



# Head Trauma

*Last Updated: September 27, 2018*

## Brain Death Determination

### 1. Coma

- Noxious stimuli without motor response (except spinal reflexes)

### 2. Absent Brainstem Reflexes

- Absent pupillary response to light bilaterally
- Absent oculocephalic reflex (doll's eyes)
- Absent oculovestibular reflex (caloric reflex test bilaterally)
- Absent corneal reflex
- Absent facial muscle contraction to noxious stimulus
- Absent gag and cough reflex

### 3. Apnea Test

- Absent respiratory drive despite CO<sub>2</sub> challenge (pCO<sub>2</sub>>60mmHg)

### 4. Vital signs

- Core body temperature 36-37°C (normothermia)
- SBP ≥ 90mmHg
- PO<sub>2</sub> >200mmHg and PaCO<sub>2</sub> ~40mmHg à before discontinue ventilator use
- Verified absence of pharmacologic agent simulating brain death

## Changes in Signal Characteristics for Blood on MRI over Time

Time	T1 Weighted Image	T2 Weighted Image
Acute	Gray	Black

Subacute	White	White
Chronic	Black	Black

## Children's Coma Scale

Consciousness level assessment in children <4 years old

Eye Opening	Motor	Verbal		Score
-	Obeys	-		6
-	Localizes pain	Smiles, oriented to sound, follows objects, interacts		5
		<b>Crying</b>	<b>Interacting</b>	
Spontaneous	Withdraws to pain	Consolable	Inappropriate	4
To speech	Flexor (decorticate)	Inconsistently consolable	Moaning	3
To pain	Extensor (decerebrate)	Inconsolable	Restless	2
None	None	None		1

## Classification of Head CT After Trauma

Grading system for brain injury based on cistern compression and midline shift

Diffuse Injury Grade	CT Appearance	Mortality
I	Normal intracranial appearance	9.6%
II	Basal cisterns present. Midline shift <5mm. No lesions.	13.5%
III	Basal cisterns compressed or absent. Midline shift <5mm. No lesions >25cc.	34%

IV	Midline shift >5mm. No lesions >25cc.	56.2%
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## Classification of Head Injury Severity

Category	Qualification (Must meet each criteria in one bullet point)
Minimal	<ul style="list-style-type: none"> <li>GCS = 15 AND no LOC AND no amnesia</li> </ul>
Mild	<ul style="list-style-type: none"> <li>GCS = 14</li> <li>GCS = 15 AND either &lt;5 min LOC OR impaired alertness/memory</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>GCS = 9-13</li> <li>≥5 min LOC</li> <li>Focal neurologic deficit</li> </ul>
Severe	<ul style="list-style-type: none"> <li>GCS = 5-8</li> </ul>
Critical	<ul style="list-style-type: none"> <li>GCS = 3-4</li> </ul>

## CSF Production, Volume, and Pressure

Normal values for daily CSF production, volume, and pressure

Characteristic	Pediatric		Adult
	Newborn	1-10 years old	
Daily Production (ml/d)	25		450-750
Volume (ml)	5		150 (50% intracranial, 50% spinal)
Pressure (cmH <sub>2</sub> O)	9-12	10 (>15 = abnormal)	7-15 (>18 = abnormal)

# Glasgow Coma Scale

## Consciousness level assessment

Eye Opening	Motor	Verbal	Score
-	Obeys	-	6
-	Localizes pain	Oriented	5
Spontaneous	Withdraws to pain	Confused	4
To speech	Flexor (decorticate)	Inappropriate	3
To pain	Extensor (decerebrate)	Incomprehensible	2
None	None	None	1

## Management of Acute Increase in Intracranial Pressure

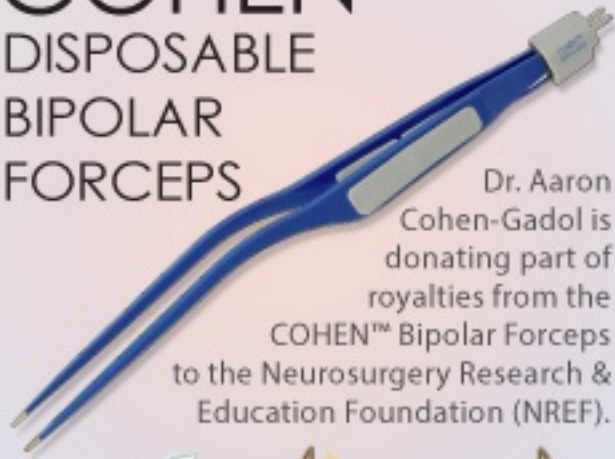
Step	Description
1	Check airway
2	Elevate head of the bed to 30°
3	Osmotic therapy with mannitol 1gm/kg IV or 10-20ml of 23.4% saline <ul style="list-style-type: none"> <li>• <i>Skip if</i> hypotensive, volume depleted, serum osmolality &gt;320mOsm/L</li> </ul>
4	<i>If</i> resistant / sudden IC-HTN is present → STAT non-contrast head CT
5	Drain 3-5ml of CSF if intraventricular catheter is present
6	Ensure patient is sedated and paralyzed
7	Hyperventilation with bag valve mask (to PaCO <sub>2</sub> 30-35mmHg)
8	Induced coma with pentobarbital 100mg IV or thiopental 2.5mg/kg IV

# Submit Your Complex Case

to be Reviewed  
by the Atlas Team



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