ALTERED STATES OF CONSCIOUSNESS

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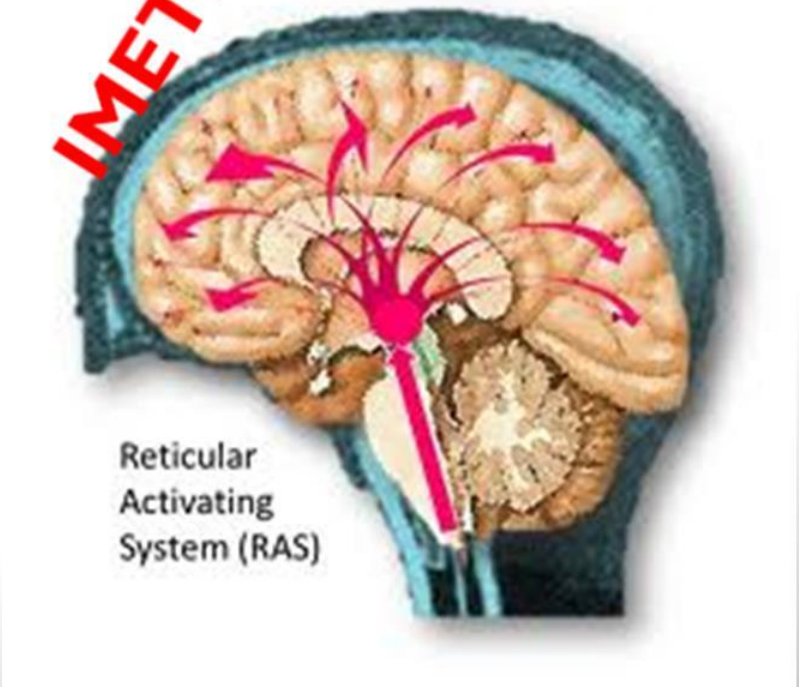
What is Consciousness?

It is **a state of general awareness of oneself and the environment.**

Reticular Activating System (RAS) controls the degree of nervous system activity.



Consciousness

Two components of consciousness:

- **Arousal**

  Alertness / Appearance of wakefulness

- **Awareness**

  Content of consciousness / Sum of cerebral mental functions

The two components are **inter- or independent.**

Cognitive Functions

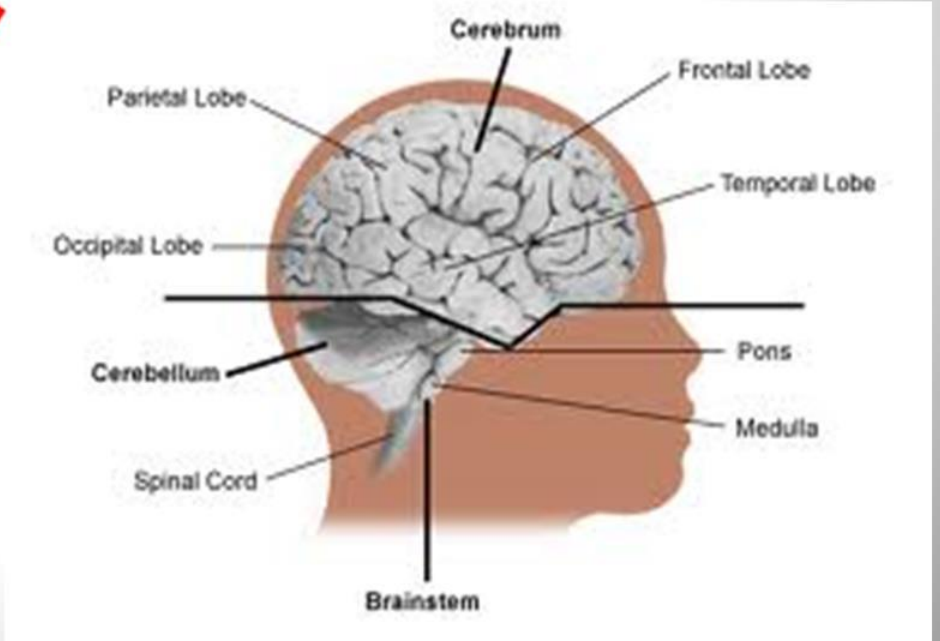
- **Cognition: Ability to store, retrieve and use information**
- **Lower order** cognitive functions:
  - Alertness
  - Attention
- **Higher order** cognitive functions:
  - Working memory
  - Mental imagery, thinking, problem solving
  - Behavioral control

Impaired Consciousness

- Indicates **brain dysfunction** or **brain failure**
- The more the **duration** and **more severe** the dysfunction, the less chance of complete recovery

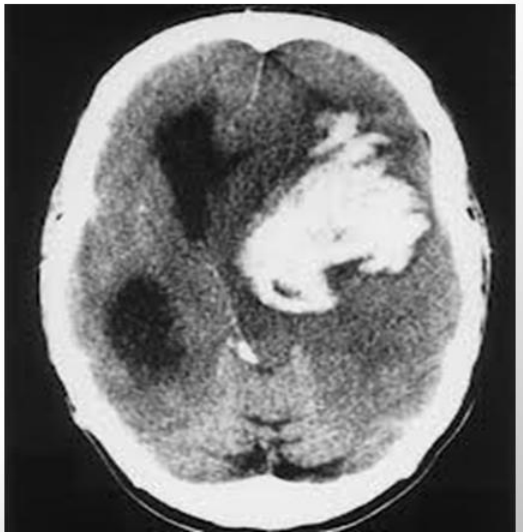
Major causes:

1. **Supratentorial**
2. **Infratentorial**
3. **Metabolic**



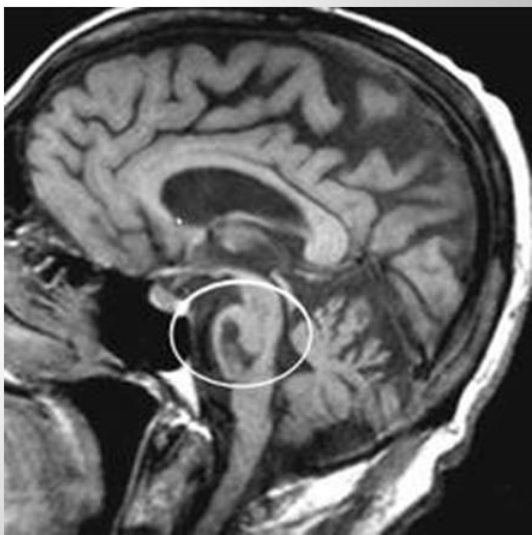
Supratentorial Impairment of Consc.

- Lesion must affect the cerebral hemispheres **directly** and **widely** to cause subsequent coma
  * (sub)cortical destructive lesion
    (ICH, epidural and subdural hematoma)
  * tumor
  * abscess
  * closed head injury



Infratentorial Impairment of Consc.

- Lesion **directly compresses** or **destroys** the neurons of **RAS**
- Common **compressive lesion** include:
  * basilar artery aneurism
  * posterior fossa epidural or subdural hem.
  *cerebellar hem., abscess, tumor or infarction
- Common **destructive lesion** include:
  * pontine hemorrhage
  * brain stem infarction



Metabolic Causes of Impairment

- Ischemic / Hypoxic
- Hypoglycemia
- Electrolyte Disturbance
- Organ failure
- Toxins

Assessing Level of Consciousness

- **Providing stimuli** and **observing the response**

- Major stimuli:
  - **Sound**
  - **Painful** stimuli

Assessing Level of Consciousness

- Response to painful stimuli:

  - **Purposeful** - pushes the examiner away
  - **Non purposeful** - removal from stimuli is incomplete
  - **Unresponsive**

Level / Quality of Consciousness…

- **Full consciousness (alert):**

  - Awake, looks about

  - Responds in a meaningful manner to verbal instructions or gestures

- **Drowsiness (somnolence, lethargy, obtundation):**

  - Can be readily aroused and responds appropriately when stimulated, but if left alone will sleep

  - Slow thought / movement / speech

Level / Quality of Consciousness…

- **Confusion:**
  - Disorientation to 1.time > 2.place > 3.person
  - Memory difficulty
  - Difficulty following commands
  - Alteration in perception of stimuli
  - Daytime drowsiness can alternate with nighttime agitation

Level / Quality of Consciousness…

- **Delirium:**
  - restlessness
  - agitation
  - disorientation
  - irritability
  - possible hallucination
  - suspiciousness

IMET2000-PAL

D	- Drugs, alcohol
E	- Electrolyte imbalance
L	- Low PO2 (hypoxia)
I	– Injury to brain
R	– Relapsing fever
I	– Infection
U	– Uremia
M	– Metabolic (liver)

Level / Quality of Consciousness…

- **Stupor:**

  - Generally lethargic and **unresponsive except to vigorous stimulation**

  - Can be briefly aroused & make attempt at verbalization to painful/repeated stimuli

  - **Open eyes to deep pain**

  - **Purposeful withdrawal**

Level / Quality of Consciousness…

- **Semi-coma**
  - no spontaneous movements
  - verbally unresponsive
  - shaking and painful stimuli to skin > **moaning**
  - **withdrawal** of the stimulated body part
  - **most reflexes are intact** (corneal, pupillary, gag and tendon) and Babinski +/-

Level / Quality of Consciousness…

- **Coma:**
  - Unarousable and unresponsive (**no moan)**
  - N**o eyes opening** on deep pain
  - Response to painful stimuli **nonpurposeful**
  - Most **brain-stem reflexes** are **intact**
  - Decerebration / Decortication
- **Deep coma:**
  - **Completely unresponsive** to any stimuli
  - Brainstem, tendon and plantar **reflexes all absent**

Assessing Coma by GCS

- Three categories:
  - **Eye opening**
  - **Best motor response**
  - **Best verbal response**
- Scoring:
  - Highest possible score is 15
  - **Score of < 8 indicates coma**
  - Lowest possible score is 3

Glasgow Coma Scale

Response	Score
Eye opening	
Opens eyes spontaneously	4
Opens eyes in response to speech	3
Open eyes in response to painful stimulation (eg, endotracheal suctioning)	2
Does not open eyes in response to any stimulation	1
Motor response	
Follows commands	6
Makes localized movement in response to painful stimulation	5
Makes nonpurposeful movement in response to noxious stimulation	4
Flexes upper extremities/extends lower extremities in response to pain	3
Extends all extremities in response to pain	2
Makes no response to noxious stimuli	1
Verbal response	
Is oriented to person, place, and time	5
Converses, may be confused	4
Replies with inappropriate words	3
Makes incomprehensible sounds	2
Makes no response	1

Coma vs. Psychogenic Coma

- Holds eyes tight, resists opening
- Fixed stare upward, quick blink
- Normal pupils
- Normal oculocephalic reflex
- Normal oculovestibular reflex
- Normal posture, breathing, BP, pulse

Special States of Altered Consciousness

- **Brain Death**:

  An **irreversible loss of cortical and brain stem activity**

- **Persistent Vegetative State**:

  A chronic condition that follows a severe brain injury

  Intact autonomic function & reflexes / Stable vital signs / Presence of **sleep/wakefulness** / Eye opening to verbal stimuli, **but no awareness**

- **Locked-In Syndrome**:

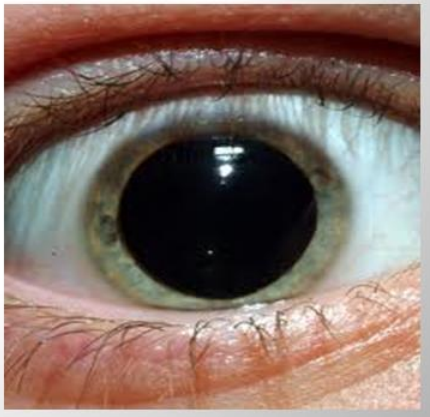
  A state of a **muscle paralysis** with preservation of **full consciousness and cognition**

Neurological Exam on a Comatose Pt.

- **Eyes** (open/closed; direction of gaze)

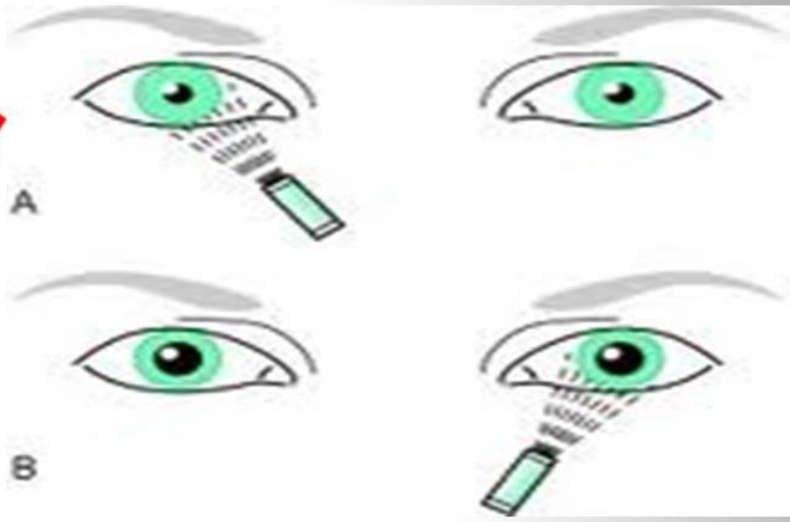
- Pupils:	**Cause:**
Small reactive	Diencephalic (metabolic)
Midsize fixed	Midbrain tectal
Irregular pear shaped	Midbrain nuclear
Fixed widely dilated	3rd nerve
Pinpoint reactive	Pontine
Pinpoint	Opiate
Small	Organophosphorus
Wide dilated	Atropine

Neurological Exam on Comatose Pt.

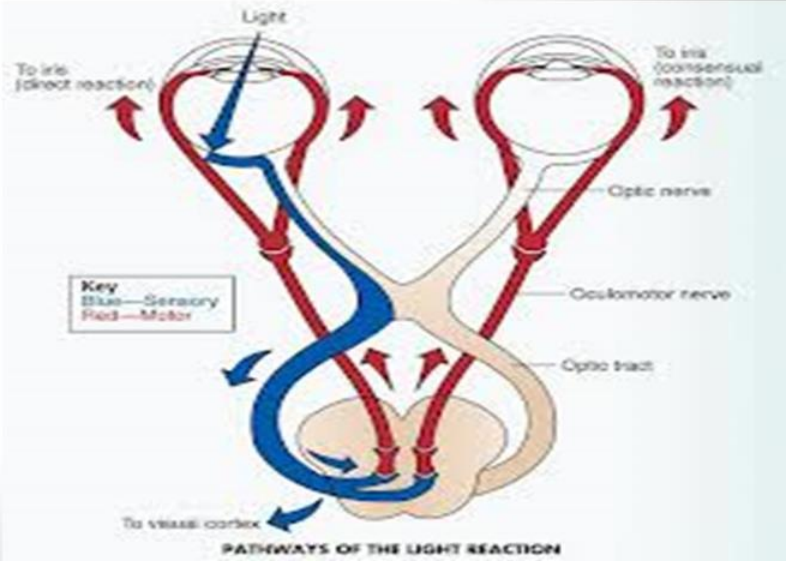


Neurological Exam on a Comatose Pt.

- Pupils / Reaction to light:
  - Direct light reflex

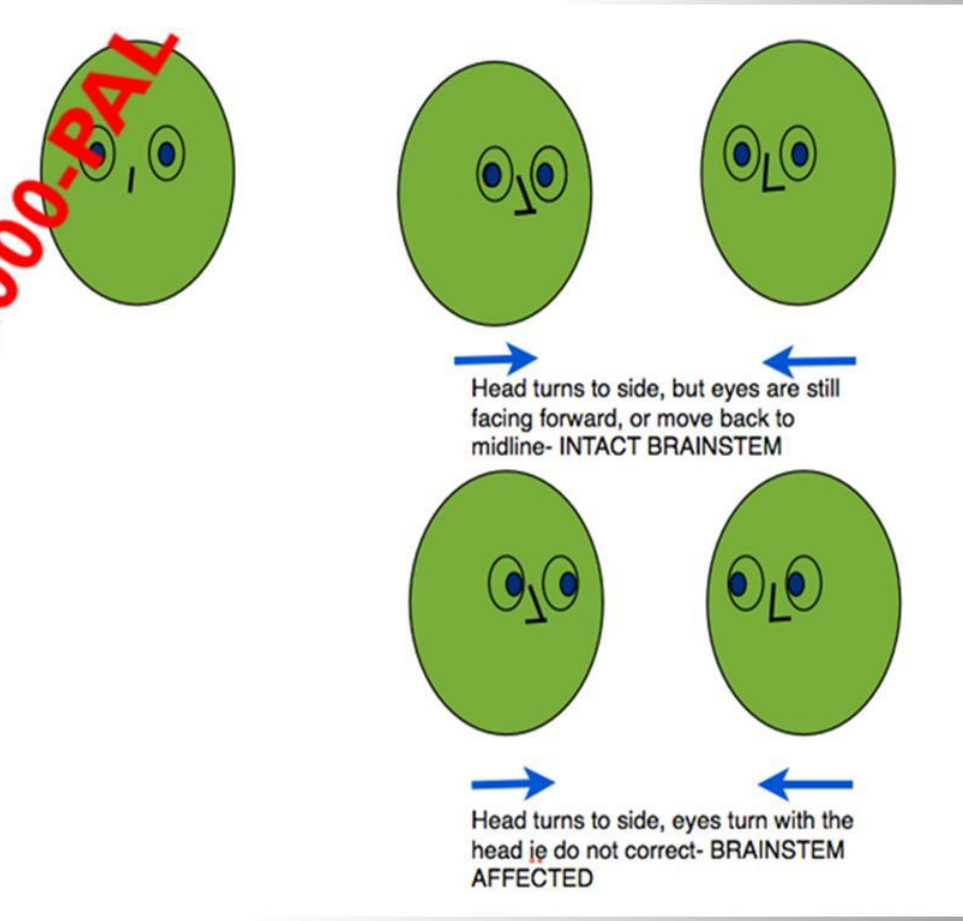


  - Consensual light reaction



Neurological Exam on a Comatose Pt.

- **Ocular movements**
  - Observe position of eyes
  - Oculo-cephalic reflex **("Doll's eyes")** assesses brain-stem function



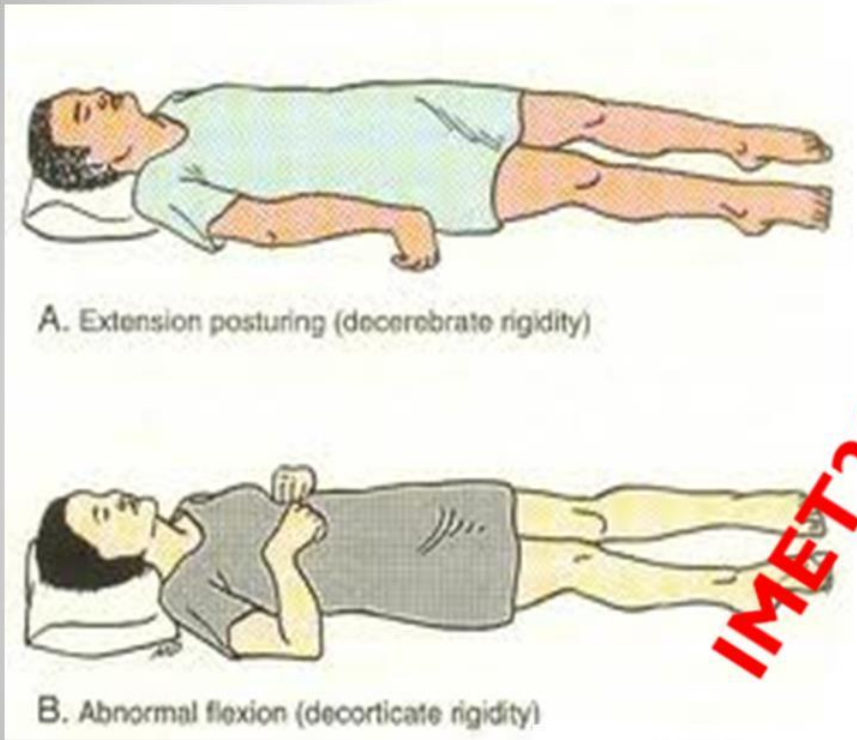
Neurological Exam on a Comatose Pt.

- **Posture, limb movements and muscle tone**
  - Observe patient's posture
  - Look for tremor, myoclonus, asterixis

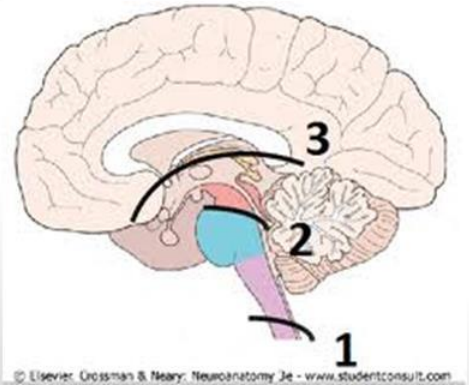
- If no spontaneous movement:
  - **apply a painful stimulus**
  - **classify** the resulting **movement**

- Test **muscle tone** (hypotonia, rigidity, spasticity)
- **Meningeal signs**

Decerebrate & Decorticate Rigidity

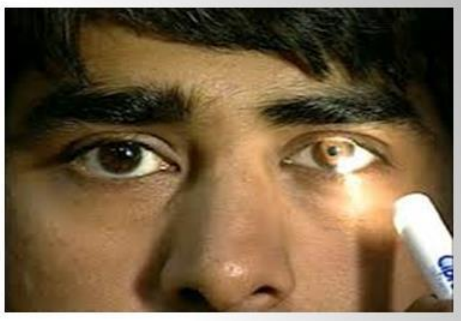


- **Decerebrate:** lesion in the **upper brain stem** (midbrain or pons)
- **Decorticate**: **destructive** lesion **in cortico-spinal tracts**



Neurological Exam on Comatose Pt.

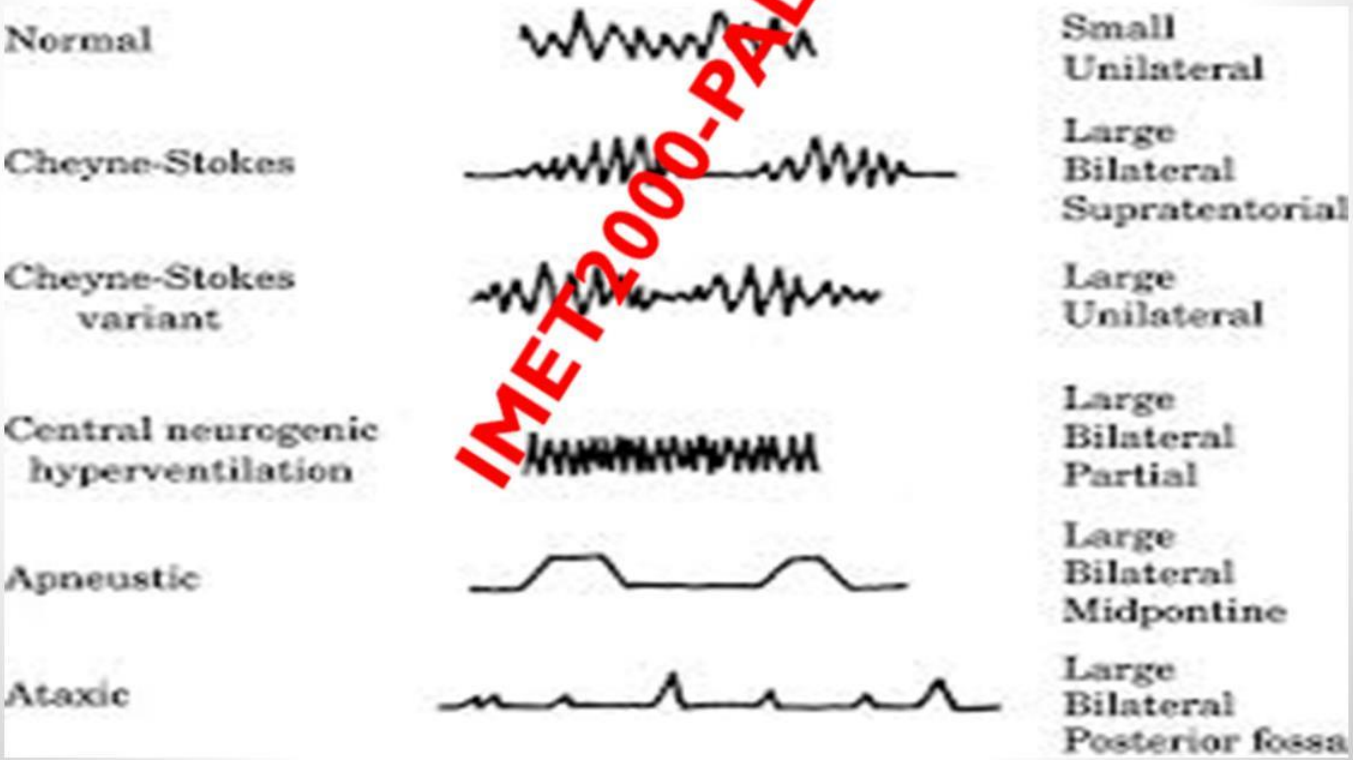
- **Reflexes:**
  - corneal
  - pupillary
  - gag
  - deep tendon reflexes
  - Babinski



brain-stem reflexes

Neurological Exam on a Comatose Pt.

- **Vital signs** and **respiration**



Neurological Exam on a Comatose Pt.

General physical examination:

- Unusual odors?
- Skin abnormalities?
- Trauma / scalp and scull?
- Inspection for **facial asymmetry**
- Ears, nose, mouth and throat
- Heart, lungs & abdomen

Management of Coma

- 1. Maintain **ventilation** / oxygenation
- 2. Start **venous line** and **draw blood**
- 3. Maintain **circulation**
- 4. Control **seizures**
- 5. Reduce **intracranial pressure**
- 6. Maintain **temperature**
- 7. Control **hypoglycemia**

1. Maintain Ventilation

- Insert **oral airway**
- **Clean** oropharyngeal **secretion**
- Insert cuffed **endotracheal tube** if apnea, hypoventilation or liable to aspirate
- **Mechanical ventilation** if apnea or increased intracranial pressure

2. Draw Blood for:

- CBC, blood sugar, MP
- BUN, creatinine, electrolytes
- Blood gases
- ALT, AST
- Give **100 ml 25% glucose with 100 mg of thiamine**

3. Maintain Circulation

- If **hypotension**:

  - Normalsaline if hyperglycemia or suspected stroke / diabetes

  - Dextrose-saline or isolyte if undiagnosed

  - Vasopressor if low systolic BP in spite of fluid

- If **hypertension**: beta-blocker, nitroglycerin or nitropruside

4. Control Seizure

- Lorazepam 4 mg or **Midazolam** 5 mg i.v. slowly
- **Diazepam** 10 -20 mg i.v. slowly
- **Pheytoin** 15-20 mg/kg 50 mg/min i.v.
- **Phenobarb** 15-20 mg/kg 50 mg/min i.v.
- Sodium Valproate 200-400 mg i.v.

5. Reduce Intacranial Pressure

- **Mannitol** 20% 1gr/kg i.v. fast
- **Hyperventilation** to bring pCO2 25-30 mmHg

6. Maintain Temperature

- **Hyperthermia**: tepid sponging, chlorpromazine
- **Hypothermia**: heating blanket

7. Control Hypoglycemia

Further Investigations

- **CSF** investigation if neck stiffness without localizing sign
- **Brain CT / MRI** if focal neurological sign or before LP
- **EEG** if SSPE suspected; in case of encephalitis or metabolic encephalopathy
- **Chest X-ray** for aspiration, chest infection, heart size
- **Abdomen U/S** for liver, kidney, bladder

Further Treatment and Prognosis

- Depends on the established diagnosis and results of investigations
- **Large proportion** of comatose patients **recover**
- **Untreated coma** may lead to further **brain damage**

Coma Subsequent Management

- Eye / mouth / skin
- Fluids / feeding / electrolytes
- Respiration / Circulation
- Urine / Bowel
- Stimulation
- Infection

Altered Mental Status / Recap.

- **History:**
  - Associated seizure activity
  - Recent trauma or infection
  - Illicit drug use
  - Exposure to toxic substances

- **Neurological Examination:**
  - Mental status exam
  - Pupillary reaction
  - Corneal reflex
  - Gag reflex
  - Posturing or motor asymmetry
  - Babinski