

# A GLANCE ON NEUROLOGICAL EMERGENCIES

Baystate Medical Center



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## Outline

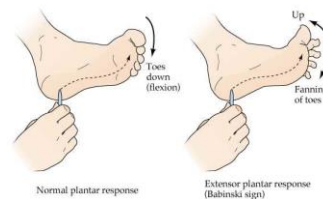
- I. Neurological Examination Made Easy
- II. Intracranial Emergencies
  - A. Conditions & examples
  - B. Management Concepts
- III. Spinal Emergencies
  - A. Conditions & examples
  - B. Management Concepts

## Objectives

- Participants will be introduced to focused neurological examination
- Participants will be introduced to intracranial emergencies
- Participants will be introduced spinal cord emergencies
- Participants will be introduced to management strategies for neurological emergencies

## Neurological Examination- Focused Approach

- Cortical exam: LOC, orientation, & memory
- Brain stem functions: focused cranial nerve exam
- Motor exam: muscle strength, pronation
- Cerebellar/base of skull exam: coordination, balance, dysarthria, dysphagia, dizziness, diplopia
- Sensory exam: sensation



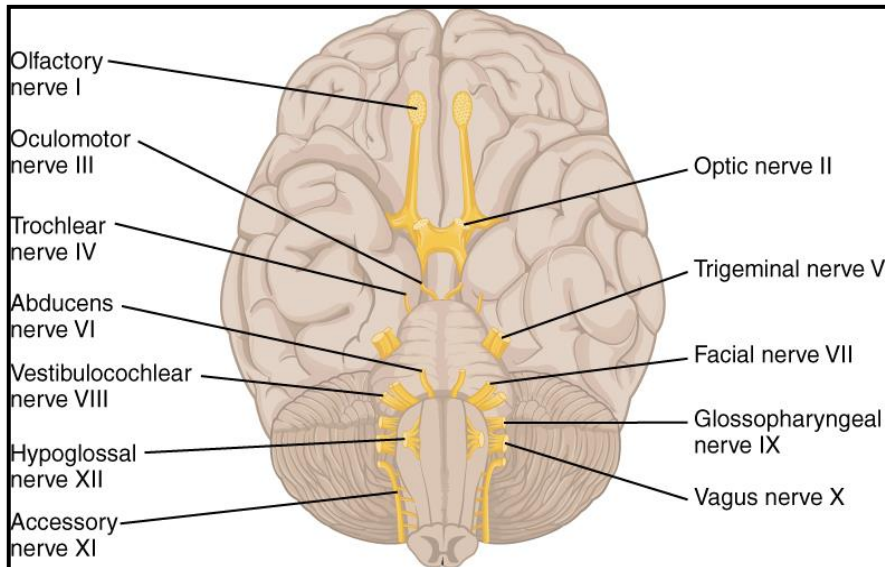
## Levels of Consciousness

LEVELS OF CONSCIOUSNESS		KEY	DEFINITION
<b>Full consciousness</b>		FC	Awake, alert, oriented to time, place, and person. Comprehends appropriately and expresses ideas verbally or in writing
<b>Confusion</b>		CF	Disoriented to time, place or person. Short attention span, difficulty in following commands. May have agitation, irritability, restlessness, and memory difficulties.
<b>Lethargy</b>		L	Oriented to time, place, and person. Shows slow/sluggish speech, mental process, and motor functions. Responds appropriately to painful stimuli.
<b>Obtundation</b>		O	Arousable with stimulation, responds verbally with 1-2 words. Follows simple commands after stimulation otherwise appears drowsy. Responds appropriately to painful stimuli.
<b>Stupor</b>		S	Arousable only to vigorous stimuli responding by incomprehensive sounds. Responds appropriately to painful stimuli.
<b>Coma</b>	Light coma Semicoma	SC	Unarousable, no spontaneous movement. Withdraws purposefully to pain, brainstem reflexes intact.
	Coma	C	Unarousable, nonpurposefull response to pain, brainstem reflexes may or may not be intact, decorticate or decerebrate posturing may be present
	Deep coma	DC	Unarousable, unresponsive to pain, brainstem reflexes are generally absent, decerebrate posturing or flaccidity is usually present

## Glasgow Coma Score

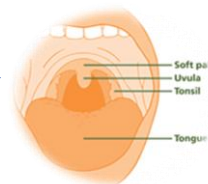
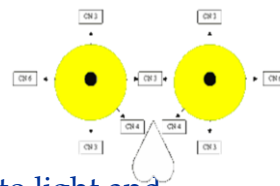
Category		Best Response
Eye opening		
Spontaneous		4
To speech		3
To pain		2
None		1
Verbal	(Modified for Infants)	
Oriented	Babbles	5
Confused	Irritable	4
Inappropriate words	Cries to pain	3
Moans	Moans	2
None	None	1
Motor		
Follows commands		6
Localizes to pain		5
Withdraws to pain		4
Abnormal flexion		3
Abnormal extension		2
None		1
Glasgow Coma Score		
Best possible score		15
Worst possible score		3
If tracheally intubated then verbal designated with "T"		
Best possible score while intubated		10T
Worst possible score while intubated		2T

## The brain stem (Midbrain, Pons, Medulla)



## Focused Cranial Nerve Exam

- Cranial Nerve II: Visual fields
- Cranial Nerve III: Pupil response to light and vertical/inward eye movement
- Cranial Nerve V: Corneal reflex
- Cranial nerve VI: Outward eye movement
- Cranial Nerve IX, X: symmetrical palate, swallow ability, cough/gag.
- Cranial Nerve XII: tongue symmetry



# Muscle Strength

SCORE	DESCRIPTION
0	Absent, no muscle contraction detected
1	Palpable muscle contraction
2	Active muscle movement, gravity eliminated
3	Active muscle movement against gravity
4	Muscle movement against some resistance
5	Normal strength against full resistance

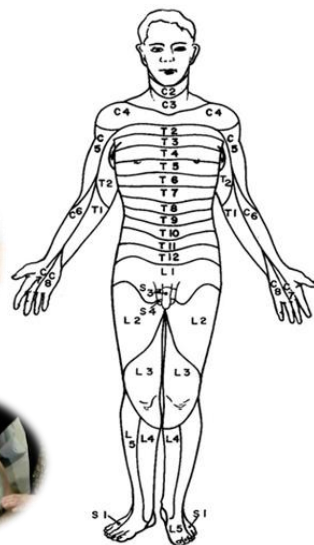


# Sensory Exam

## Superficial (light and pain)

### A more detailed approach

1. Two point discrimination
2. Point localization
3. Stereognosis
4. Graphesthesia
5. Double simultaneous stimulation (extinction)



# Intracranial Emergencies



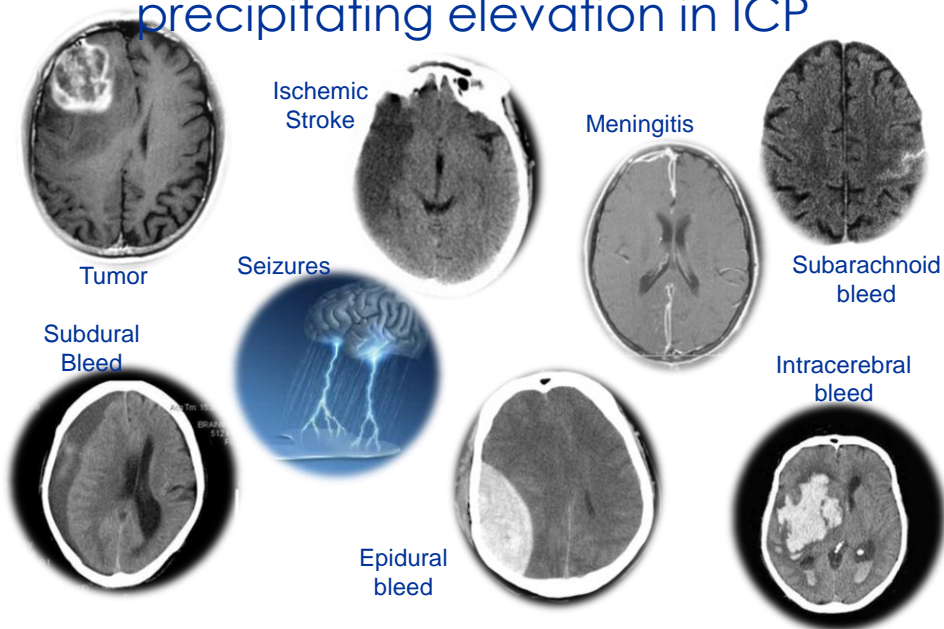
## Monro-Kellie Hypothesis

- **Brain tissue (1,400 ml) ~ 80%**
  - **CSF (150 ml) ~ 10%**
  - **Blood (150 ml) ~ 10%**
- 
- The unchanged volume of brain, CSF, and blood creates a constant dynamic equilibrium.
  - If one component's volume increases, another component's volume must decrease to maintain the equilibrium in the fixed hard skull.
    1. CSF moving from ventricles and cerebral subarachnoid space → spinal subarachnoid space
    2. Compression of low pressure venous system
    3. Decrease in CSF production
    4. Vasoconstriction

# Intracranial Pressure

- Intracranial Pressure (ICP) is the pressure normally resulting from the cerebrospinal fluid (CSF) that circulates in the ventricles
- Normal range: 0-10 mmHg with 15 mmHg as upper normal limit
- ICP > 20mmHg for 5 minutes or more = Intracranial Hypertension

## Major conditions precipitating elevation in ICP



# Status Epilepticus

A neurological emergency characterized by continuous state of seizure	
CLASSIFICATION	CLINICAL FEATURES
<b>Generalized Convulsive</b>	Continuous convulsions OR more than 1 seizure during which patient does not return to baseline consciousness
<b>Non Convulsive</b>	Seizure activity seen on EEG without clinical findings
<b>Refractory</b>	Seizure that is not controlled after initial management of benzodiazepine followed by anti-epileptic therapy
<b>Super refractory</b>	Occurring even if patient on anesthetic therapy OR occurring after reduction or withdrawal of anesthetic agents

## Key interventions to remember:

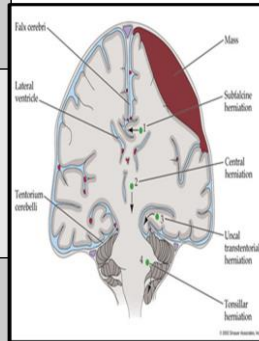
- Patient safety and Airway protection
- STAT page medical team and RT
- Activate RRT
- Have available EC ready for Ativan and possible intubation
- Consult neurology

# Signs & Symptoms of Elevated ICP

Alteration in LOC	Pupillary abnormalities	Visual disturbances	Motor weakness	Headache/ seizure
Aphasia	Cheyne-stokes respirations	Changes in vital signs (↑ BP, ↓ HR and widening of pulse pressure)	Impaired brainstem reflexes	Vomiting, nuchal rigidity



HERNIATION SYNDROMES	DESCRIPTION	SIGNS AND SYMPTOMS
<b>Cingulate/ Subfalcine</b>	Unilateral expansion of frontal portion in one hemisphere	Often thought to be a precursor to other more serious herniation syndromes, and may/may not manifest with signs/symptoms associated with elevated ICP
<b>Central</b>	Downward movement of cerebral hemisphere, basal ganglia, midbrain	<ul style="list-style-type: none"> <li>• Decreased LOC</li> <li>• Small reactive pupils</li> <li>• Gradual loss of upward gaze</li> <li>• Cheyne-Stokes</li> <li>• Contralateral hemiplegia</li> <li>• Ipsilateral posturing</li> </ul>
<b>Uncal</b>	Temporal lobe moves downward through tectorial notch	<ul style="list-style-type: none"> <li>• Decreased LOC</li> <li>• Contralateral hemiparesis</li> <li>• Dilated, nonreactive ipsilateral pupil</li> </ul>
<b>Infratentorial/ Tonsillar</b>	Movement of cerebellar tonsils through foramen magnum	Compression of respiratory and cardiac centers in medulla leading to brain death



## Management of Neurological Emergencies

<b>Head of bed elevation</b>	At least 30° . Neck stabilization for TSI
<b>Hyperventilation</b>	PaCO <sub>2</sub> : 35-45 mmHg
<b>Oxygenation</b>	PaO <sub>2</sub> >100 mmHg
<b>BP and Cerebral Perfusion Pressure (always clarify goals with MD)</b>	MAP > 80 mmHg Allow for SBP up to 160 mmHg in ischemic stroke post reperfusion, and less than 130 mmHg in hemorrhagic stroke
<b>CSF drainage</b>	Maintain normal ICP & CPP (when monitoring indicated)
<b>Mannitol Hypertonic Saline</b>	Serum osmolality < 320 mOsm Maintain 165 < serum Na <sup>+</sup> <170 mEq/L
<b>Paralysis, sedation, and pain control</b>	Reduce agitation, straining, coughing, oxygen demand, glucose utilization, seizures, irritation upon suctioning...
<b>Fluid management and diuretics</b>	NSS → Euvolemia. No Dextrose
<b>Temperature control Glucose control</b>	Normothermia Blood sugar 120-180 mg/dl
<b>Seizure control and serum level check</b>	SE protocol: BZD, Sedation, Paralysis

# Spinal Cord Emergencies



## Spinal Shock

- Immediate flaccidity, paralysis, and loss of all sensation and reflex activity below the level of injury
- Characterized by severe HTN and arrhythmias (2-5 min)
- Hypothermia (6-8 wks) is characteristic; due to the loss of connection between hypothalamus and sympathetic tone (sweating and passive dilation of vessels)
- Resolution of spinal shock takes around 72 hours.
- 4-6 weeks following the injury, the flaccid and hypo-reflexic state is replaced by spastic, hyper-reflexia and positive babinski bilaterally.
- The recovery is a gradual and long-term process, during which the perianal reflexes return first and before the DTRs .

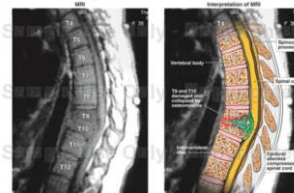
## Autonomic Dysreflexia

- Occurs in patients with SCI at T6 or above after resolution of spinal shock
- Precipitating conditions:
  - Distended bladder
  - Constipation or fecal impaction
  - Acute abdominal lesions
  - Labor contractions
  - Pressure on glans penis
  - Pressure ulcers
  - Ingrown toenail
- Signs and symptoms:
  - Flushed skin above level of injury
  - Pallor skin below level of injury
  - Severe hypertension
  - Headache
  - Bradycardia,
- Assess and remove the cause

## Spinal Epidural Abscess

- Fever: only 60%
- Back pain: majority but not all
- Back tenderness or nerve root pain
- Neurologic deficit: minority
- Most patient have 2-3 ED/MD visits
- Symptoms may be indolent

Spinal Cord Compression - T9-10 Epidural Abscess.



## Risk factors

- Bacteremia or conditions predisposing to it
  - IDU
  - Foreign bodies
  - HD
- Infections elsewhere (contiguous, distant)
- Trauma
- Immunocompromised
- ETOH
- DM
- Invasive spinal procedures

## Outcomes

- Neurologic deficit: 20-30%
- Paresis/paralysis: 10-19%
- Death: 13-23%
- Complete recovery: 28-47%

**SEA is a medical/surgical emergency**

# Management of Spinal Emergencies

- Methylpredisolone 30 mg/kg loading dose followed by a maintenance dose 5.4 mg/kg/hour for 24 hours (Within 3 hours of injury)
- Methylpredisolone 30 mg/kg loading dose followed by a maintenance dose 5.4 mg/kg/hour for 48 hours (Between 3-8 hours of injury)
- Surgery

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