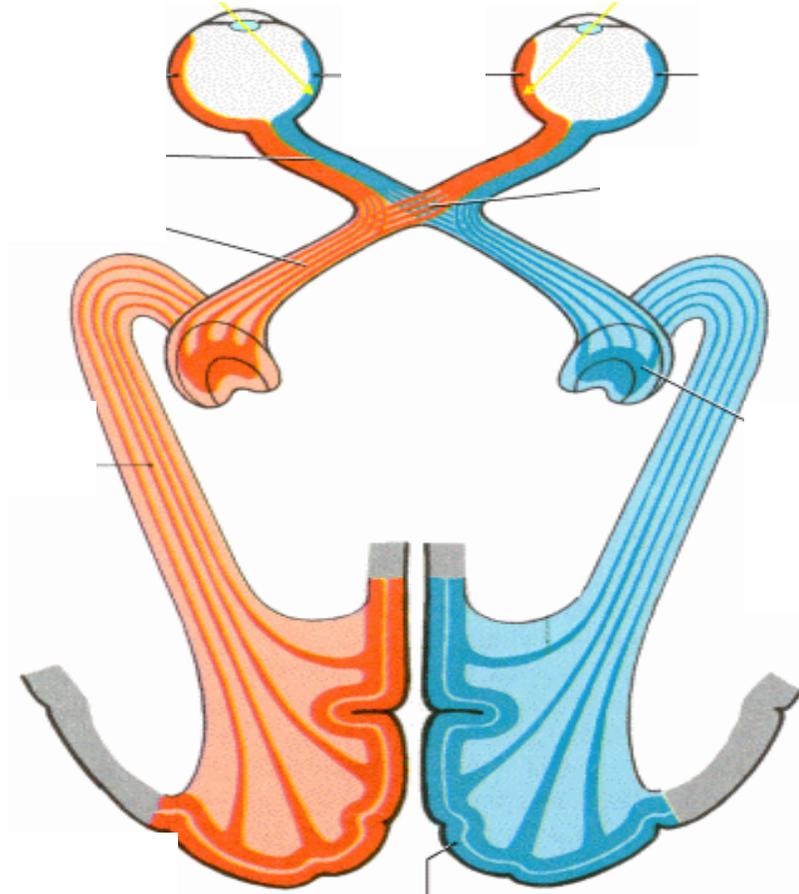


# Neuro Ophthalmology



## Sources:

- The Dr Slides
- The 429 Ophtha Team

I just rearranged the lecture in a way that hopefully would make it easier to study from  
Good Luck

Amna Baljoun

# Neuro- ophthalmology

Consists of :

- Afferent
- Efferent
- Other

## Afferent System:

- Anatomy
- Examination
- Diagnoses
- Tests

Neuro- ophthalmology has no important role in preventing Blindness

## Anatomy:

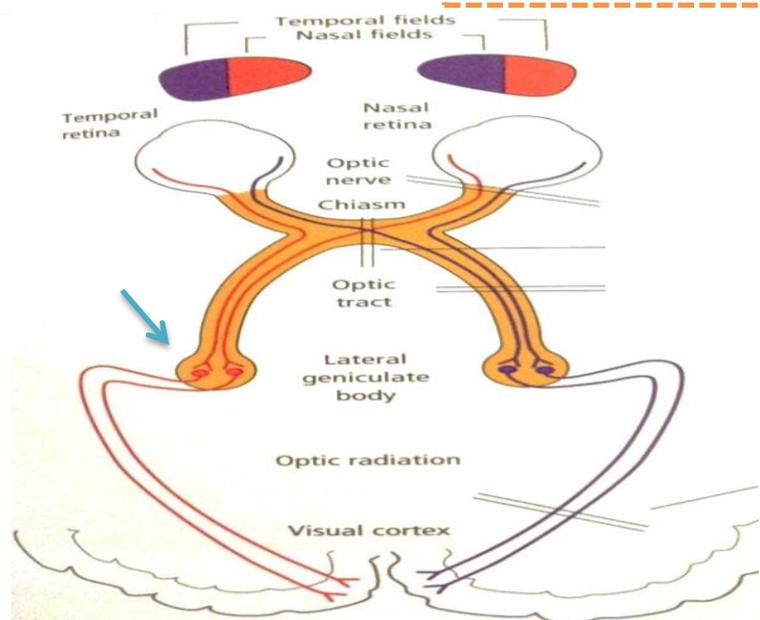
- Vision is generated by photoreceptors in the **retina**, a layer of cells at the back of the eye. The information leaves the eye by the optic nerve, in the chiasm partial axon crossing occurs. After the chiasm the axons are called the **optic tract**. The optic tract wraps around the midbrain to get to the lateral geniculate nucleus (LGN) where all the axons synapse. From there the LGN axons fan out through the deep white matter of the brain as the **optic radiation** , which will ultimately travel to the **primary visual cortex** at the back of the brain.
- **Blood supply**
  - Inner surface of the retina → Central retinal Artery “ branch of ophthalmic artery “
  - Outer Retina → Choroid arteries
  - Optic Nerve → penetrating vessels of the ophthalmic artery “ which are running in the optic sheath “

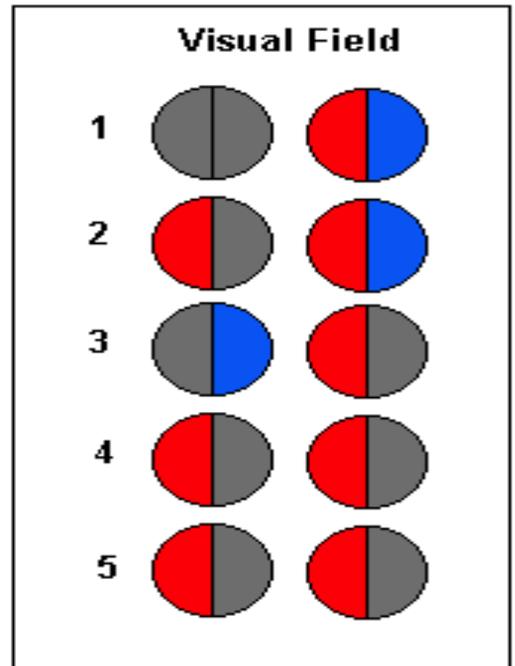
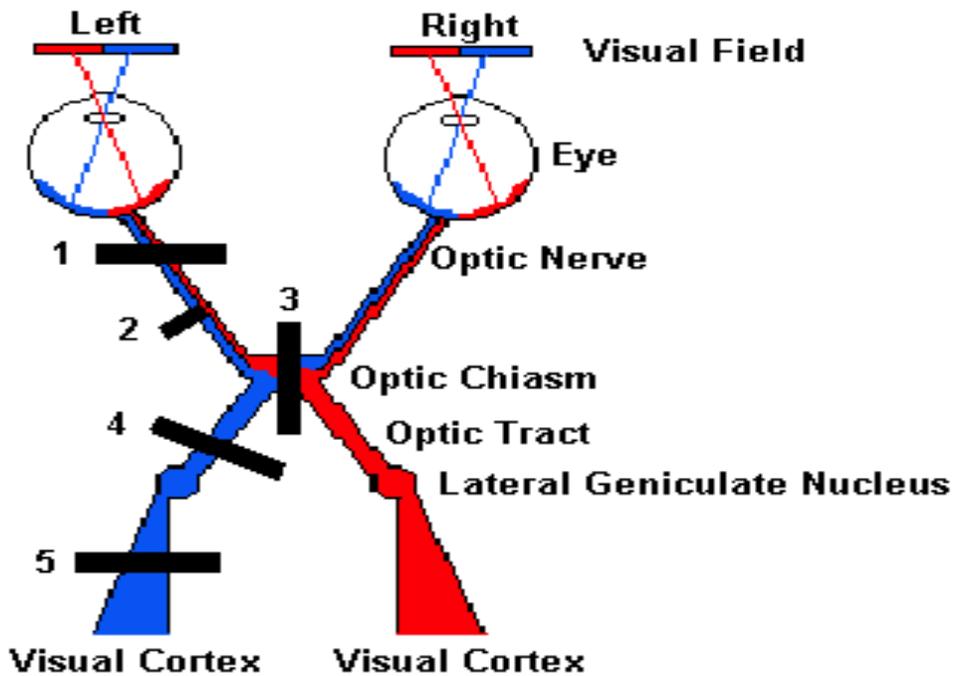
Removal of the sheath will cause optic nerve atrophy

The visual pathway has 2 nerves only, the first starts at the ganglion cells in the retina and ends at the LGN. The second starts at the LGN and ends at the cortex.

Any injury before the Lateral Geniculate Body (LGN) will make the optic disk pale.

If the injury is in the LGN or the optic radiation as in MCA stroke the optic disk will appear normal.





### Hemianopia

Blindness in half of the visual field

### Congruous Hemianopia

Identical defect in the 2 visual fields, common with lesions in the posterior optic radiation.

### Incongruous Hemianopia

Defect in the two visual fields that differ in one or more ways, common with lesions of the optic tract

You can differentiate clinically between 4 and 5 by using the ophthalmoscope. In 4 the optic disk will be atrophied (pale), while in 5 it will be normal.

## Examination:

- **Visual acuity**

- Distance ( ex. Snellen Chart )
- Near

- **Visual field**

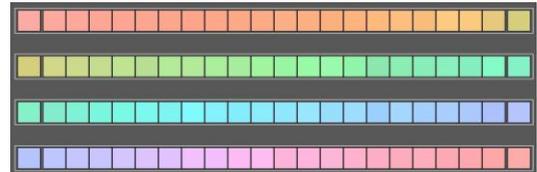
- Confrontation
- Goldman
- Humphrey

- **Fundoscopy**

- Light
- Dark

- **Color vision**

- Ishihara
- AOC “ 100 hu test “  
( patients are asked to arrange colored blocks in the right order )



- **Pupil examination**

- Direct ophthalmoscopy
- Slit lamp and lens
- Indirect ophthalmoscopy

- Total right optic nerve damage will not affect the pupillary size in both eyes, in the absence of Horner's syndrome or 3<sup>rd</sup> nerve palsy. Shinning the light at the right pupil will not cause any reaction while shining it at the left pupil will constrict both pupils
- Optic neuropathy affects the color vision early unlike cataract and diabetic retinopathy which affect the visual acuity before the color vision.

## Diagnosis:

- Compression

- Intraorbital Optic Nerve
- Intracranial Optic Nerve
- Optic chiasm
- Optic tract
- Posterior afferent system

- Trauma

- Globe
- Intraorbital Optic Nerve
- Optic canal
- Optic chiasm
- Occipital lobe

- Ischemic

- Non-arteritic ischemic
- optic neuropathy
- Central retinal artery occlusion
- Other retinal emboli
- Giant cell arteritis with ION ( ischemic optic neuritis )

- Congenital and genetic problems

- Congenital retinal dystrophies
- Optic nerve hypoplasia
- Leber hereditary optic neuropathy
- Dominant and recessive optic atrophy
- Glaucoma

- Inflammation

- Optic neuritis
- Orbital pseudotumor
- Other

## Cases

### Case 1

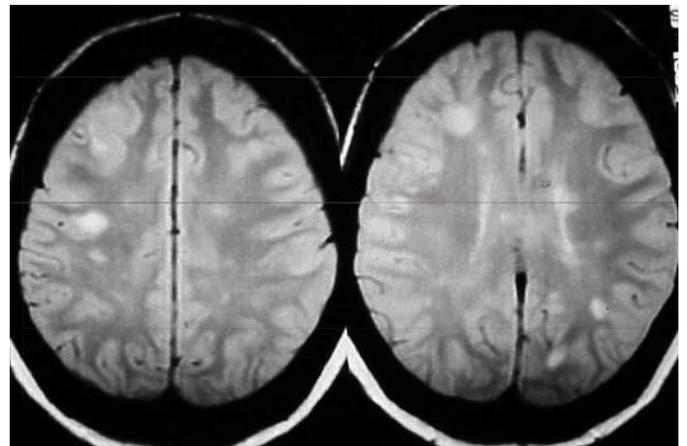
25 year old man who was exposed to a firecracker  
hat exploded near his left eye  
NLP OS ( no light perception in the left eye )



### Case 2

27 y/o women developed blurred vision OD and  
mild right periorbital pain  
VA 20/50, MRI abnormal

**Diagnosis** multiple Sclerosis



### Case 3

28 y/o woman developed modest left periorbital pain  
3weeks ago  
she has some blurring of vision OS  
• B-scan showed posterior scleritis



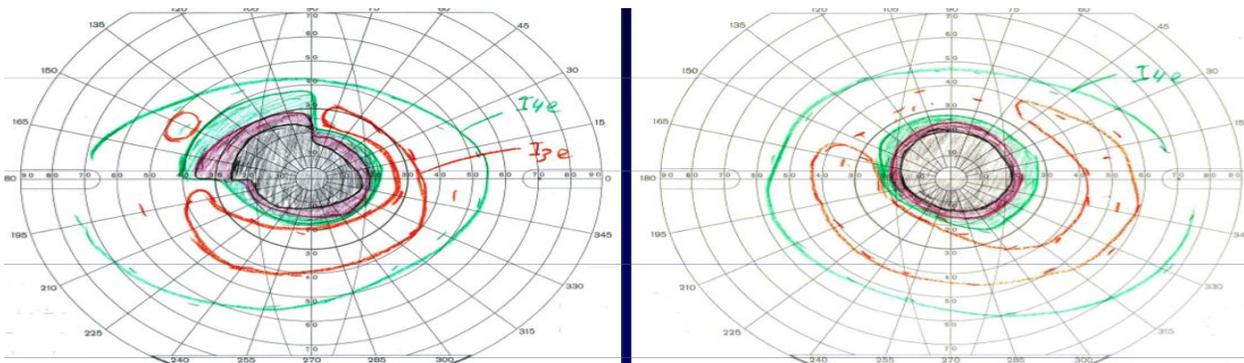
## Case 4

14 y/o girl, vision OS began to decline gradually without pain

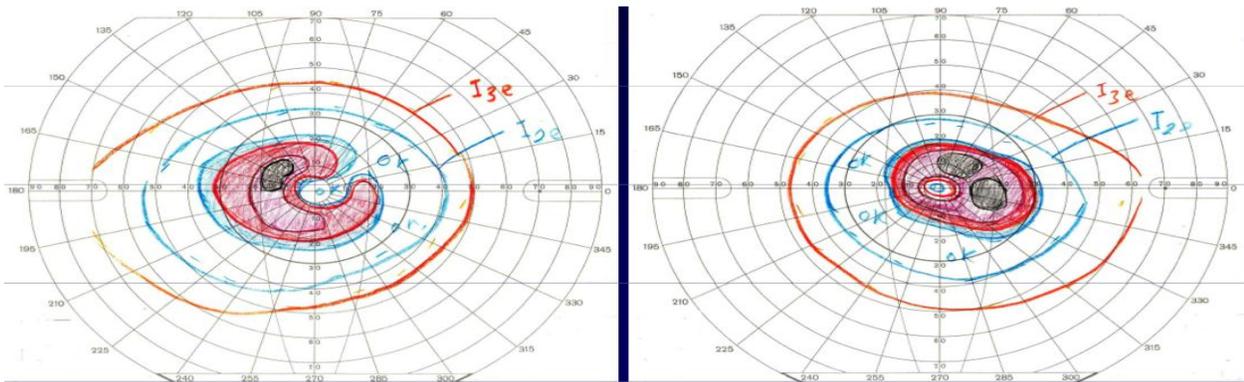
- First visit with VA OD 20/40 and OS CF at 3'
- Pale, flat optic disks OU
- VA 1 month later CF at 3' OU
- VA 10 months later 20/20 OU
- **Diagnosis** LHON-like optic neuropathy

Leber's hereditary optic neuropathy (LHON) or Leber optic atrophy is a mitochondrially inherited (mother to all offspring) degeneration of retinal ganglion cells (RGCs) and their axons that leads to an acute or subacute loss of central vision

VF 1 month later shows Big Bilateral Central Scotoma



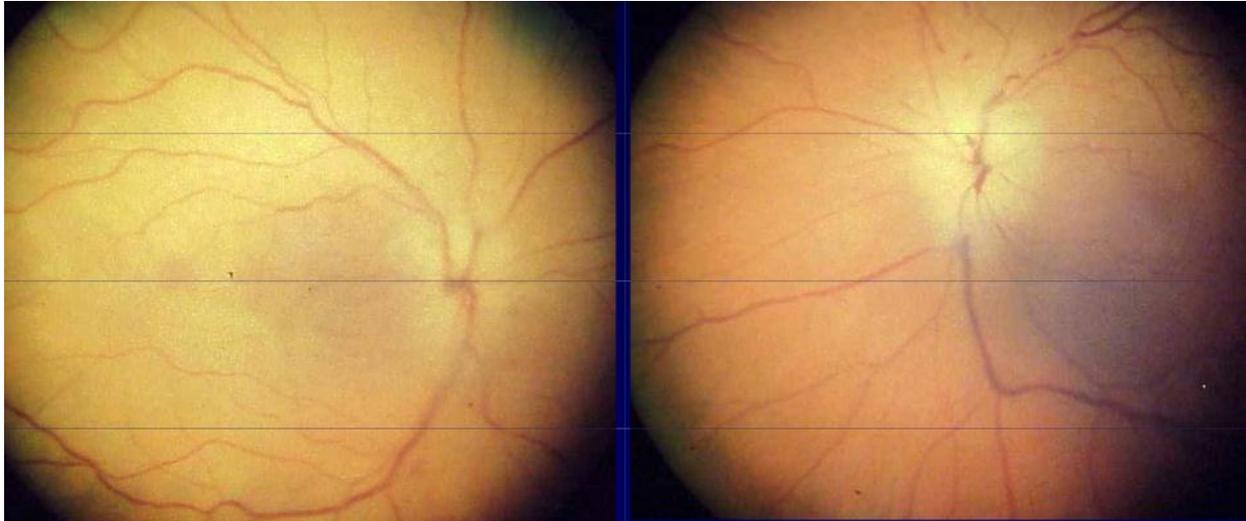
VF 10 months later shows a Doughnut Scotoma; where there is areas of good vision inside the central scotoma



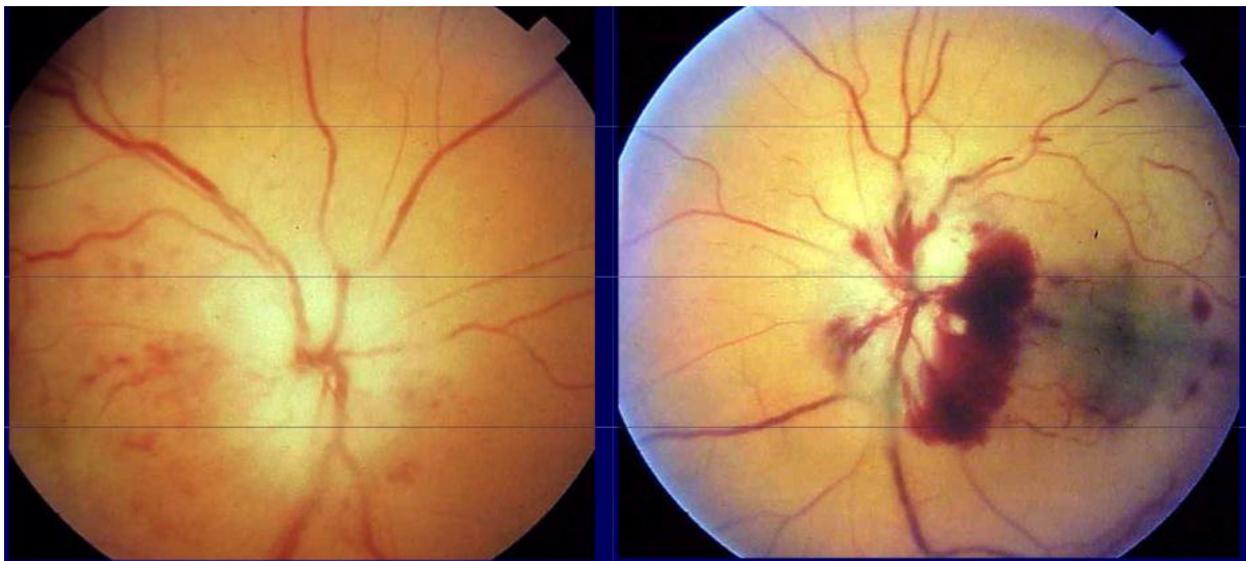
Case 5

Giant cell arteritis

**Day 2**



**Day 4**

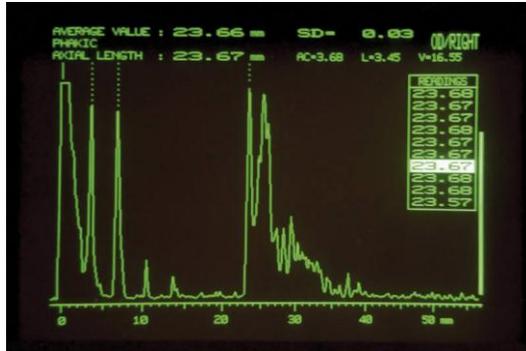


Total blindness in both eyes

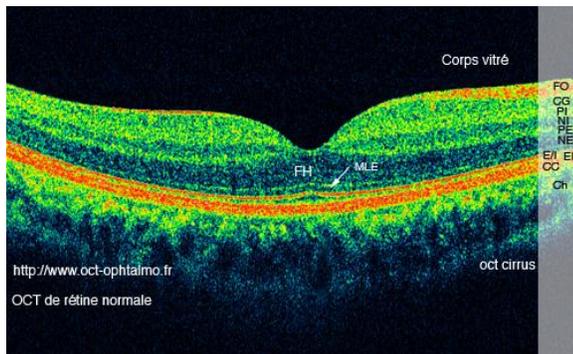
## Tests:

- During exam

- Visual fields
- A scan



- OCT

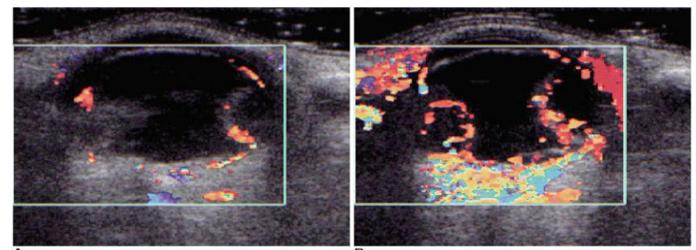


- Neuro-imaging

- CT scan ( better for bone )
- MRI ( superior to CT )

- Ultrasound

- Orbital color Doppler
- Carotid Doppler

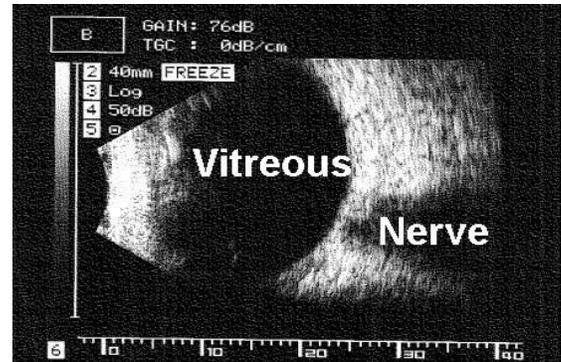


- Blood tests

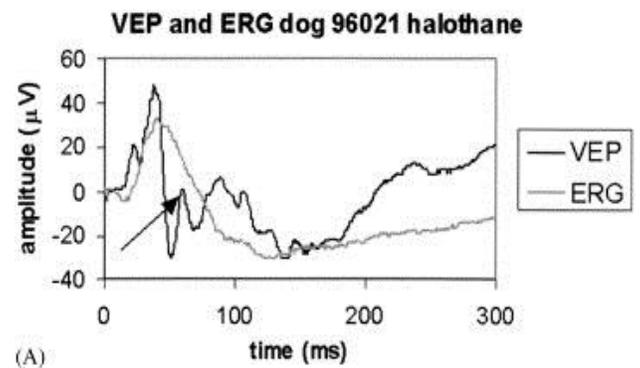
- Vasculitis (ESR, CBC, ANA, VDRL)
- Uremia (BUN, Creatinine, U/A )
- Liver function tests (SGOT, SGPT, alkaline phosphatase)
- Electrolytes
- Genetic evaluation

All blood test must be done. Although Syphilis is rare but the VDRL test should be done because it is easily treatable

- B scan



- ERG/VEP

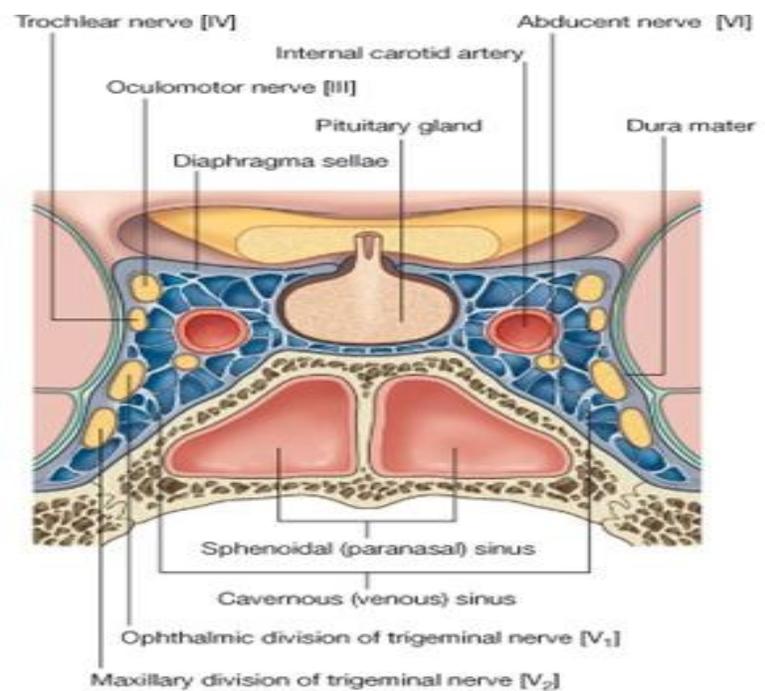
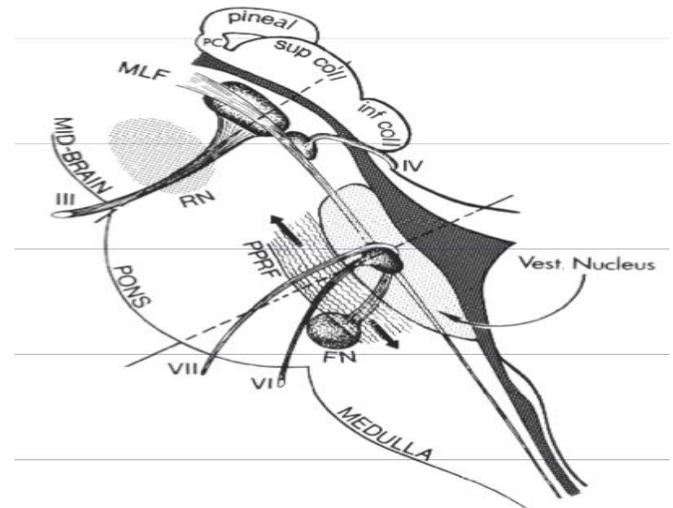


## Efferent System

- Anatomy
- Examination
- Diagnoses
- Tests

### Anatomy:

- The facial nerve (7<sup>th</sup>) loops around the nucleus of the 6<sup>th</sup> cranial nerve. A single brain mass affecting both of them together is not uncommon.
- The 3<sup>rd</sup> nerve runs across the top of the cavernous sinus in about half its length and this has an important clinical implication. PCA is located above the cavernous sinus so commonly the 3<sup>rd</sup> nerve would be affected if a PCA aneurysm ruptures
- 4<sup>th</sup> cranial nerve is the only nerve located posteriorly and immediately decussating and runs in a horizontal course.
- 6<sup>th</sup> cranial nerve has the longest intracranial course of cranial nerves and can be damaged in the brain stem or more often in it's intracranial course.
- Cavernous sinus wall is formed of the tough dura matter. If the internal carotid artery ruptures here, the high blood pressure of the artery will be contained within the sinus, given rise to a C-C fistula (carotid-cavernous). Patients usually present with sudden or insidious onset of redness in one eye associated with progressive proptosis or bulging.



Neurofibromatosis type 1 affecting the development of the skull and the globe.  
The picture show a big orbit and the superior orbital fissure is 5 times bigger

## Examination:

### • Just look at patient

- Are eyes straight?



- Are the eyes proptotic?



- What is the lid position?



- Are there any spontaneous eye movements?



### • Movements of both eyes in all directions

- Have the patient move eyes in all directions, not just the direction where you think there is a problem.
- Hold lids if necessary (only after looking first without holding lids).
- Examine each eye separately if necessary



**Rt frozen globe**

### • Smooth pursuit

- The reflex that helps to maintain fixation on an object in motion in the visual world while the head is stable
- Also the reflex that inhibits the vestibule - ocular reflex.

### • Saccades

- The reflex that permits a rapid refixation from one point in the visual field to another.
- They are quick simultaneous movement of both eyes in the same direction.

#### Smooth pursuit eye movement:

Allow the eyes to closely follow a relatively slowly moving object while your head is stable. Smooth pursuit is asymmetric: most humans tend to be better at horizontal than vertical smooth pursuit as defined by their ability to pursue smoothly without making catch up saccades. Most human are also better at downward than upward pursuit.

Pursuit is modified by ongoing visual feedback. There is significant evidence that smooth pursuit is deficient in schizophrenic, autistic and patients with post traumatic stress disorder.

## Case

10 y/o girl born with weakness of the face. The parents noticed unusual eye movements at early age

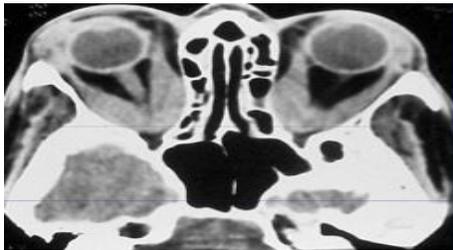
**Diagnosis** bilateral Mobius Syndrome, Rt >Lt or possible congenital injury to the 3<sup>rd</sup> cranial nerve OD.



## Diagnosis:

- Orbit

- Extraocular muscles (inflamed or enlarged muscles may damage the optic nerve at the narrow apex)



- Trauma



- Mass



- Neuromuscular junction



- Single cranial nerves

- Oculomotor nerve (3)



A complete oculomotor nerve palsy will result in a characteristic down and out position in the affected eye. The eye will be displaced downward, because the superior oblique (innervated by the 4<sup>th</sup> nerve) is unantagonized by the paralyzed superior rectus and inferior oblique. It will be displaced outward because the lateral rectus (innervated by the 6<sup>th</sup> nerve) is unantagonized by the paralyzed medial rectus. The affected individual will also have a ptosis or drooping of the eyelid and pupil dilatation.

- Trochlear nerve (4)



Congenital 4<sup>th</sup> nerve palsy, note that the right eye is slightly higher. The pt may complain of vertical diplopia which gets worse when the affected eye looks toward the nose.

The 4<sup>th</sup> nerve lesion causes atrophy of the superior oblique muscle; when looking down and in (medially) with the affected eye there will be diplopia the false image will lie below the true image. Patients mainly complain of difficulty in reading or going downstairs.

The superior oblique weakness in the primary position causes mild extorsion and elevation of the affected eye due to the unopposed action of the inferior oblique. This will result in a torsional and vertical diplopia.

For instance, if the left superior oblique is paralyzed, this eye will be extorted and elevated. In order to get rid of the double vision the patients will tilt their heads to the side opposite to the paralyzed muscle, that is to the right. This causes reflex intorsion (from otoliths) of the normal right eye so that the vertical axis of the two eyes becomes parallel. To alleviate the vertical diplopia the patient will also flex his chin when tilted to the right. In this position the patient will have to elevate the normal right eye in order to look

- Abducent nerve (6)



**Right eye does not abduct**

- Multiple cranial nerves

trauma to the 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup> cranial nerves may recover, but the optic nerve doesn't recover.

- Intraparenchymal problem

- INO (internuclear ophthalmoplegia)
  - Is a disorder of conjugate lateral gaze in which the affected eye shows impairment of adduction.



Right eye abduct, but the left doesn't adduct

- Gaze palsy
  - Commonly due to a lesion in the brainstem.
  - This patient had a stroke in the pons, he has right face weakness.



## Other

- Unusual faces



- Dysmorphism



Unusual teeth

- Unusual scans



Skin Lesions

- Unusual Posture



Congenital fibrosis of the ocular muscles type 1, the hallmark is that the patient tilt his head back because the eyes cant be elevated to primary gaze.