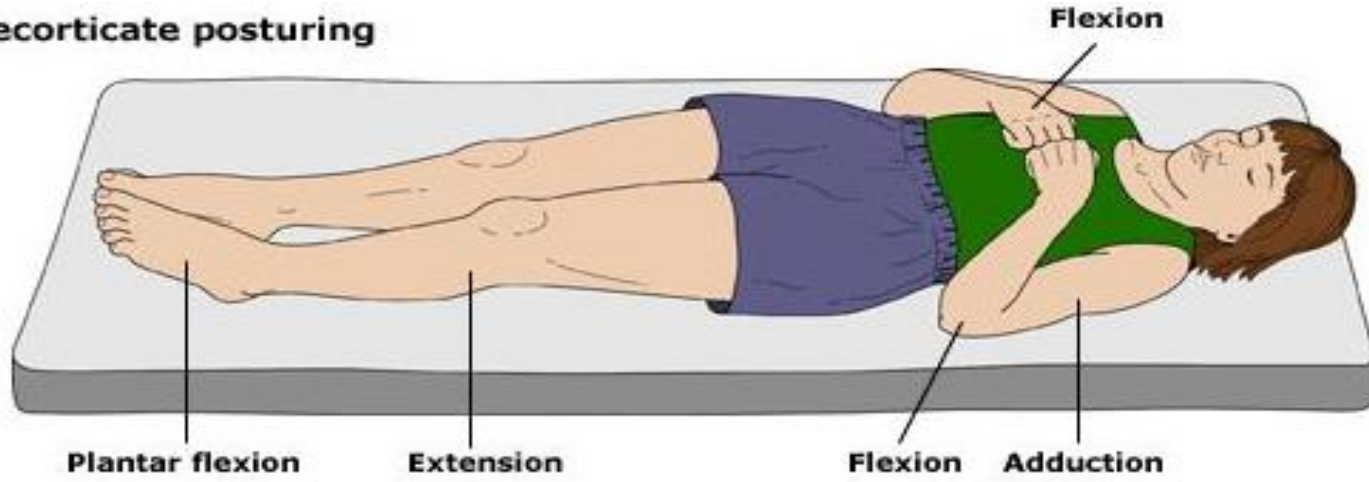
Clinical Manifestations

- When ICP increases to the point at which the brain's ability to adjust has reached its limits, neural function is impaired; this may be manifested by clinical changes **first in LOC** and **later by abnormal respiratory** and **vasomotor responses**. **Slowing of speech** and **delay in response to verbal suggestions** are other early indicators.
- Restlessness (without apparent cause), confusion, or increasing drowsiness, has neurologic significance.
- **These signs may result from :**
 - **compression due to swelling from hemorrhage or edema**
 - **expanding intracranial lesion (hematoma or tumor)**
 - **combination of both**

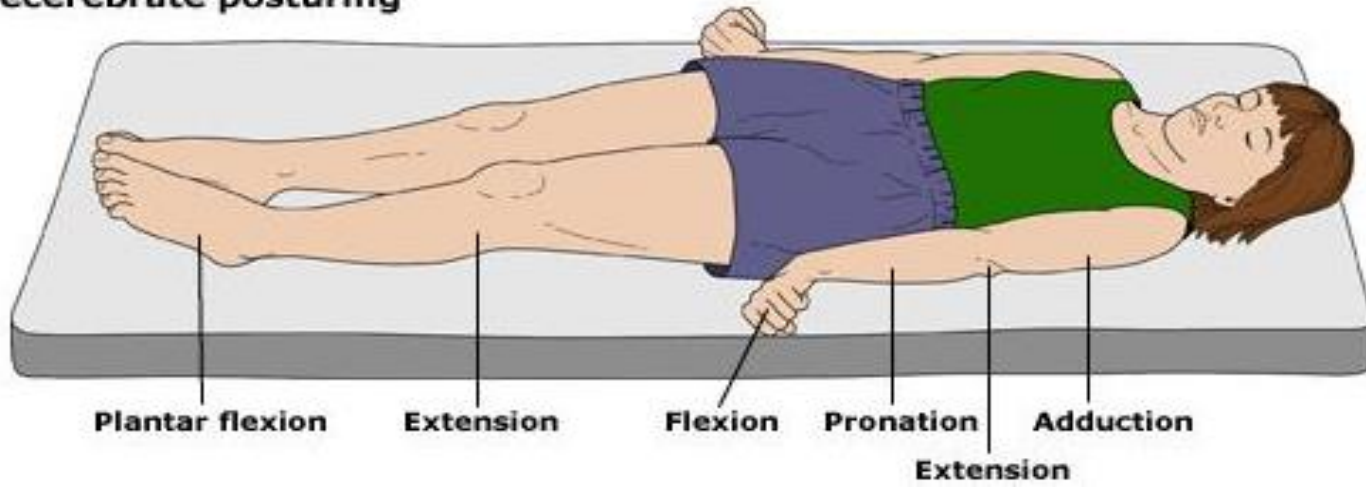
Continued.....

- As ICP increases, the patient becomes stuporous (reacting only to loud auditory or painful stimuli)
- At this stage serious impairment of brain circulation is probably taking place, and immediate intervention is required
- As neurologic function deteriorates further, the patient becomes comatose and exhibits abnormal motor responses in the form of decorticate or decerebrate posture (see next slide).
- When the coma is profound, with the **pupils dilated and fixed** and **respirations impaired**, **death** is usually inevitable

Decorticate posturing



Decerebrate posturing



Assessment

- # Obtain a **history** of events leading to the present illness
- # The **neurologic examination** :
 - ☺ evaluation of mental status
 - ☺ level of consciousness (LOC)
 - eye opening
 - verbal and motor responses
 - pupils (size, equality, reaction to light)
 - ☺ cranial nerve function
 - ☺ cerebellar function (balance and coordination)
 - ☺ reflexes
 - ☺ motor and sensory function
- # **Glasgow Coma Scale** (next slide), which is a tool for assessing a patient's LOC. Scores range from 3 (deep coma) to 15 (normal)

Glasgow Coma Scale

Eye opening response	Spontaneous	4	
	To voice	3	
	To pain	2	
	None	1	
Best verbal response	Oriented	5	
	Confused	4	
	Inappropriate words	3	
	Incomprehensible sounds	2	
	None	1	
	Best motor response	Obeys command	6
		Localizes pain	5
Withdraws		4	
Flexion (decorticate)		3	
Extension (decerebrate)		2	
None		1	
Total		3 to 15	



Assessment and Diagnostic Findings

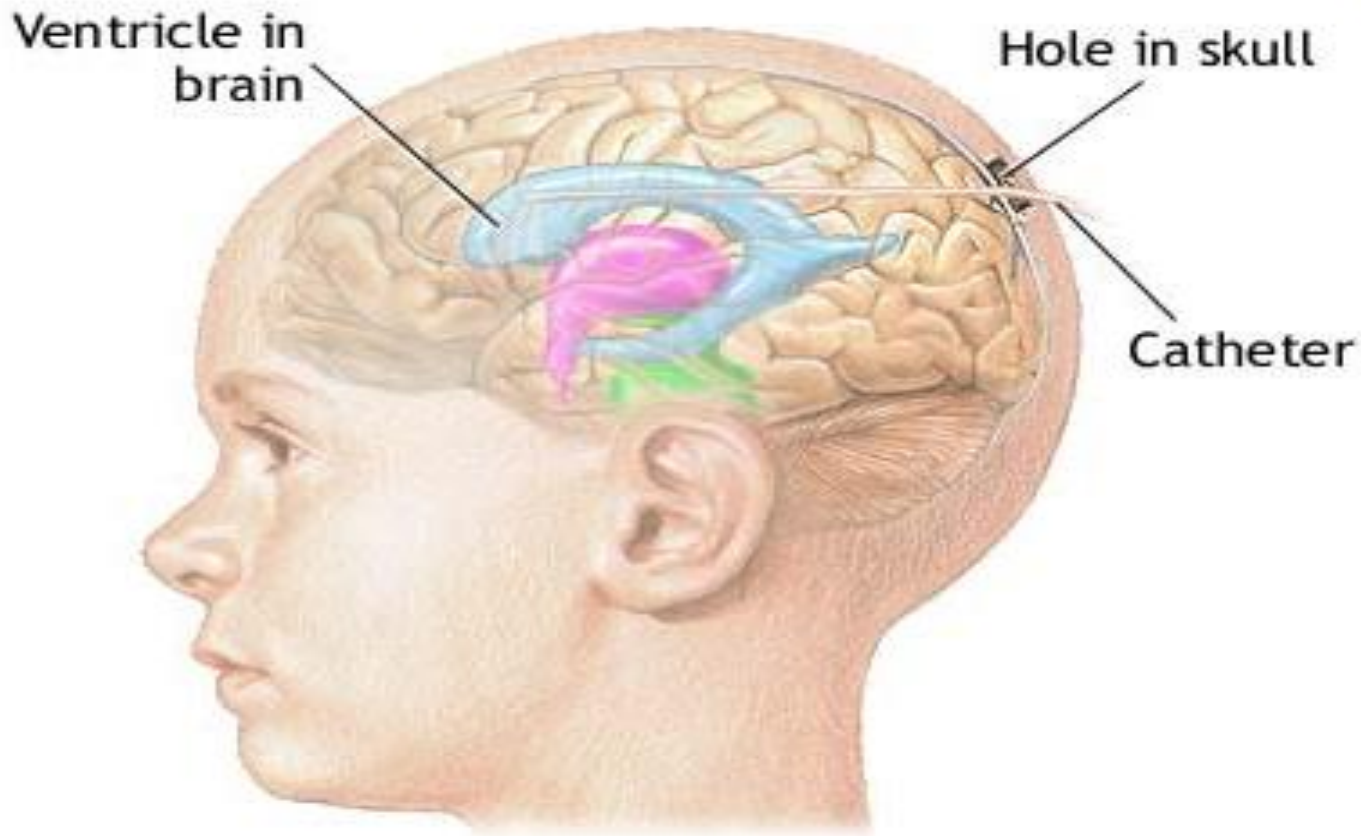
- The patient may undergo **cerebral angiography**, computed tomography (**CT**) scanning, or magnetic resonance imaging (**MRI**).
- **Transcranial Doppler** studies provide information about cerebral blood flow. The patient with increased ICP may also undergo **electrophysiological** monitoring to monitor the pressure (next slide).
- **Lumbar puncture** is avoided in patients with increased ICP because the sudden release of pressure can cause the brain to herniate.

Medical Management

- Increased ICP is a true emergency and must be treated immediately through:

1- *Invasive monitoring of ICP to :*

- ▶ early identifying increased pressure
- ▶ quantify the degree of elevation
- ▶ initiate appropriate treatment
- ▶ provide access to CSF for sampling and drainage
- ▶ evaluate the effectiveness of treatment



ADAM.

Intracranial pressure monitoring is performed by inserting a catheter into the head with a sensing device to monitor the pressure around the brain.

Medical Management

2- *Decreasing cerebral edema:*

- ▶ Osmotic diuretics (mannitol)
- ▶ Corticosteroids (e.g. dexamethasone) in brain tumor

3- *Maintaining cerebral perfusion:(>70 mm Hg)*

- ▶ $CPP = MAP - ICP$
- ▶ by manipulating cardiac output
- ▶ Inotropic agents such as dobutamine
- ▶ Normal CPP = 80 mmHg (nearer DBP)

Medical Management

3- *Lowering the volume of CSF and cerebral blood:*

- ▶ ventriculostomy

4- *Controlling fever:*

- ▶ fever increases cerebral metabolism

5- *Maintaining oxygenation:*

- ▶ Arterial blood gases must be monitored
- ▶ optimizing the hemoglobin saturation



Medical Management

6- *Reducing metabolic demands:*

- ▶ administration of high doses of barbiturates when the patient is unresponsive to conventional treatment
- ▶ administration of pharmacologic paralyzing agents: the patient cannot respond or report pain

7- *Hyperventilation:*

- ▶ Monitor PaCO₂ (normal range 35 to 45 mm Hg)
- ▶ reduce ICP (by cerebral vasoconstriction and a decrease in cerebral blood volume)

8- *surgical intervention*

- *Optimizing cerebral tissue perfusion*

- Maintain head alignment and **elevate head of bed 30 degrees**. The rationale is that hyperextension, rotation, or hyper flexion of the neck causes decreased venous return.
- **Avoid extreme hip flexion** as this increases intra-abdominal and intrathoracic pressures, leading to rise in ICP.
- **Avoid the Valsalva maneuver** (straining at stool) as it raises ICP. Administer stool softeners as prescribed. If appropriate, provide high fiber diet.
- Note abdominal distention. Avoid enemas and cathartics (sorbitol, magnesium citrate, sodium sulfate).

- Spontaneous intracranial hypotension (SIH) was initially described in the early 1900s.
- The incidence is approximately 5 in 100,000 person-years.
- The peak incidence is in the fourth or fifth decade of life



IIH

- **Idiopathic pathic intracranial hypertension (IIH)**, previously known as **pseudotumor cerebri** and **benign intracranial hypertension**, is a condition characterized by increased intracranial pressure (pressure around the brain) without a detectable cause.
- The main symptoms are headache, vision problems, ringing in the ears, and shoulder pain.
- Complications may include vision loss

- The diagnosis may be suspected on the basis of the history and examination. To confirm the diagnosis, as well as excluding alternative causes, several investigations are required; more investigations may be performed if the history is not typical or the person is more likely to have an alternative problem: children, men, the elderly, or women who are not overweight



treatment

- Medication
- surgery



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