# Approach to Neurological Examination

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# Basics of examination

- Neurological examination starts during the history taking itself.
- Hypotheses about lesion localization, neurological systems involved, and pathology of the disorder can be formed once the history is complete.
- The neurologist then uses the examination findings to confirm the localization of the lesion before trying to determine its cause.
- The full neurological examination is too lengthy to perform in practice.
- This approach should confirm, refute, or modify the initial hypotheses of disease location and causation derived from the history.
- Both the presence and absence of abnormalities may be of diagnostic importance.

# Basics of examination

The screening neurological examination is designed for quick evaluation of the mental status, cranial nerves, motor system (strength, muscle tone, presence of involuntary movements, and postures), coordination, gait and balance, tendon reflexes, and sensation.

**We couldn’t perform a neurologic exam since the patient could not cooperate.**

The initial question is whether the disease is in the brain, spinal cord, peripheral nerves, neuromuscular junctions, or muscles.

# Screening Neurologic Exam

- More complex functions are tested first; if these are performed well, then it may not be necessary to test the component functions.
- Eg- the patient who can walk heel to toe (tandem gait) does not have a significant disturbance of the cerebellum or of joint position sensation.
- Patient who can do a pushup, rise from the floor without using the hands, and walk on toes and heels will have normal limb strength when each muscle group is individually tested.
- Asking the patient to hold the arms extended in supination in front of the body with the eyes open allows evaluation of strength and posture.
- It also may reveal involuntary movements such as tremor, dystonia, myoclonus, or chorea. A weak arm is expected to show a downward or pronator drift.
- Repeating the maneuver with the eyes closed allows assessment of joint position sensation.

# Screening Neurologic Exam

- Of importance, the screening neurological examination may miss important neurological abnormalities.
- Moreover, what is abnormal in young adults may be normal in the elderly. Loss of the ankle reflex and loss of vibration sense at the big toe are common findings in patients older than 70 years.
- Isolated deviation of the tongue or uvula to one side and minor asymmetries of reflexes or sensation – soft signs
- At the end of the neurological examination, the abnormal physical signs should be classified as definitely abnormal (hard signs) or equivocally abnormal (soft signs).

# Screening Neurologic Exam

- Loss of pain and temperature sensation on one half of the body, excluding the face, indicates a lesion of the contralateral spinothalamic tract in the high cervical spinal cord.

- A left sixth nerve palsy, with weakness of left face and right limbs, points to a left pontine lesion.

- A left homonymous hemianopia indicates a lesion in the right optic tract, optic radiations, or occipital cortex.

# Mini-Mental State Examination (MMSE)

Patient's Name: _____ Date: _____

***Instructions:*** ***Ask the questions in the order listed. Score one point for each correct response within each question or activity.***

| Maximum Score | Patient's Score | Questions |
|---|---|---|
| 5 | | "What is the year? Season? Date? Day of the week? Month?" |
| 5 | | "Where are we now: State? County? Town/city? Hospital? Floor?" |
| 3 | | The examiner names three unrelated objects clearly and slowly, then asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible. Number of trials: _____ |
| 5 | | "I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...) Stop after five answers.<br>Alternative: "Spell WORLD backwards." (D-L-R-O-W) |
| 3 | | "Earlier I told you the names of three things. Can you tell me what those were?" |
| 2 | | Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them. |
| 1 | | "Repeat the phrase: 'No ifs, ands, or buts.'" |
| 3 | | "Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.) |
| 1 | | "Please read this and do what it says." (Written instruction is "Close your eyes.") |
| 1 | | "Make up and write a sentence about anything." (This sentence must contain a noun and a verb.) |
| 1 | | "Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)<br>  |
| 30 | | TOTAL |

(Adapted from Rovner & Folstein, 1987)

# Examination


- Mental Status Assessed while recording the history

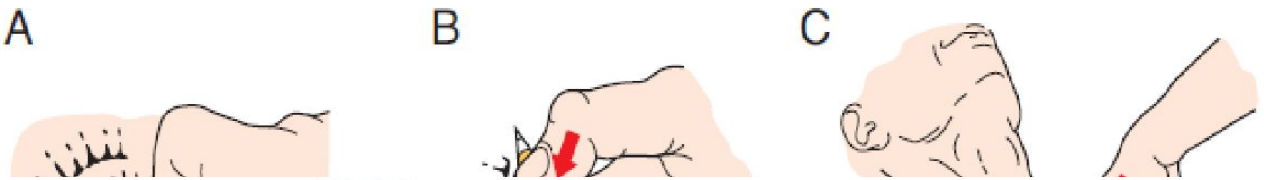
- **Cranial nerves**
- CN I Should be tested in all persons who experience spontaneous loss of smell, in patients suspected to have Parkinson disease, and in patients who have suffered head injury
- CN II Each eye:
    - Visual acuity with glasses/contacts
    - Visual fields by confrontation
    - Swinging flashlight to detect relative afferent pupillary defect
    - Fundoscopy
- CN III, IV, VI:
    - Horizontal and vertical eye movements (saccades, pursuit, vestibulo-ocular reflex)
    - Pupillary symmetry and reactivity
    - Presence of nystagmus or other ocular oscillations

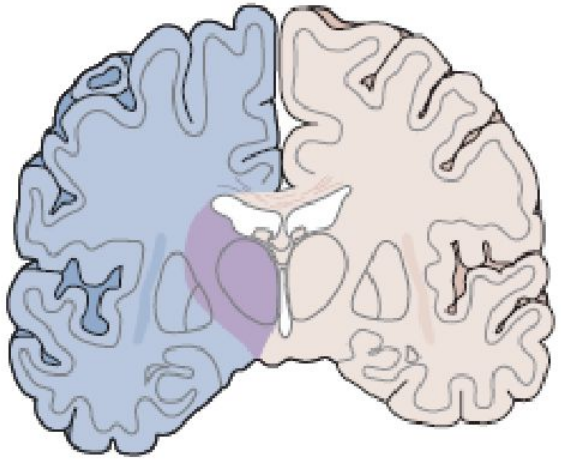
- CN V Pinprick and touch sensation on face, corneal reflex Jaw strength

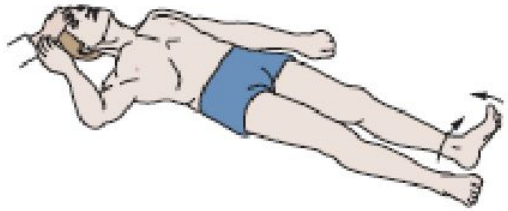
- CN VII Close eyes, show teeth

# Examination

- CN VIII Perception of whispered voice in each ear or rubbing of fingers; if hearing is impaired, look in external auditory canals, and use tuning fork for lateralization and bone-versus-air sound conduction
- CN IX, X Palate lifts in midline, gag reflex present
- CN XI Shrug shoulders
- CN XII Protrude tongue





## Eye Response

4 = eyes open spontaneously
3 = eye opening to verbal con
2 = eye opening to pain
1 = no eye opening

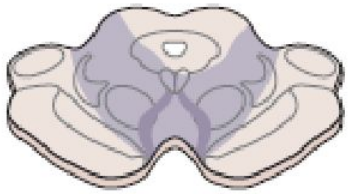
## Motor Response

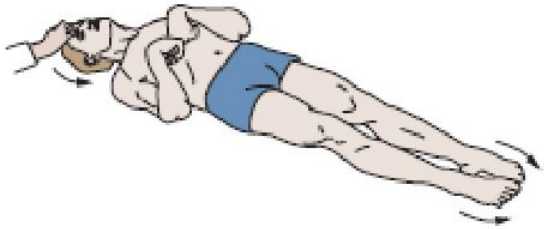
6 = obeys commands
5 = localizing pain
4 = withdrawal from pain
3 = flexion response to pain
2 = extension response to pai
1 = no motor response

## Verbal Response

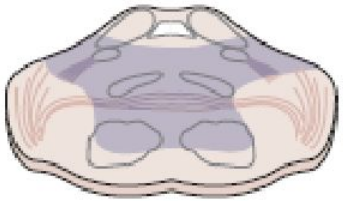
5 = oriented
4 = confused
3 = inappropriate words
2 = incomprehensible sounds
1 = no verbal response

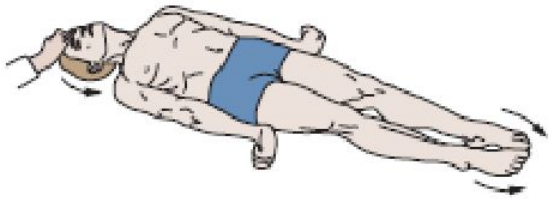
B Upper midbrain damage



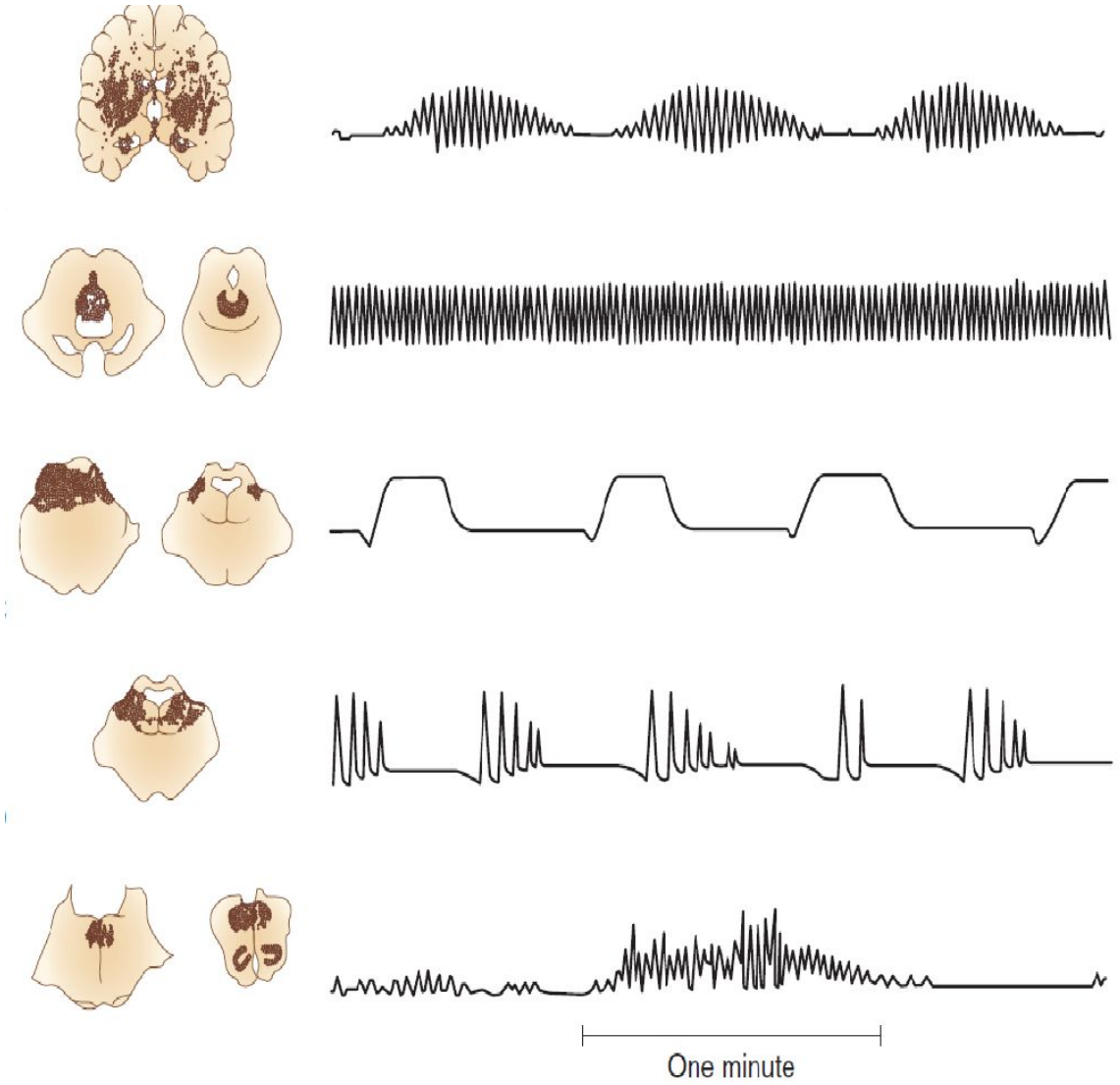


C Upper pontine damage

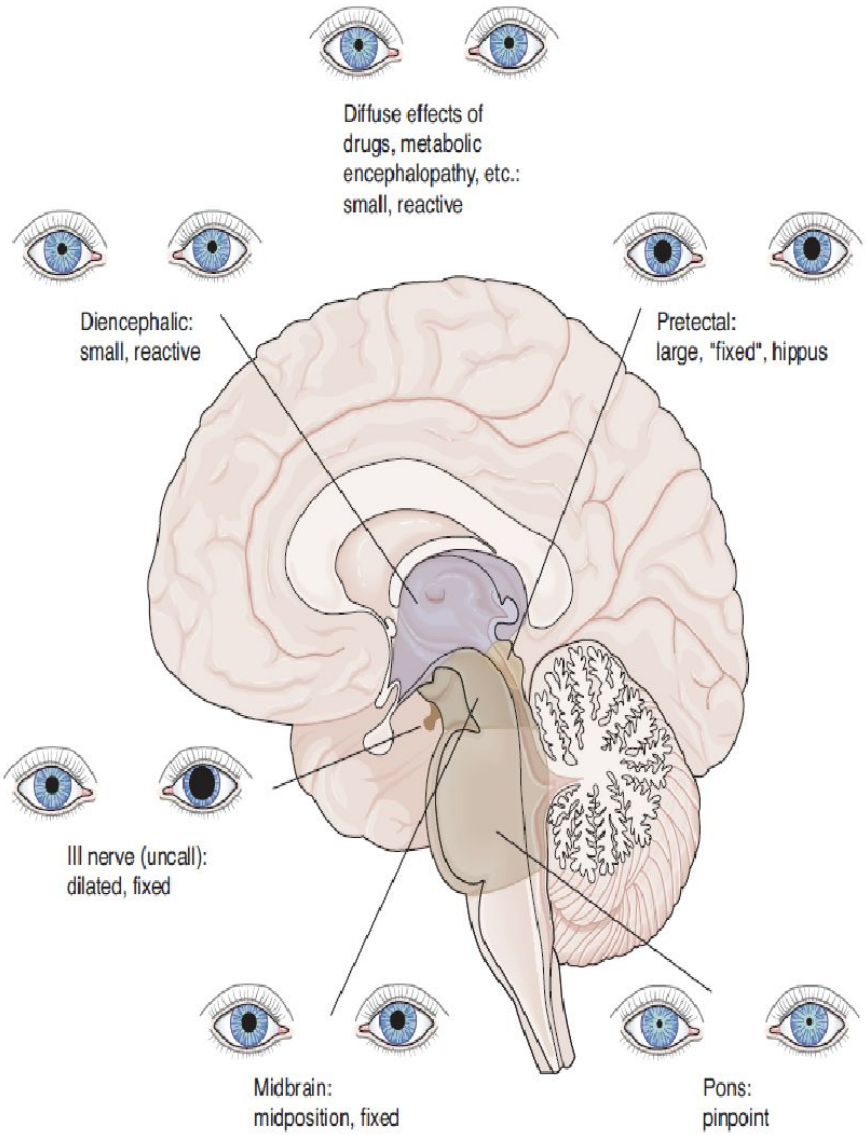




# Patterns of breathing



# Pupillary examination



(i) Coma with meningism (with or without intact brainstem function and lateralizing signs)

(ii) Coma with signs of focal brainstem dysfunction

(iii) Coma with intact brainstem function and lateralizing signs

(iv) Coma with intact brainstem function, no meningism, and no lateralizing signs

# Coma with meningism

- Infection: meningitis, encephalitis, malaria, HIV disease
- Vascular: subarachnoid haemorrhage

# Coma with signs of focal brainstem dysfunction

- Herniation syndromes
- Intrinsic brainstem dysfunction

- Vascular: vertebrobasilar occlusion, dissection, haemorrhage, arteriovenous malformation
- Mass lesions: posterior fossa tumours, abscesses, tuberculosis.
- Traumatic brain injury
- Advanced metabolic/ toxic encephalopathy
- Others: central pontine myelinolysis,brainstem encephalitis, leukoencephalopathy

# Coma with intact brainstem function and lateralizing signs

- Vascular:
  - Infarction - ischaemic, thromboembolic, or hypoperfusion
  - Haemorrhage - epidural, subdural, subarachnoid, and intracerebral
  - Vasculitis
  - Venous thrombosis
- Traumatic brain injury
- Infection: brain abscess, subdural empyema, Creutzfeldt–Jakob disease, malaria, HIV disease, endocarditis
- Cerebral neoplasm

# Coma with intact brainstem function, no meningism, and no lateralizing signs

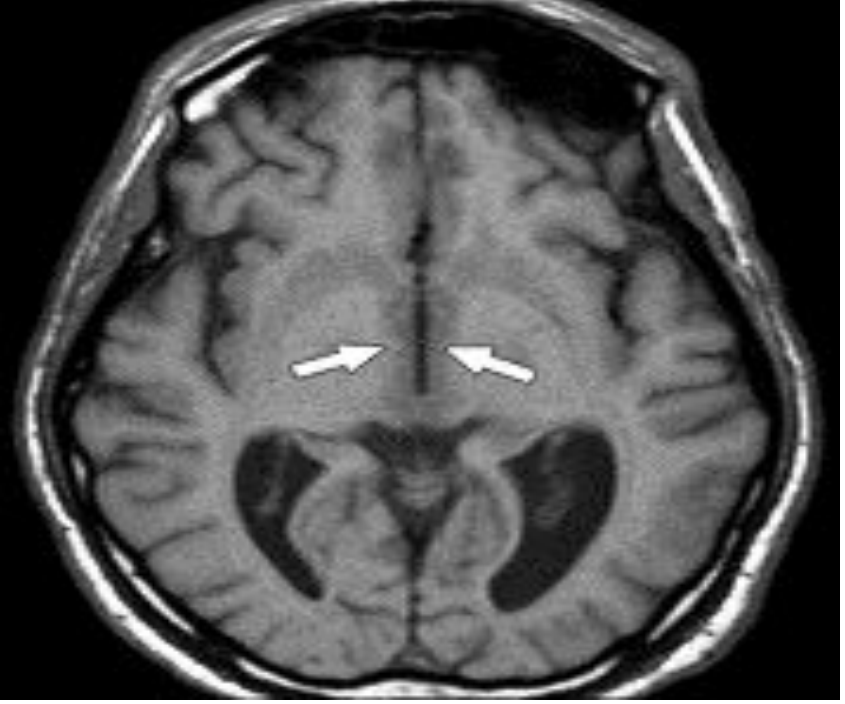
- Alcohol
- Drugs and toxins: sedatives, anaesthetic agents, opioids, amphetamines, barbiturates, salicylates, organophosphorus poisoning, carbon monoxide, methanol, lead, cyanide
- Seizure: convulsive and non-convulsive status epilepticus, post-ictal states
- Hypoxic: ischaemic encephalopathy
- Endocrine: hypo and hyperthyroidism, Addison's disease, hypopituitarism, diabetic ketoacidosis, hyperosmolar non-ketotic coma
- Metabolic: hypo and hyperglycaemia, sepsis, electrolyte disturbance—hypo and hypernatraemia, hypercalcaemia, hepatic failure, encephalopathy, renal failure
- Respiratory: hypoxaemia, hypercarbia
- Other: porphyria, Reye's syndrome, mitochondrial disease, inborn errors of metabolism  NMDA-receptor antibody encephalitis

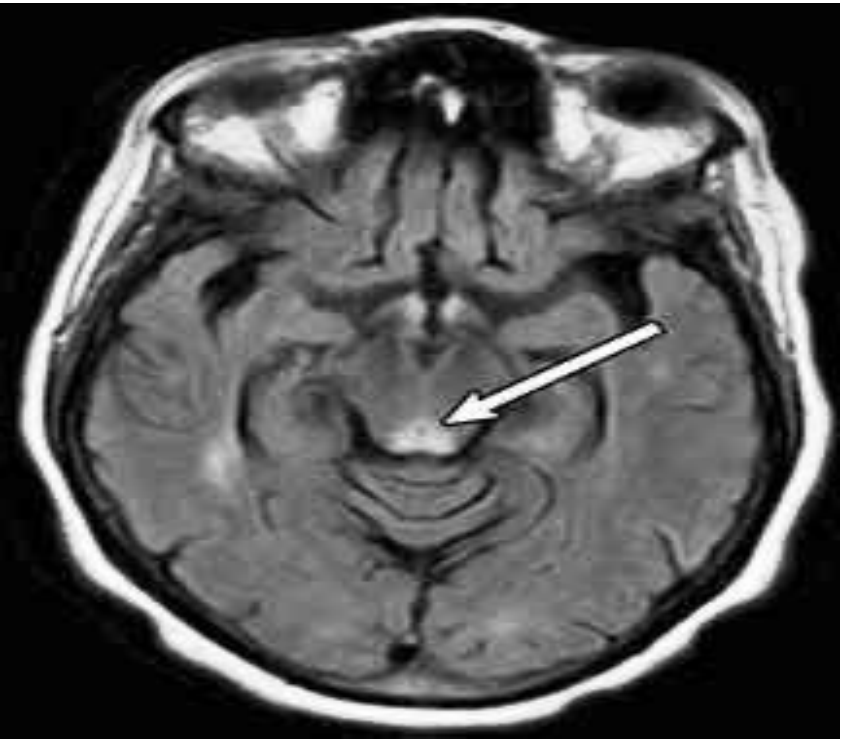
Table 1–1 **Cause of Stupor or Coma in 500 Patients Initially Diagnosed as "Coma of Unknown Etiology"***

| | Subtotals |
|---|---|
| I. Supratentorial lesions | 101 |
| A. Rhinencephalic and subcortical destructive lesions | 2 |
| 1. Thalamic infarcts | 2 |
| B. Supratentorial mass lesions | 99 |
| 1. Hemorrhage | 76 |
| a. Intracerebral | 44 |
| (1) Hypertensive | 36 |
| (2) Vascular anomaly | 5 |
| (3) Other | 3 |
| b. Epidural | 4 |
| c. Subdural | 26 |
| d. Pituitary apoplexy | 2 |
| 2. Infarction | 9 |
| [illegible] | [illegible] |
| II. Subtentorial lesions | 65 |
| A. Compressive lesions | 12 |
| 1. Cerebellar hemorrhage | 5 |
| 2. Posterior fossa subdural or extradural hemorrhage | 1 |
| 3. Cerebellar infarct | 2 |
| 4. Cerebellar tumor | 3 |
| 5. Cerebellar abscess | 1 |
| 6. Basilar aneurysm | 0 |
| B. Destructive or ischemic lesions | 53 |
| 1. Pontine hemorrhage | 11 |
| 2. Brainstem infarct | 40 |
| 3. Basilar migraine | 1 |
| 4. Brainstem demyelination | 1 |
| III. Diffuse and/or metabolic brain dysfunction | 326 |
| A. Diffuse intrinsic disorders of brain | 38 |
| 1. "Encephalitis" or encephalomyelitis | 14 |
| 2. Subarachnoid hemorrhage | 13 |
| 3. Concussion, nonconvulsive seizures, and postictal states | 9 |
| 4. Primary neuronal disorders | 2 |
| [illegible] | [illegible] |
| 9. Drug poisons | 149 |
| 10. Ionic and acid-base disorders | 12 |
| 11. Temperature regulation | 9 |
| 12. Mixed or nonspecific metabolic coma | 1 |
| IV. Psychiatric "coma" | 8 |
| A. Conversion reactions | 4 |
| B. Depression | 2 |
| C. Catatonic stupor | 2 |

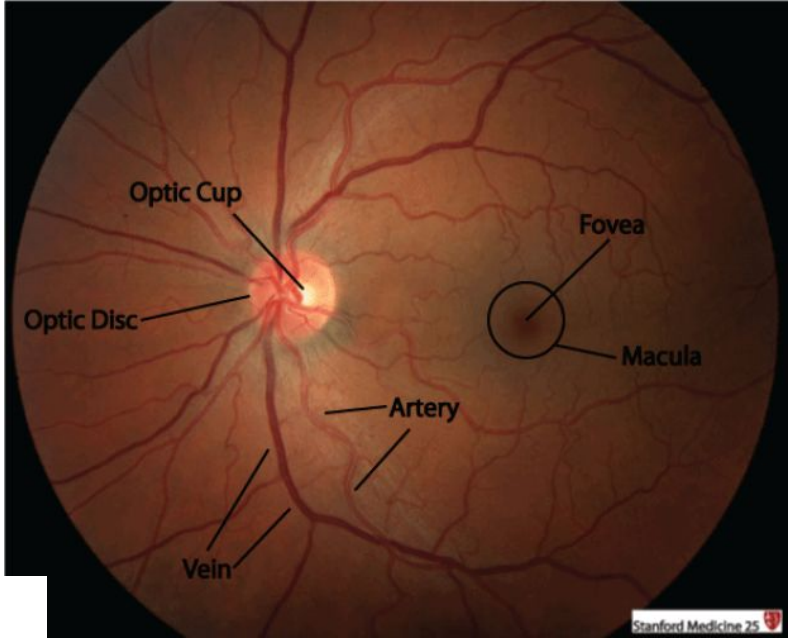
**More than half of all cases of coma are due to diffuse and metabolic brain dysfunction**

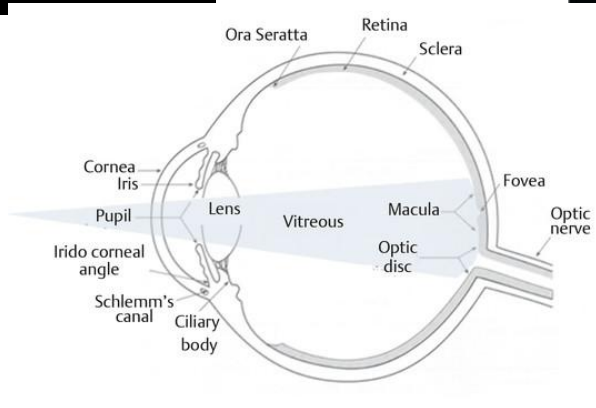
*Plum and Posner's diagnosis of stupor and coma, 2007*





35 year lady, 2 months gestation presented with h/o acute onset of memory disturbances. She was previously diagnosed with hyperemesis gravidarum and managed accordingly.


Optic Cup
Fovea
Optic Disc
Macula
Artery
Vein
Stanford Medicine 25

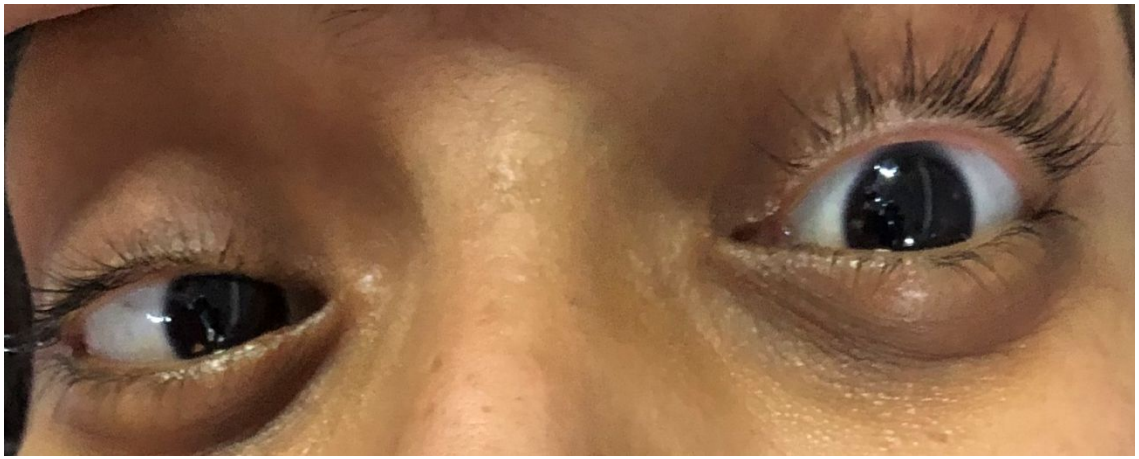

Ora Seratta
Retina
Sclera
Cornea
Iris
Pupil
Lens
Vitreous
Macula
Fovea
Optic nerve
Irido corneal angle
Optic disc
Schlemm's canal
Ciliary body

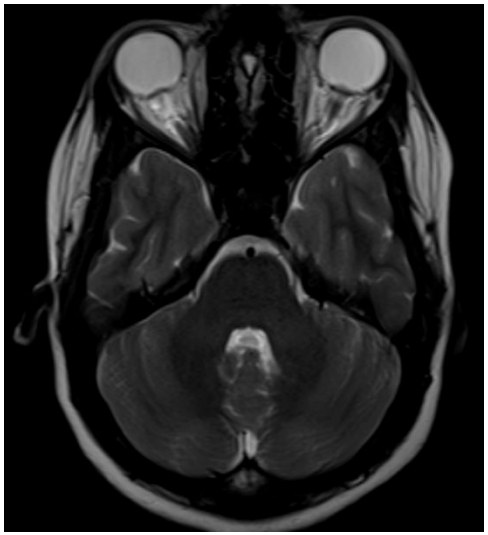
a

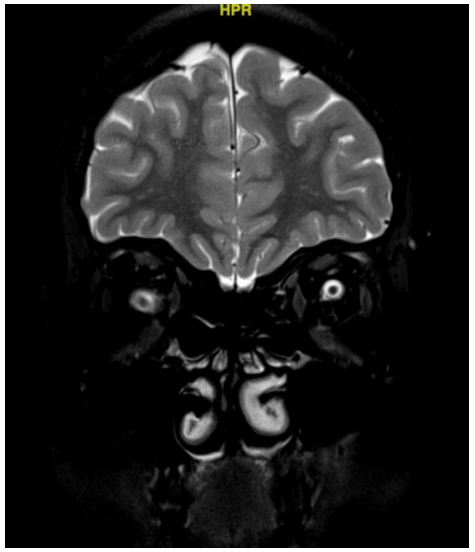

University of Michigan
Kellogg Eye Center

b

- A 18  year-old woman with a history of obesity and PCOS presented to our emergency department complaining of bifrontal headache for one month associated with nausea, vomiting, transient visual disturbances, and Pulsatile tinnitus.

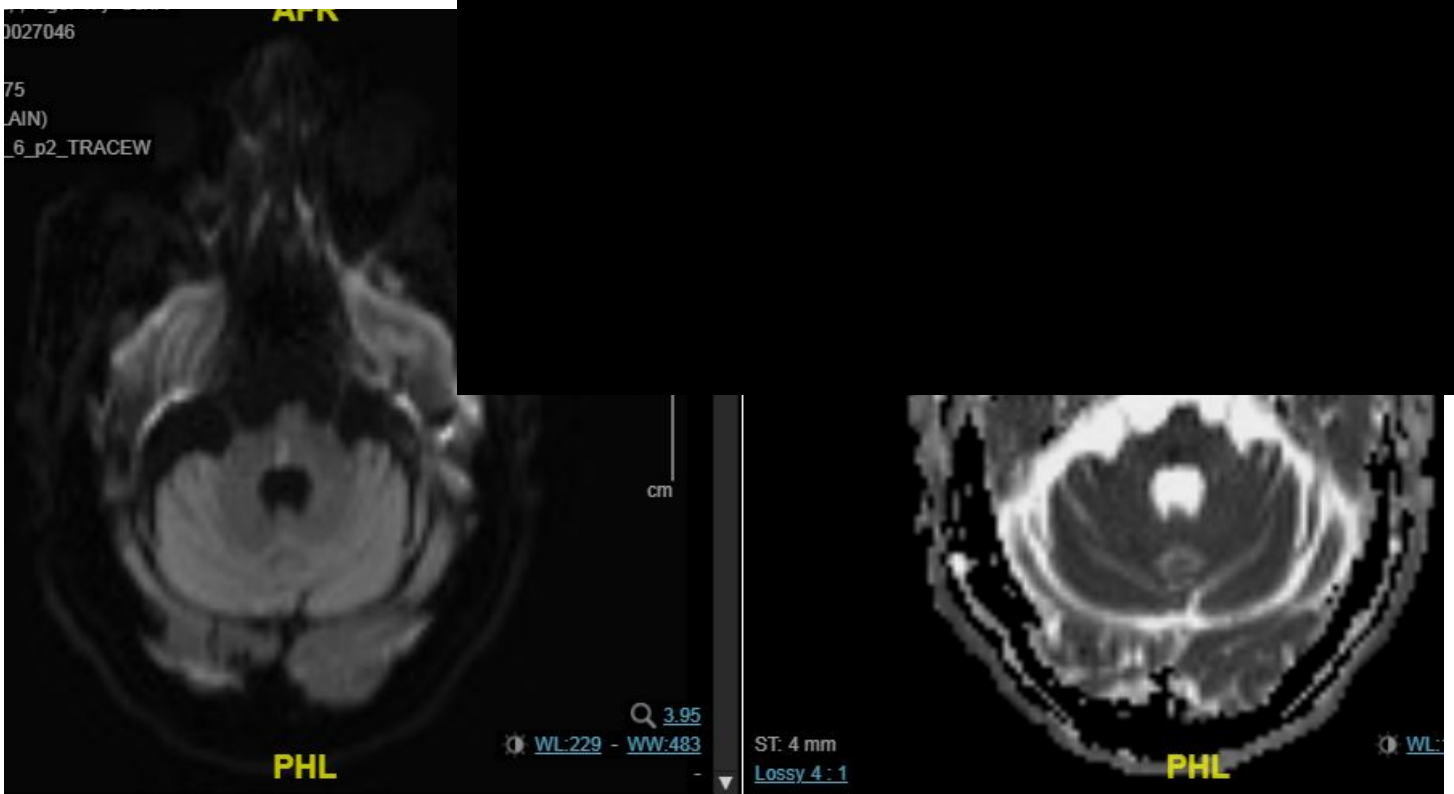






A 65 year old lady presented with sudden onset of blurring of vision of two days duration.

O/E- her visual acuity was normal. Eye movements were examin

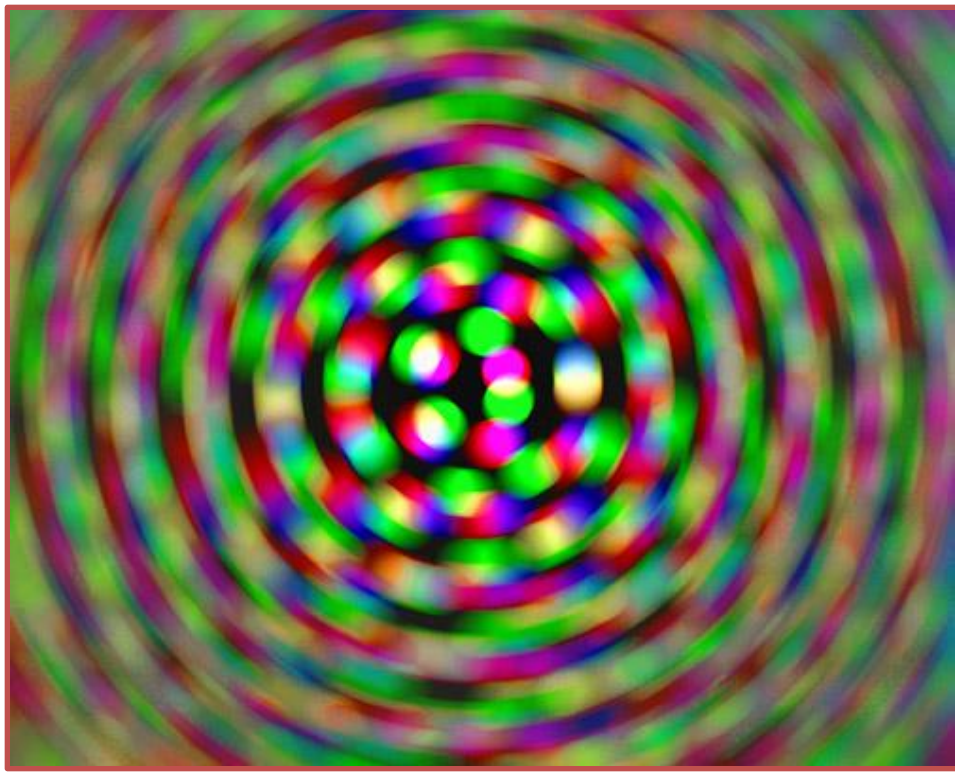


Optic Neuritis and MS Do

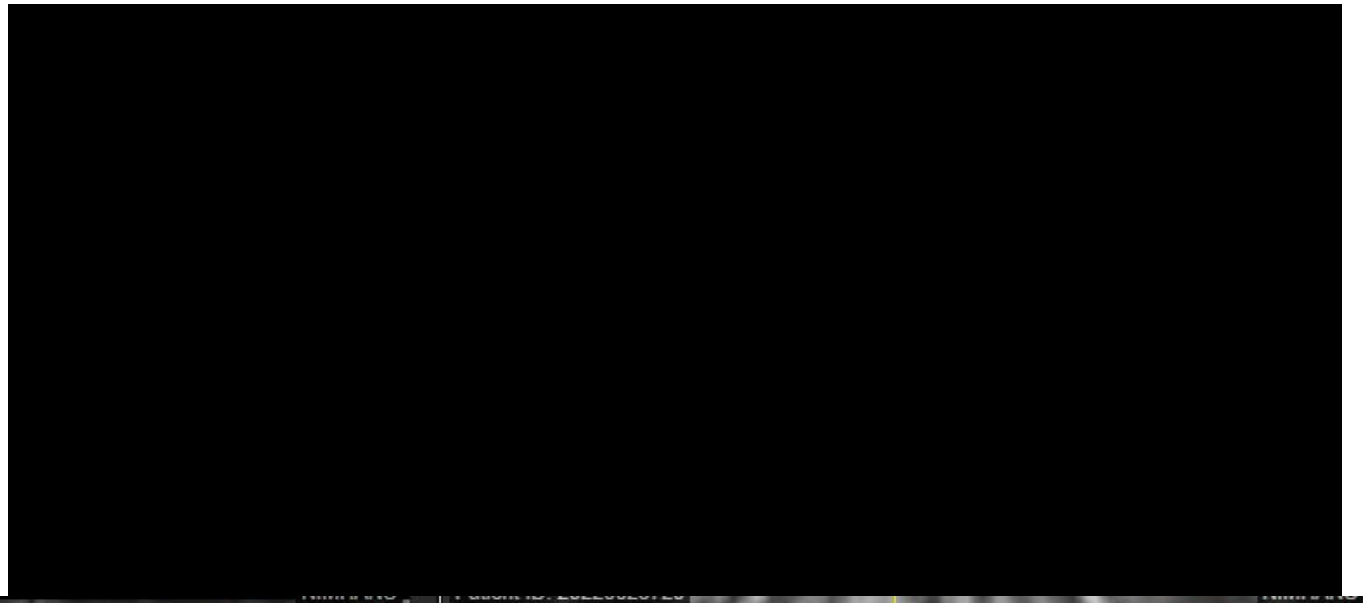
# Oscillopsia

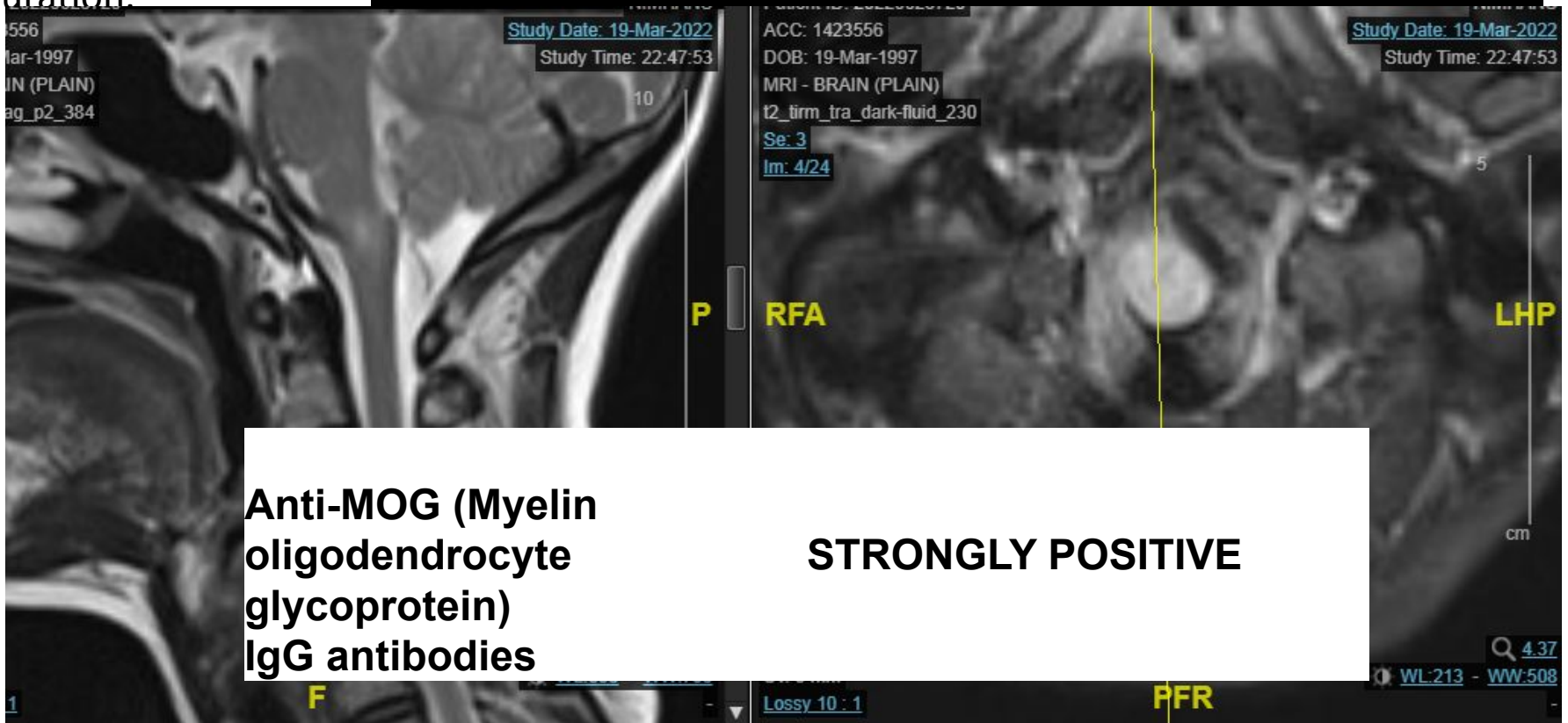
- Both nystagmus and saccadic dyskinesia move the fovea off target, which results in a decrease in vision.

- They also cause oscillopsia, an **illusion of motion in the stationary environment.**



A 25 year old lady came with blurring of vision of 7 days duration followed by weakness of all 4 limbs of three days duration.

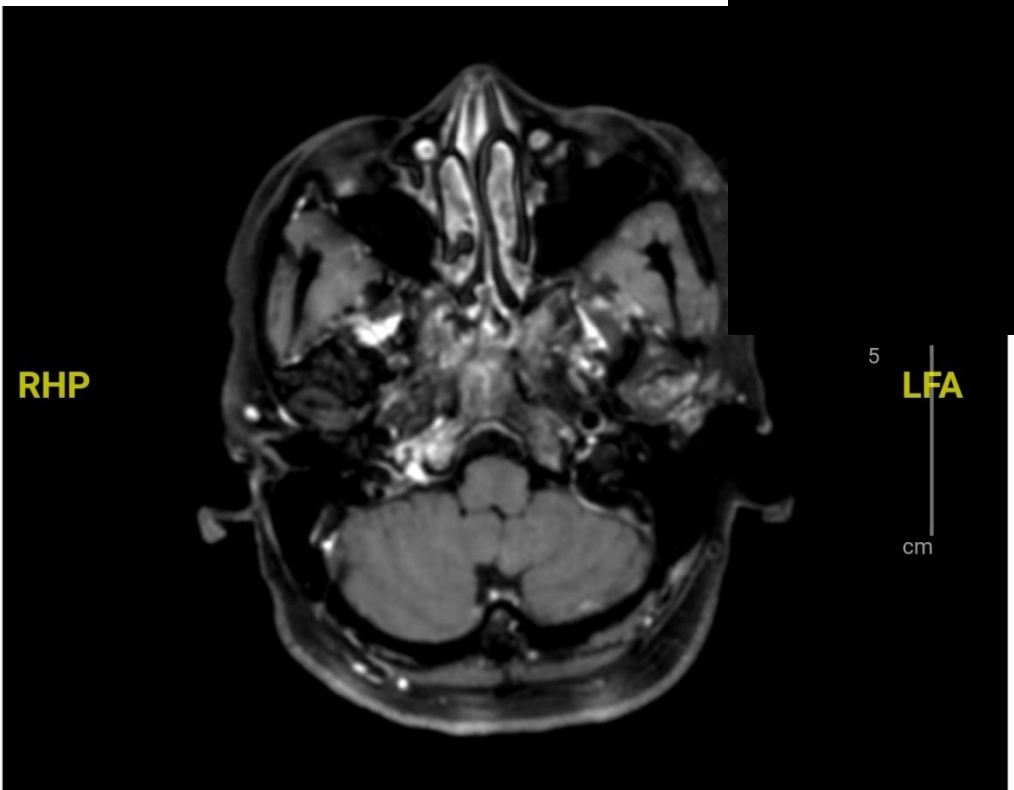





**Anti-MOG (Myelin oligodendrocyte glycoprotein) IgG antibodies**

**STRONGLY POSITIVE**

A 41 year old lady with recurrent neurological illness since 2019, came with slurring of speech, difficulty swallowing liquids with nasal regurgitation.



An 18 year old girl with history of swaying while walking since 10 years of age and frequent falls.
History of similar illness in father.
She has scanning dysarthria and cerebellar signs on exam.
Genetics s/o SCA-1