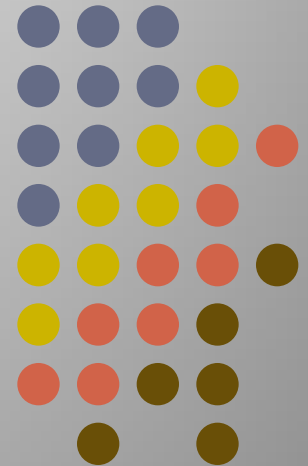


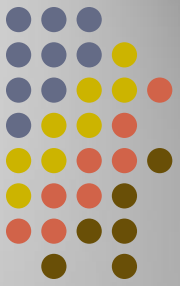
# Disorders of consciousness

---

Dr. Kifah Alubaidy



# Consciousness

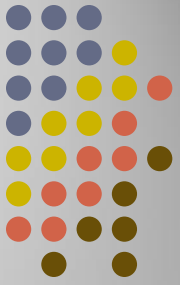


Consciousness is defined by two fundamental elements:

- Awareness
- Arousal

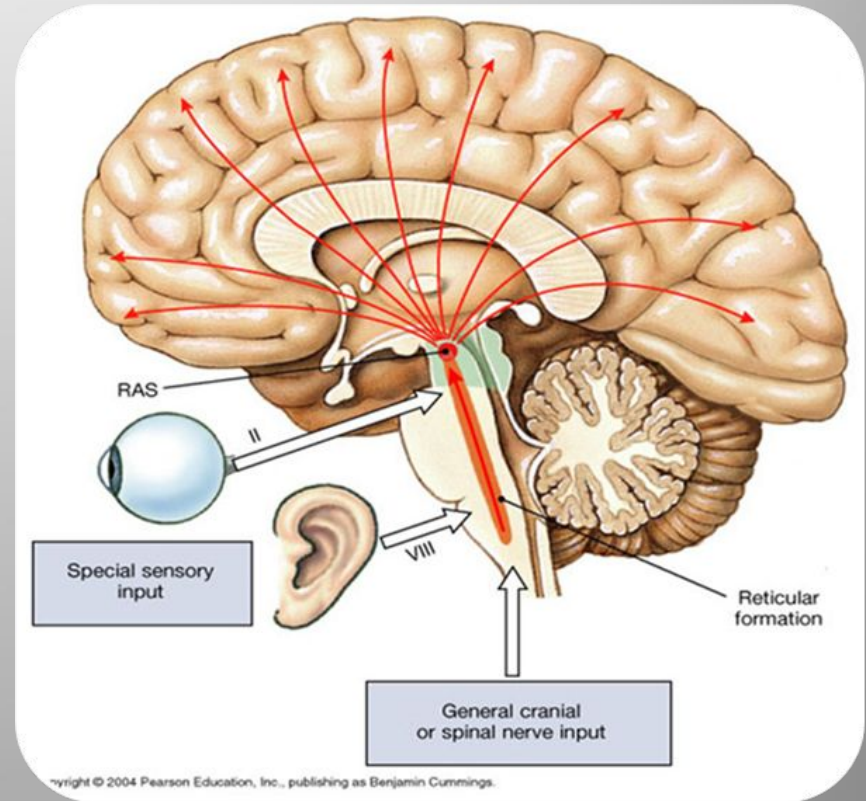


# Arousal

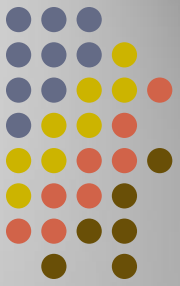


Is primitive responsiveness to the world (involuntary responses to stimuli).

maintained by the reticular activating system



# Awareness

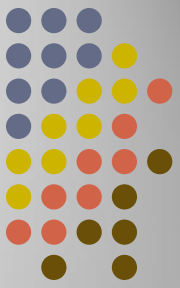


The receiving and processing all the information consciously & allow the orientation to self and outside world.

Awareness is regulated by cortical areas within the cerebral hemispheres



# Brain metabolic demands



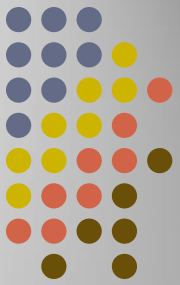
The adult human brain weighs about (1,300-1,400 g). It accounts 2% of the total body weight.

Cerebral neurons are fully dependent on cerebral blood flow (20% of cardiac output)

- CBF 55 ml/100 g brain /min
- Brain glucose need 55 mg/ 100 g brain /min
- Brain O<sub>2</sub> consumption 3.5 ml/ 100 g brain /min

## Brain stores

- Glucose/ 2 min
- O<sub>2</sub> / 8-10 sec



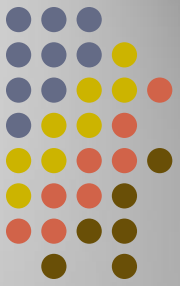
# Level of consciousness

**Drowsiness**

**Light sleep**

- Easy aroused
- Persistent of alertness for brief period

# Level of consciousness

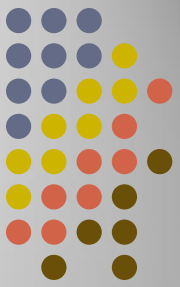


## Stupor

Partial degree of arousability

Awaked only by  
vigorous stimuli

Have motor behavior  
to avoid vigorous  
stimuli



# Level of consciousness

## Coma

profound state of loss of consciousness

deep sleep like state the patient cannot be awakened

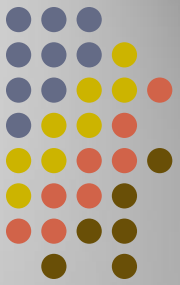
fails to respond normally to pain or light

does not have sleep-wake cycles

does not take voluntary actions



# Acute confusional state



---

## Confusion alteration of :

---

Orientation

---

Concentration & attention

---

Memory & thinking

---

Level of consciousness awake or drowsy

---

---

## Delirium is confusion with

---

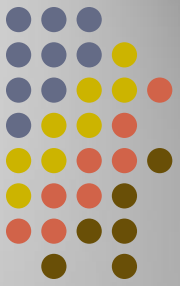
Psychomotor changes

hyperactive, hypoactive, or mixed with hallucinations and delusions

---

Autonomic hyperactivity

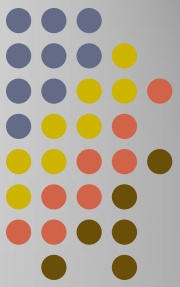
# Vegetative state



Awake with  
non  
responsive  
state

- Eye open
- Yawning, coughing, swallowing
- No meaningful responses to stimuli
- Respiratory and autonomic functions are retained
- Pathology; Extensive damage in both cerebral hemispheres (**preserve brainstem function**)
- Main causes are cardiac arrest & head injury

# Vegetative state



# Akinetic mutism

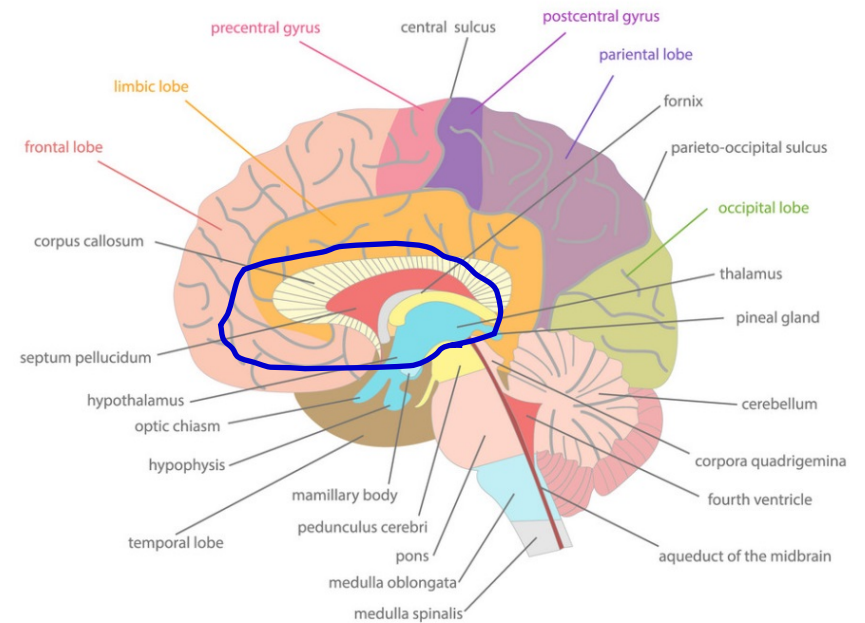
Partially or fully awake

Able to think & make impressions

Immobile and mute

Pathology; Damage of thalamus, frontal lobe or hydrocephalus

Abulia is mild form with mental & physical slowness an inability to initiate activity



# Locked-in state

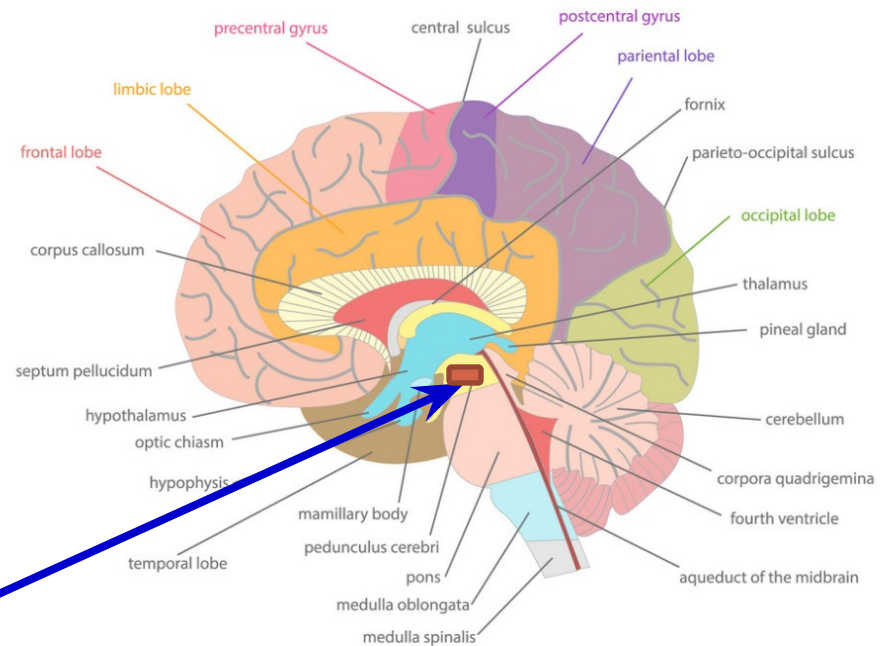
Awake

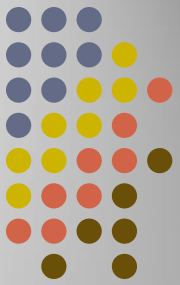
Quadriplegia, anarthria & dysphagia

Normal vertical eye movements & eyelid elevation.

Normal pupillary reactions

Pathology; Damage to the ventral pons ( CVA )





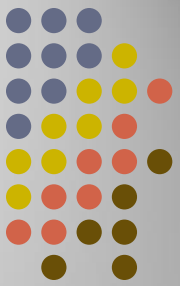
# Causes of impaired consciousness



Damage to RAS

Distraction of large portion of both cerebral hemispheres

Suppression of reticulo-cerebral function by drugs, toxins and metabolic derangements



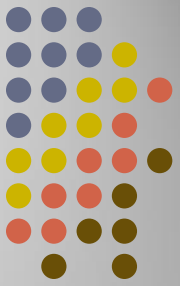
# Metabolic disorders

coma or  
Acute  
confusional  
state by  
widespread  
cortical  
dysfunction  
without FND

- Altering neuronal excitability
- Interrupting O<sub>2</sub> & energy delivery
- False neurotransmitter
- Brain edema

# Causes

## Metabolic and endocrine disorders



Hyponatraemia

Hypocalcemia / Hypercalcaemia

Hypoglycemia or hyperglycemia & Diabetic ketoacidosis

Hypo or Hyperthyroidism and Hyperparathyroidism

Cushing syndrome

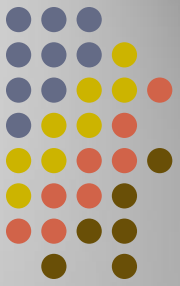
Anemia, Dehydration and malnutrition

Vitamin deficiencies: B12, thiamine, folate, niacin



# Causes

## Organ failure



Azotemia

hypercapnia or Hypoxia

Hepatic failure

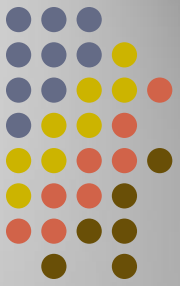
Heart failure

Hyperammonemia

Hypertensive encephalopathy

# Causes

## Intoxication



○ Sedatives, antipsychotic,  
antidepressants

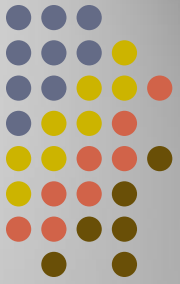
○ Anticholinergic, antiepileptic

○ Prednisone, dexamethasone  
can cause paradoxical confusion

○ Polypharmacy

○ Alcohol intoxication / withdrawal

# Causes Infection



Chest infection

Urinary infection

Septicemia

Viral illness

Meningitis

Encephalitis

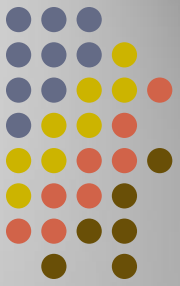
Cerebral abscess

Subdural empyema

AIDS

# Causes

## Vascular



Cerebral hemorrhage

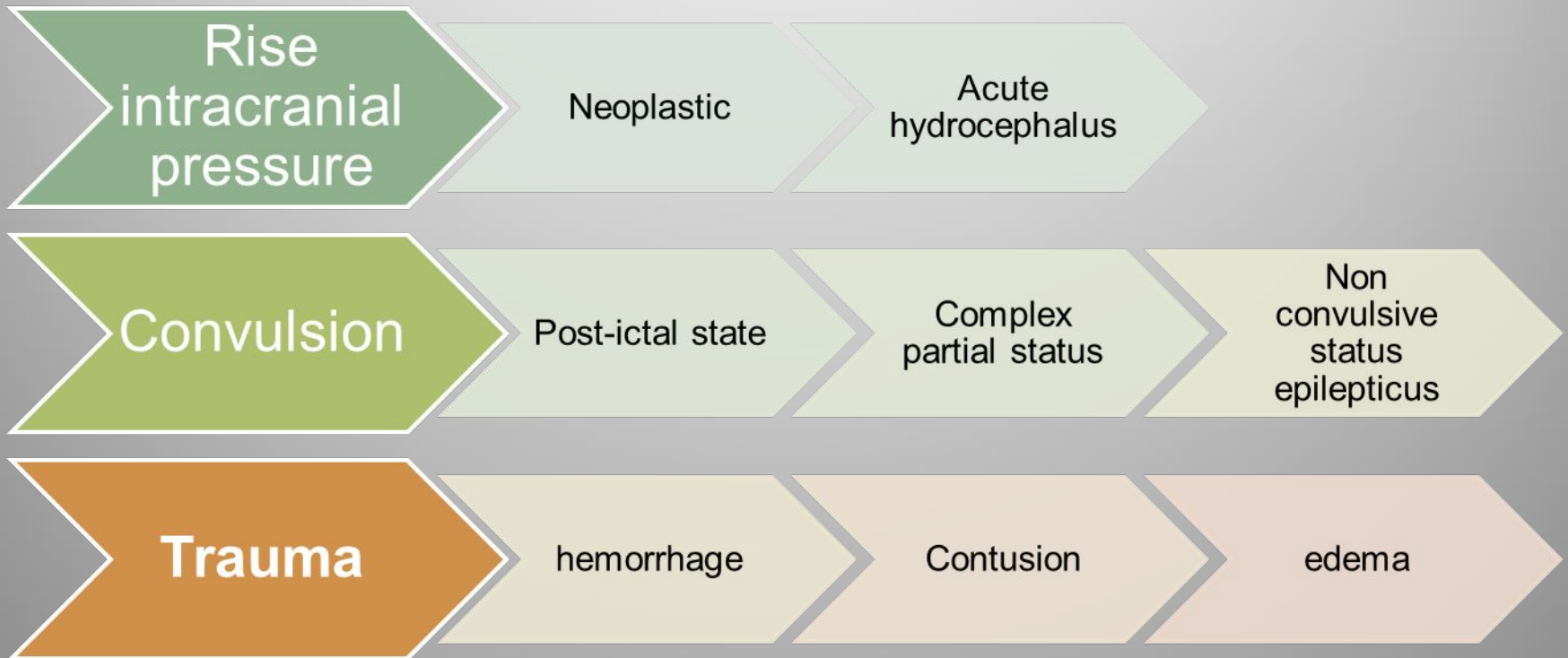
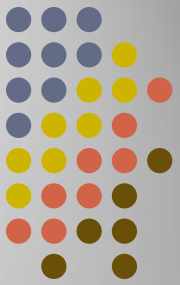
Cerebral infarction

Subarachnoid hemorrhage

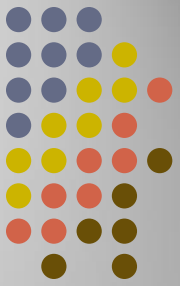
Vasculitis

Cerebral venous sinus thrombosis

# Causes



# HISTORY



Trauma, cardiac arrest, or reported drug ingestion

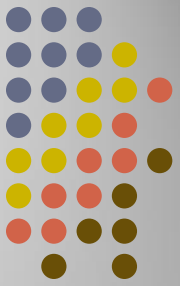
Antecedent symptoms: confusion, weakness, headache, Fever, seizures, dizziness, double vision, or vomiting

Medications, illicit drugs, or alcohol

Chronic liver, kidney, lung, heart disease

# Examination

## Vital signs



### Fever

Infections

Anticholinergic intoxication

Withdrawal of ethanol

Withdrawal of sedative

### Hypothermia

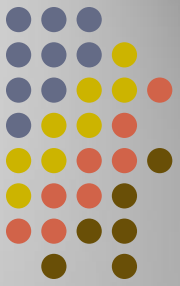
Ethanol or sedative intoxication

Hypothyroidism

Hepatic encephalopathy

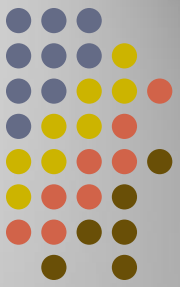
hypoglycemia

# Hypertention



- Hypertensive encephalopathy
- Ethanol or sedative Withdrawal
- Anticholinergic intoxication
- Subarchinoid hemorrhage
- Sympathomimetic intoxication
- rapid rise in intracranial pressure





# Hypotension

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Alcohol or barbiturate intoxication

---

Internal hemorrhage

---

Myocardial infarction

---

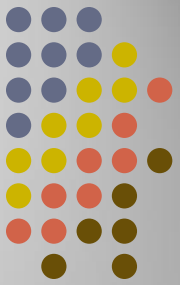
Sepsis

---

Profound hypothyroidism

---

Addisonian crisis.



# Vital signs

## Tachycardia

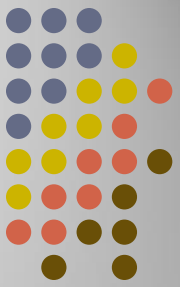
Ethanol or sedative  
Withdrawal

Anticholinergic  
intoxication

Thyrotoxicosis

## Bradycardia

Hypothyroidism



# Vital signs

## Hypoventilation

Hyperglycemia

Hepatic encephalopathy

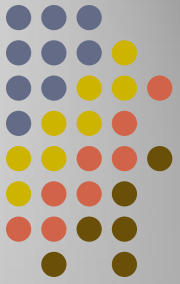
## Hyperventilation

Pulmonary encephalopathy

Opioid intoxication

Ethanol or sedative intoxication

# Meningeal irritation signs



- CNS infection
- Intracranial hemorrhage
- Coning

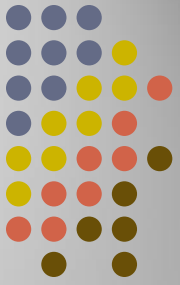
## **Brudzinski's sign**

- neck stiffness
- involuntary flexion of hips and knees when flexing neck is positive sign for meningeal irritation

STEDMANS



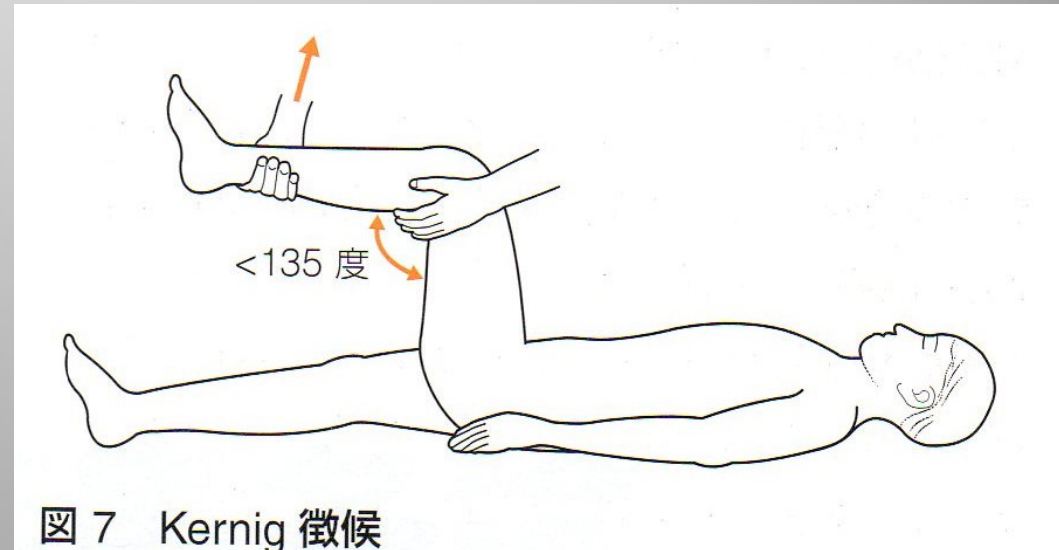
# Meningeal irritation signs



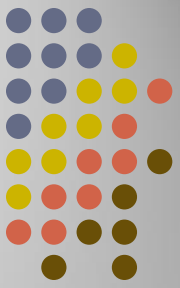
Neck stiffness



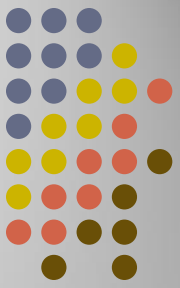
Kernig's sign



# Fundi papilledema



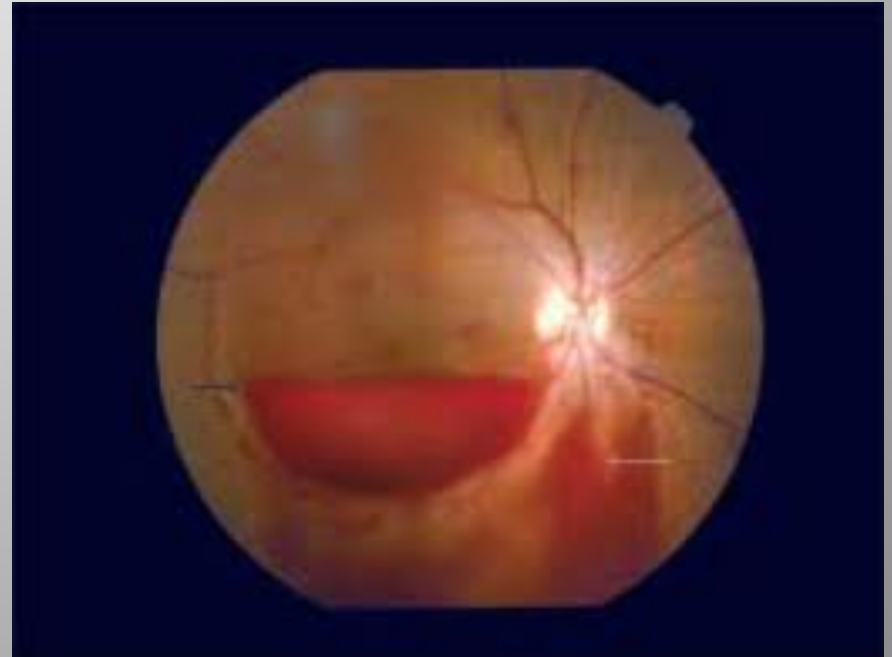
# Fundi

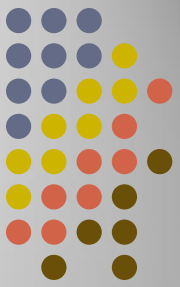


retinopathy



hemorrhage





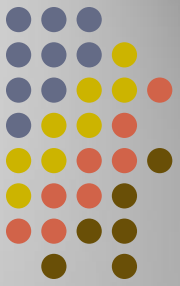
# Glasgow Coma Scale

## Eye Opening

- Spontaneous 4
- To loud voice 3
- To pain 2
- None 1



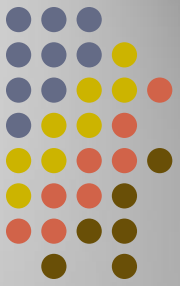
# Glasgow Coma Scale



## Verbal Response

- Oriented 5
- Confused & Disoriented 4
- Inappropriate words 3
- Incomprehensible words 2
- None 1

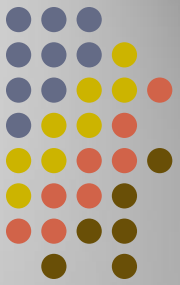
# Glasgow Coma Scale



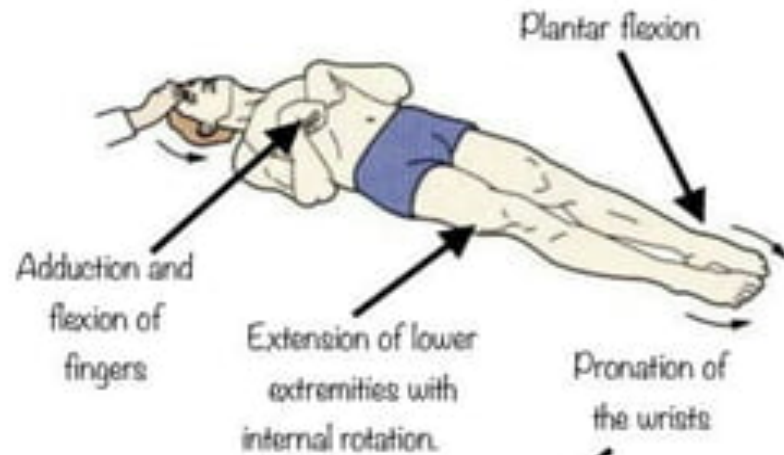
## Motor Response

- Obeys commands 6
- Localizes pain 5
- Withdraws from pain 4
- Abnormal flexion posturing 3
- Extensor posturing 2
- None 1

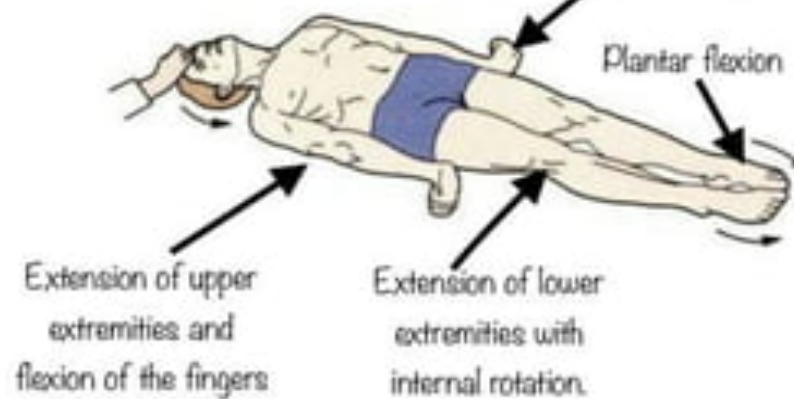
# Posture



Upper midbrain damage  
Decorticate posture

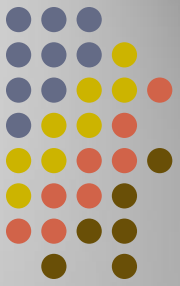


Upper pontine damage  
Decerebrate posture



# brainstem function examination

## Essential to localization of the lesion in coma

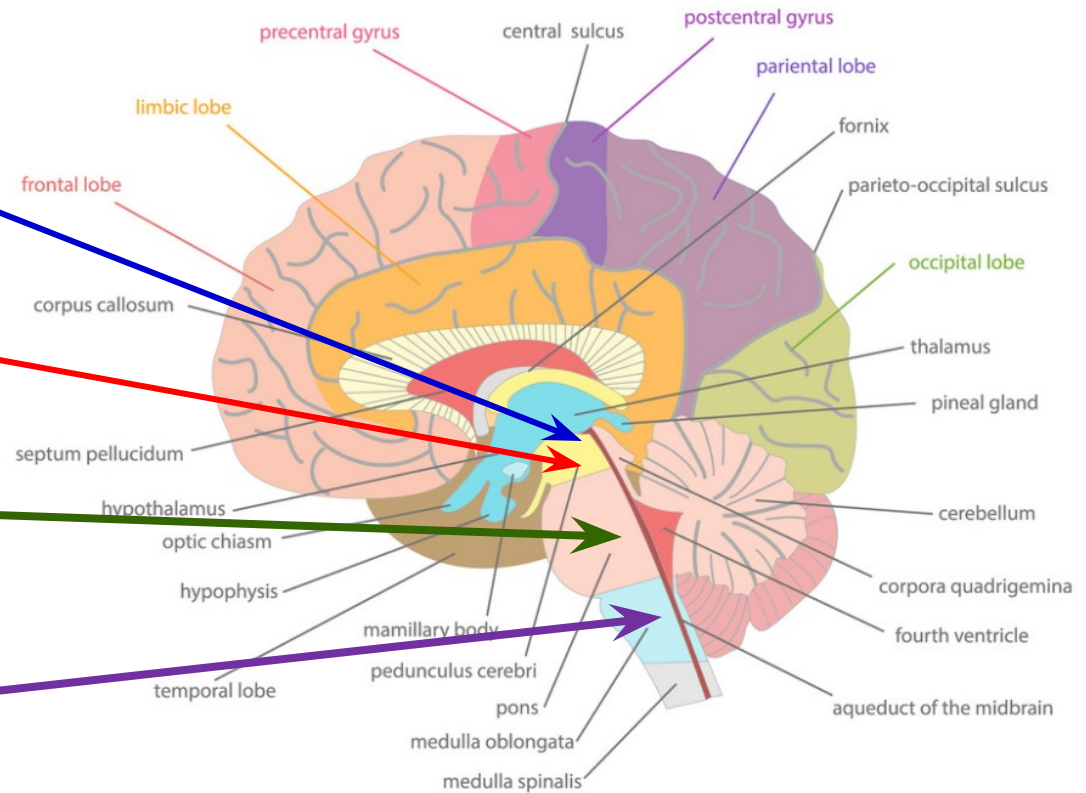


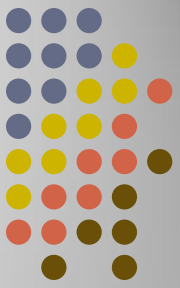
pupillary size and reaction to light

corneal responses

spontaneous and elicited eye movements,

respiratory pattern.





# pupillary size and reaction to light

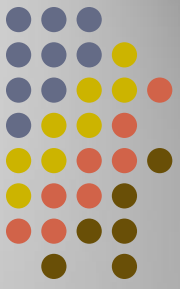
## loss of light reflex

- **fixed dilated pupils**
  - **mid-point pupils**
  - **pin-point pupils**
- central diencephalic herniation**  
**midbrain lesion**  
**pontine hemorrhage**

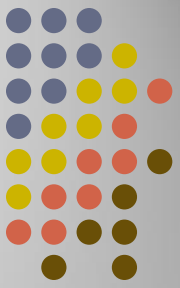
metabolic coma / pupils relatively small with brisk light reflexes

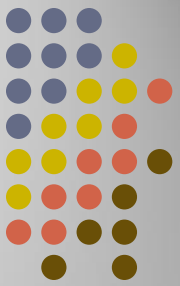
most drug intoxications / small and sluggishly reactive pupils

# pupils



# pupils





# spontaneous eye movements

## Conjugate deviation of eyes,

Cortical lesion The eyes look toward lesion and away from hemiparesis

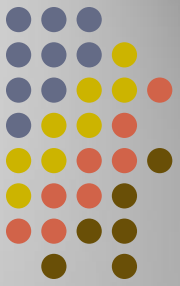
Brainstem lesion the eyes look to the hemiparesis.

Depression of eyes below meridian seen with damage at level of midbrain and in metabolic coma

Spontaneous nystagmus reflects interaction between the oculovestibular system and the cerebral cortex and thus is rare in coma



# spontaneous eye movements

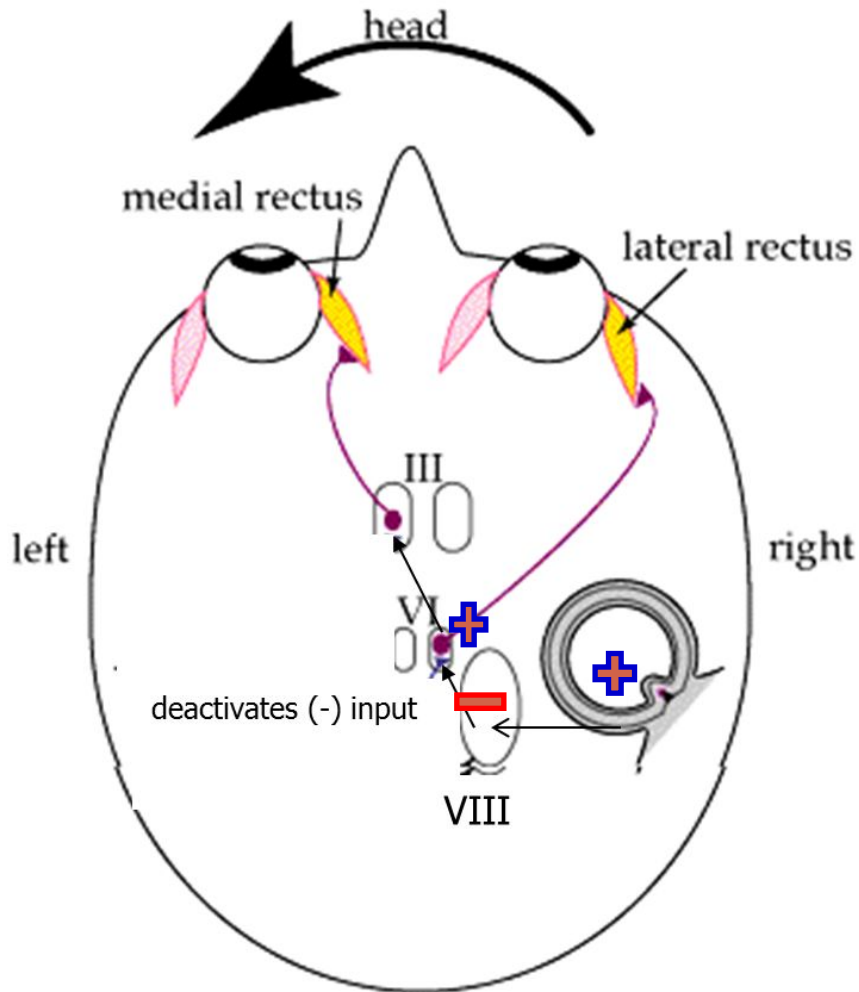
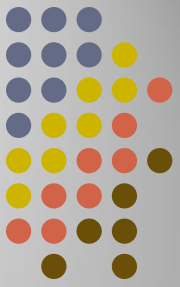


conjugate deviation

depression of eyes

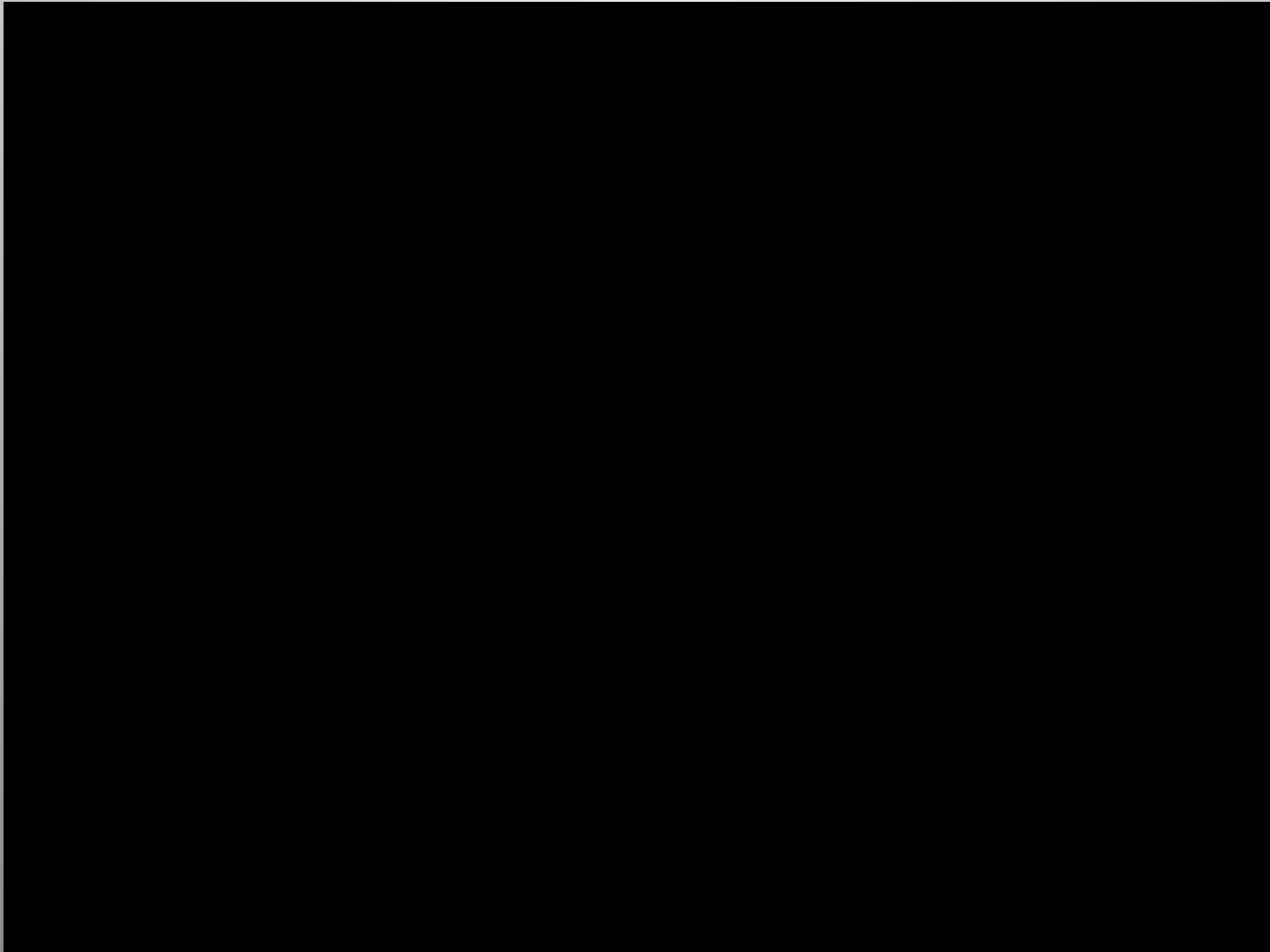
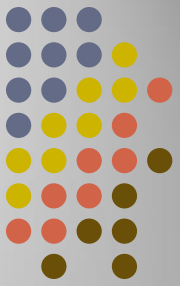


# Reflexive eye movements

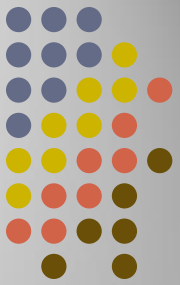


- maintains gaze on a target despite head movement
- The semicircular canal detects motion and deactivates the ipsilateral vestibular nucleus which inhibits the ipsilateral VI
- results in eyes turning opposite to the head turn

# Reflexive eye movements



# oculovestibular reflex

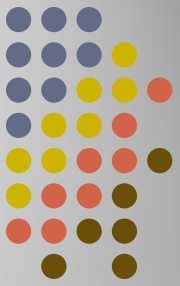


Response is nystagmus with quick phase to contralateral side. normally suppressed in the awake patient.

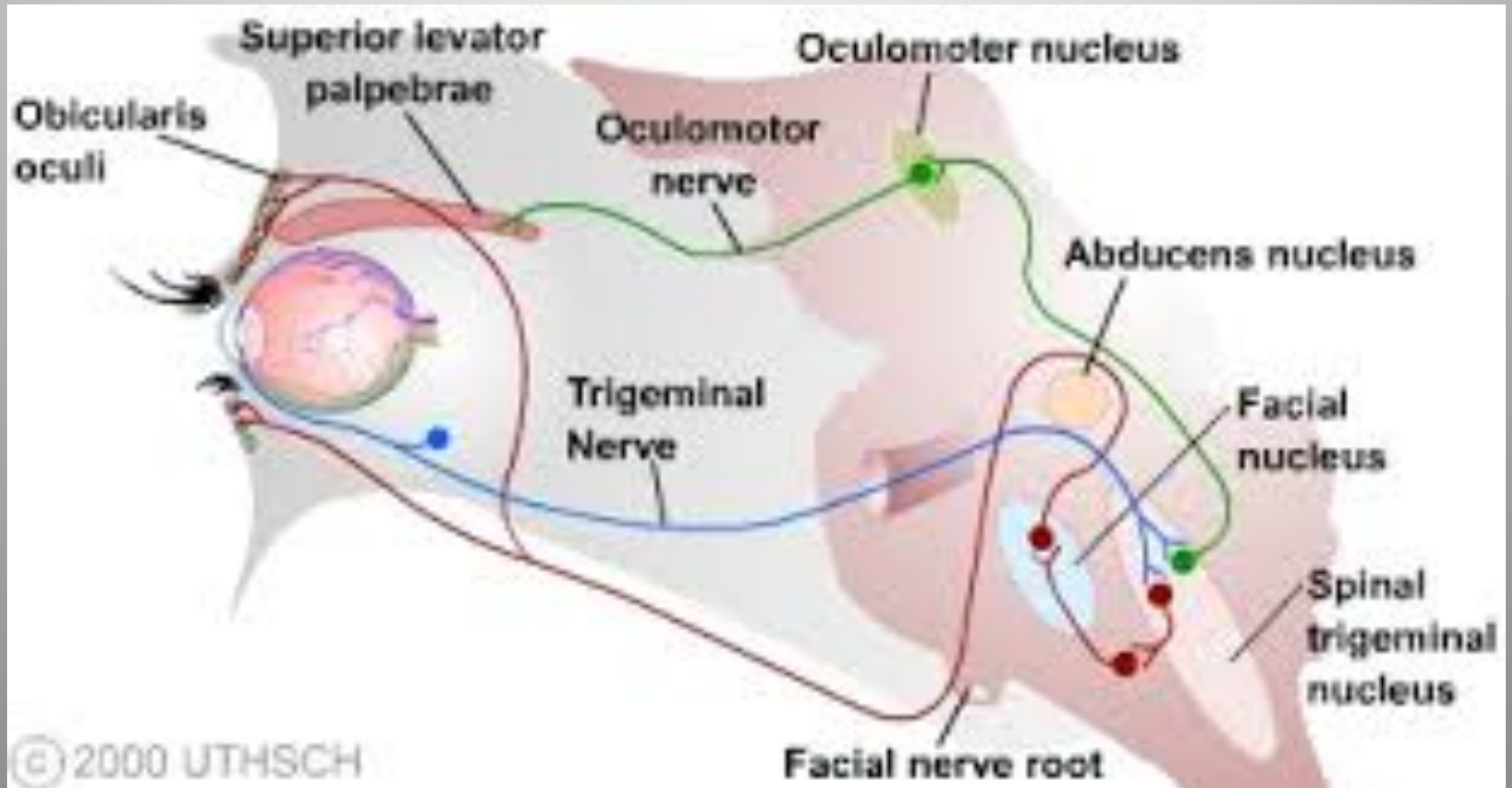
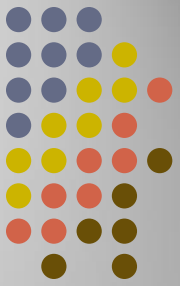
Lost in patients with pontine lesion

Tonic response with conjugate movement of eye towards stimulated side indicates an intact pons suggesting a cortical cause for coma

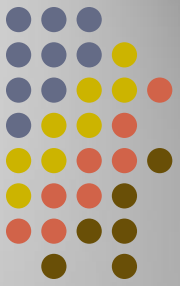
# Corneal reflex



# Corneal reflex



# Breathing



Periodic (Cheyne-Stokes) breathing is common in patients with brainstem lesion & metabolic encephalopathy

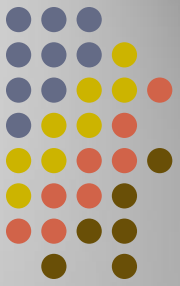
smell of breath: ketones, alcohol, uraemic foetor

# Periodic breathing





# Motor

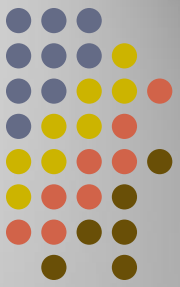


Metabolic  
encephalopathy

drug  
intoxication

Tremors  
Myoclonus  
Rigidity & Fits

# Autonomic response



Hypotension unresponsive to volume expansion

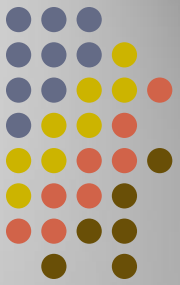
Metabolic

drug (barbiturates or opiates)

Myxoedema

Addisonian crisis

# Coma



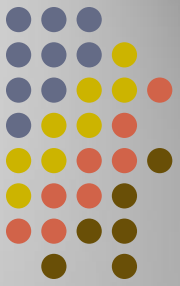
## CNS

- Focal neurological deficit
- Meningeal irritation sign
- High intracranial pressure
- Periodic (Cheyne-Stokes) breathing
- convulsion

## Metabolic toxic

- Hypothermia
- Hypo- hypertension
- Tachycardia or bradycardia.
- Regular breathing
- Tremors Myoclonus Rigidity
- Normal size pupils normal light reflexes

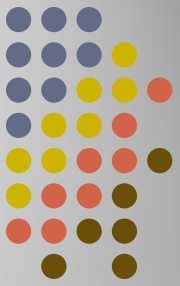
# Investigations



## Blood tests

- CBP,ESR,RFT,LFT,RBS,S Ca, S Na
- Thyroid FT
- Vit B12
- Copper studies
- ANA, anti-ds DNA, VDRL
- Neoplastic & Paraneoplastic markers

# Investigations



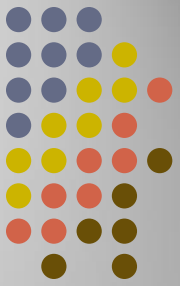
CNS

- CT brain
- EEG
- Lumbar puncture

Others

- ECG & CXR
- Arterial blood gases
- Infection screen
- Drugs & toxin screen

# Management



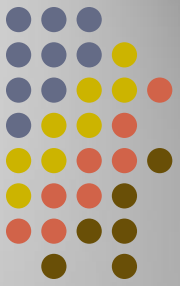
ABCs

Nalaxone  
flumazenil  
reverse the  
effect of narcotic.

Thiamine 100  
mg

50% Dextrose  
50ml

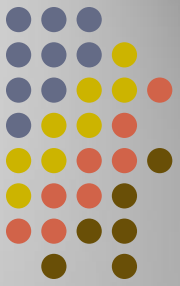
# Management



The immediate goal in a comatose patient is prevention of further nervous system damage.

- **Correcte** Hypotension, hypoglycemia, hypercalcemia, hypoxia, hypercapnia, and hyperthermia
- **Oropharyngeal airway** is adequate to keep the pharynx open in a drowsy patient who is breathing normally.
- **Tracheal intubation** is indicated if there is apnea, upper airway obstruction, hypoventilation, or emesis, or if the patient is liable to aspirate because of coma.
- **Mechanical ventilation** is required if there is hypoventilation or a need to induce hypocapnia in order to lower ICP.

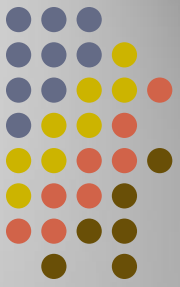
# Management

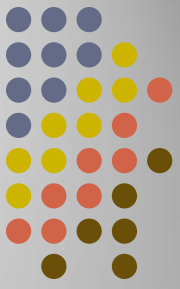


- **Sodium** should be normalized at appropriate rates. In hyponatremia, too-rapid correction may cause central pontine myelinolysis and paraparesis.
- **Magnesium** and **phosphorus** should be replaced
- **Empiric antibiotic** treatment should be given while awaiting culture results if septicemia is suspected
- Benzodiazepines should be administered in delirium tremens
- **The specific etiology needs to be found and treated appropriately.**

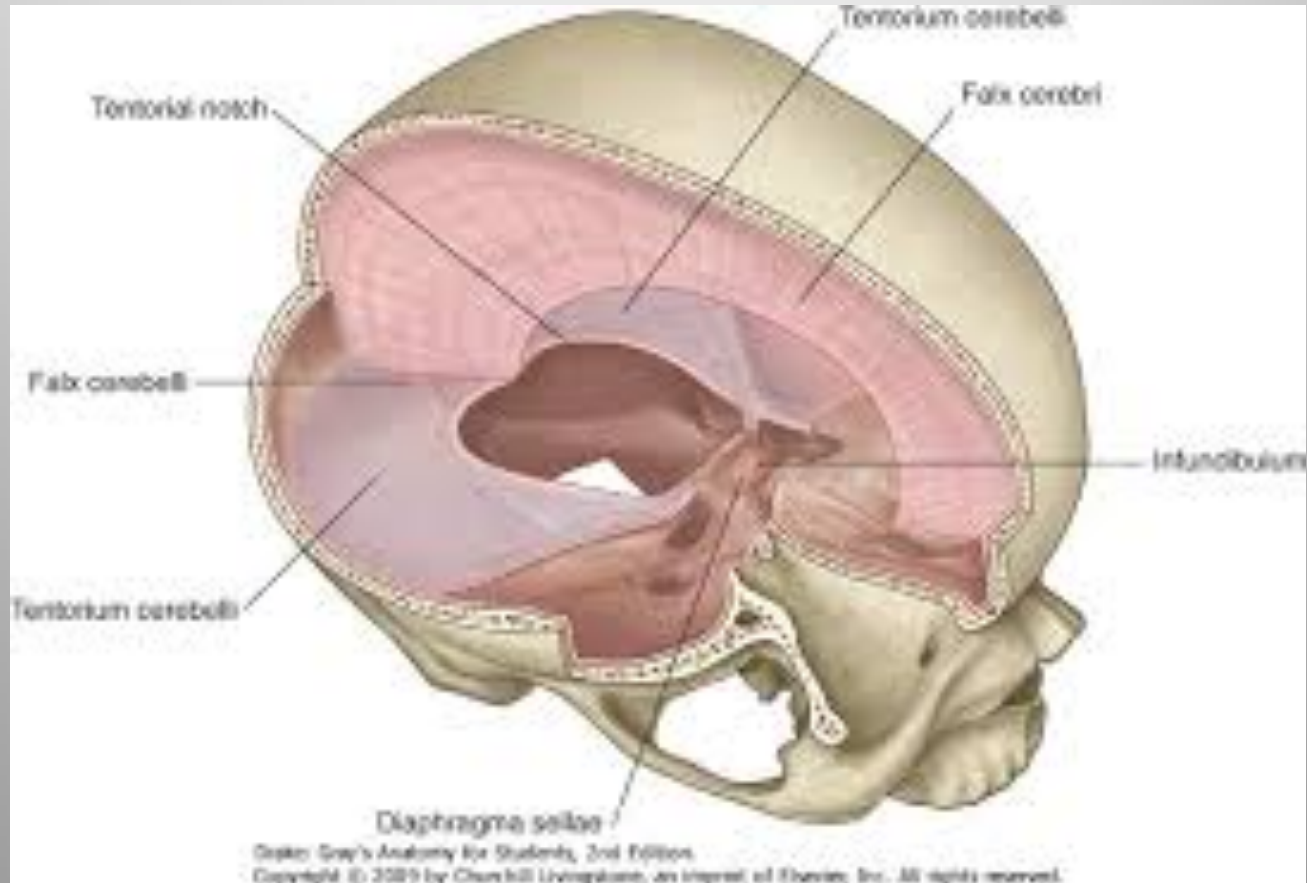


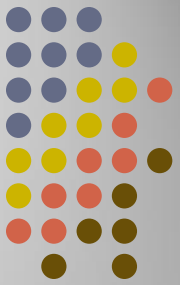
# Intracranial mass





# Intracranial mass





# Intracranial mass

## FND

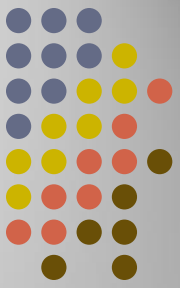
- Local distraction
- Mass effect (compression )

## false localizing signs

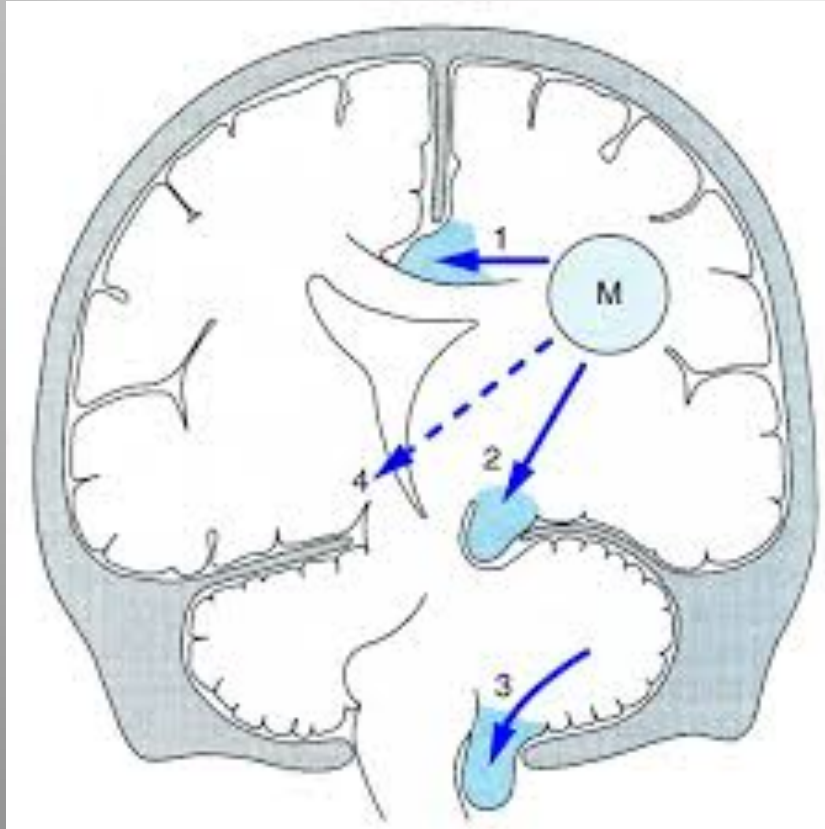
- Ipsilateral oculomotor nerve palsy
- Hemiplegia contralateral to the original hemiplegia

## Herniation

- displacement of brain tissue to other compartment lead to coma & false localizing signs by compression of brain structure away from the mass

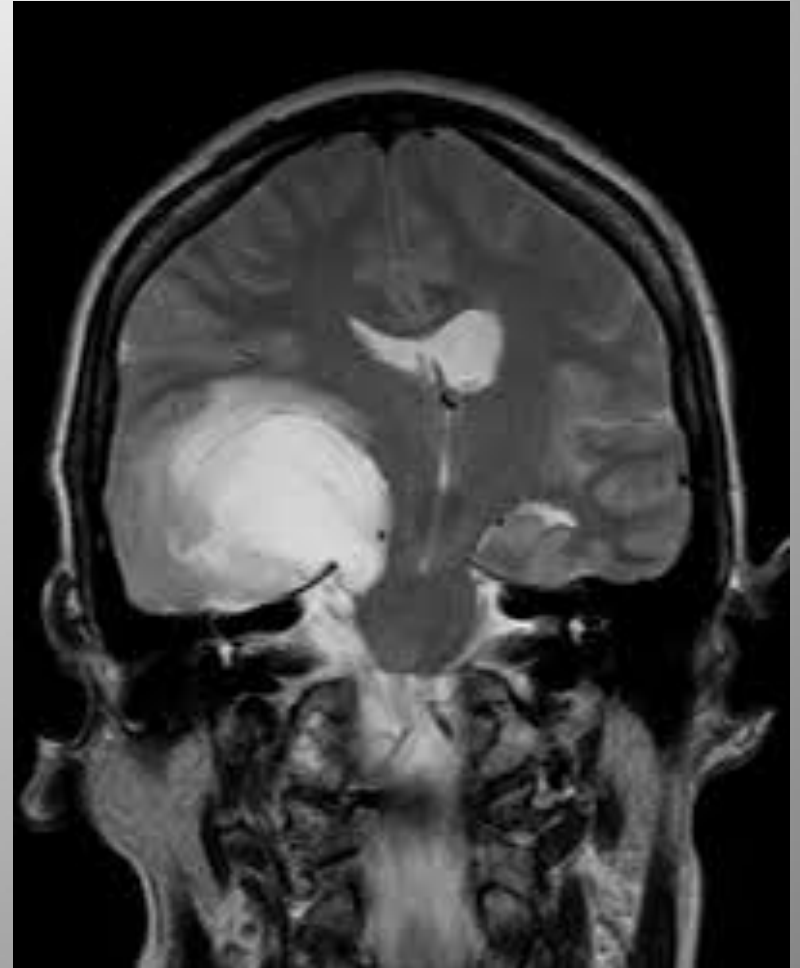
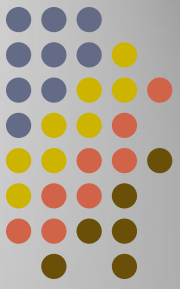


# Intracranial mass

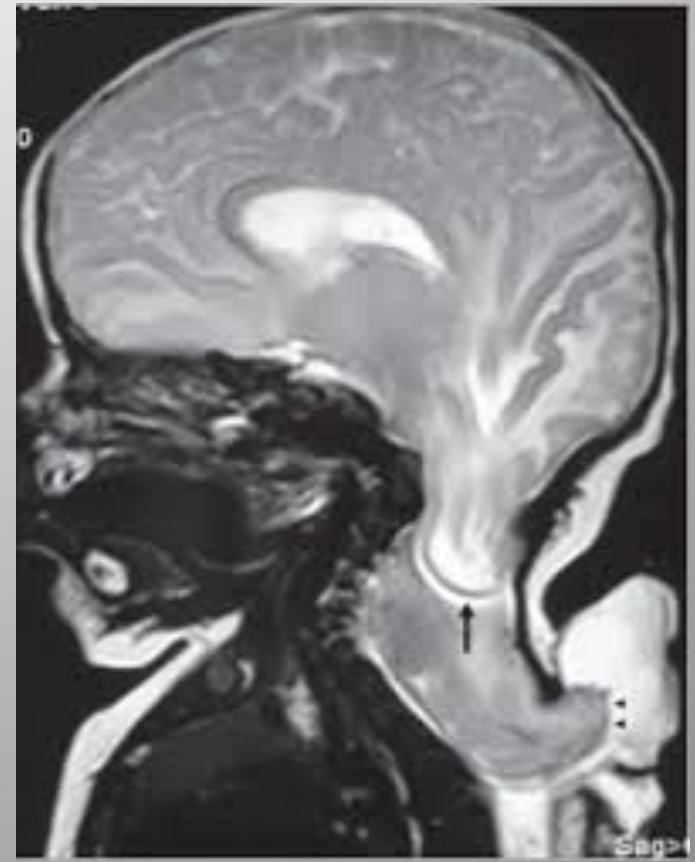
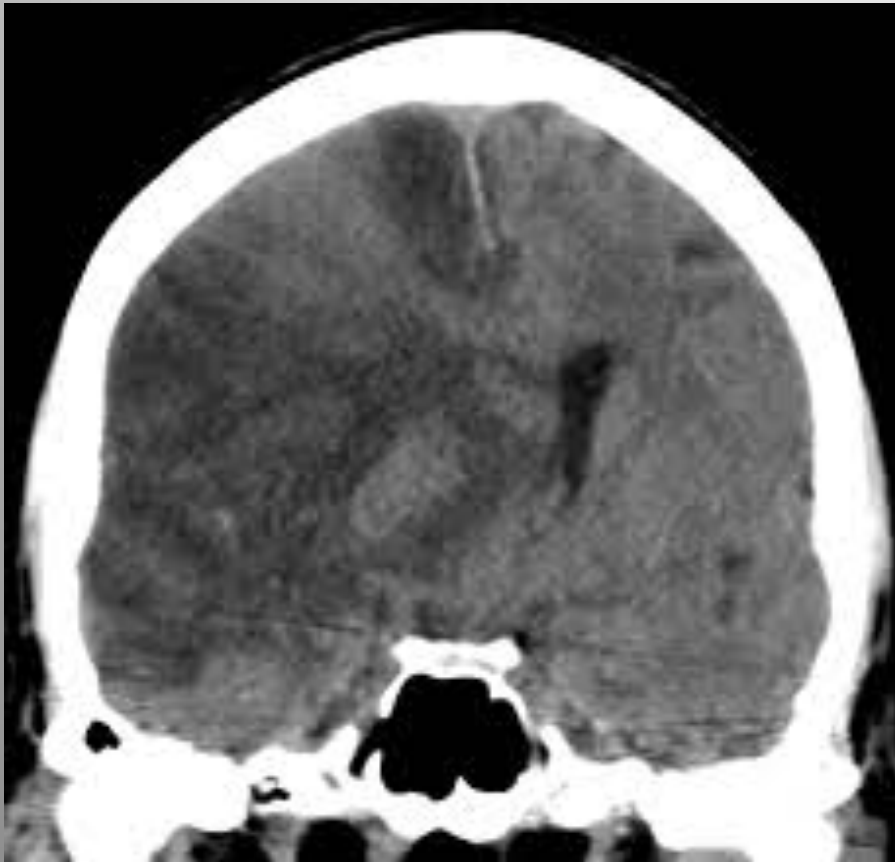
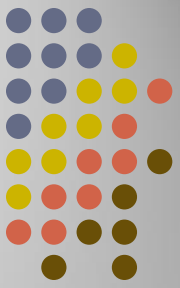


1. Transfalcine
2. Uncal transtentorial
3. Central transtentorial
4. foraminal herniation

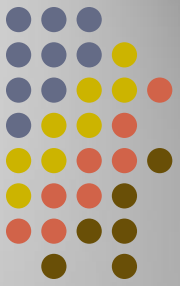
# Intracranial mass



# Intracranial mass



# Management



## Relieving the cause

- surgical decompression of mass lesion
- steroids to reduce vasogenic oedema
- shunt procedure to relieve hydrocephalus

## Supportive treatment

- maintenance of fluid balance
- blood pressure control
- head elevation
- diuretics & mannitol.
- Intensive care support

# Status Epilepticus

Any seizure lasting longer than 5 minutes or two or more sequential seizures without full recovery of consciousness between seizures

overall mortality rate was 22%

The seizure activity results in pathologic changes in neurons after 30 minutes; after 60 minutes, neurons begin to die by excitatory neurotransmitters



# Status Epilepticus

seizures >  
5 mins

- diazepam 10 mg IV or rectally
- lorazepam 4 mg IV

No  
response

- Phenytoin: 15 mg/kg at 50 mg/min
- Fosphenytoin: 15 mg/kg at 100 mg/min
- Phenobarbital: 10 mg/kg at 100 mg/min

after 30–  
60 mins

- Transfer to intensive care for intubation, ventilation and general anaesthesia using propofol or thiopental

# Status epilepticus

Cardiac monitor and pulse oximetry Monitor neurological condition, blood pressure, respiration; check blood gases

EEG monitor

Respiratory insufficiency is an indication for intubation from the start

# Once status controlled

Start longer-term anticonvulsant medication with one of:

- Sodium valproate 10 mg/kg IV over 3–5 mins, then 800–2000 mg/day
- Phenytoin give loading dose (if not already used as above) of 15 mg/kg, infuse at < 50 mg/min, then 300 mg/day
- Carbamazepine 400 mg by nasogastric tube, then 400–1200 mg/day