

Optic nerve and Visual pathway

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Anatomy

- The optic nerve starts at the lamina cribrosa as a collection of the axons of the ganglion cells of the retina.
- It ends at the optic chiasma with a length of about 0 cm it is divided into:
 1. Intra-ocular part is 0.6 mm.
 2. Intra-orbital part is 3 cm.
 3. Intra-canalicular part is 6 mm in optic foramen.
 4. Intra-cranial part is 1 cm and ends at the chiasma.

papilloedema

Papilloedema is a passive oedema of the optic disc which is not accompanied by inflammation or loss of vision

Aetiology

- Intracranial causes (increased intracranial tension.)
- Intraorbital causes (pressure on optic nerve.)
- Ocular causes (acute hypotony and central retinal vein occlusion.)
- General causes (anaemia, polycythaemia, malignant hypertension, renal retinopathy and eclampsia.)

Symptoms

- No Symptoms and good vision.
- May be transient attacks of loss of vision for few minutes (amaurosis fugax.)
- Headache and vomiting
- Later vision falls secondary to optic atrophy.

Signs

- Blurring of edges and filling of the physiological cup.
- Hyperaemia of the disc and congestion of retinal veins.
- Advanced: disc elevation up to 9 dioptres ,haemorrhages occur on disc , spread oedema to retina(macular fan.(
- Increased blind spot. Central scotoma for blue

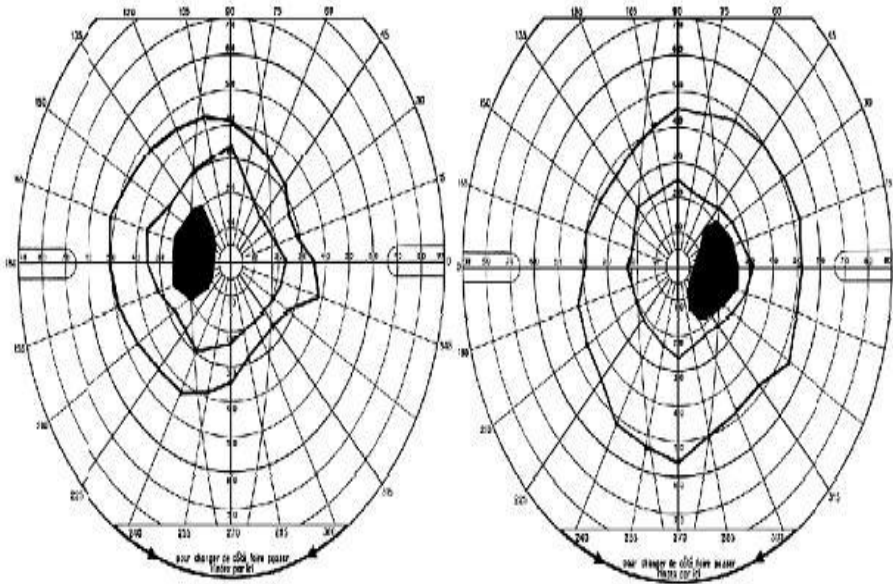
paipilloedema



Severe papilloedema with macular fan (incomplete star)

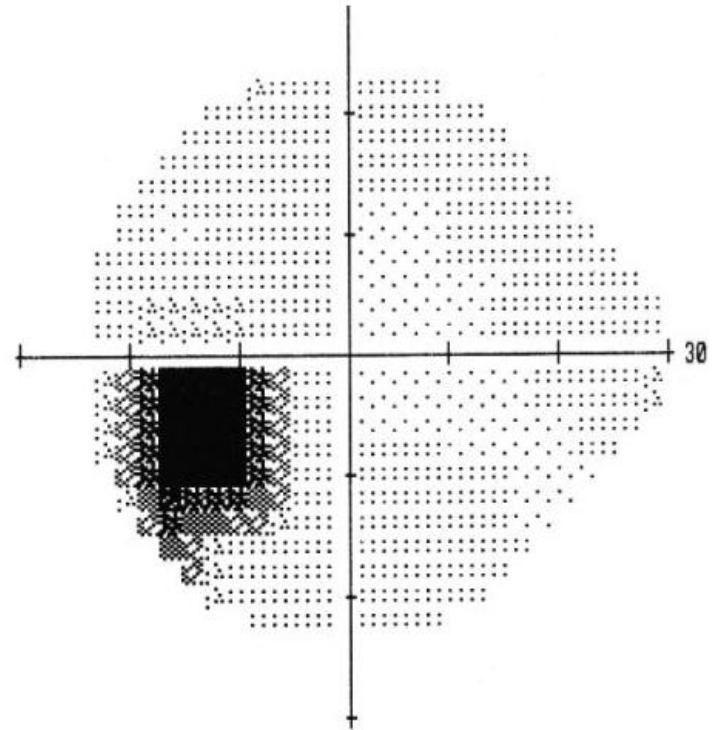


Enlarged blind spot



Left eye

Right eye



Fluorescein angiography of papilloedema



DJO

Digital Journal of Ophthalmology
www.djo.harvard.edu

Differential Diagnosis

Papilledema

- Increased I.C.T(headache &vomiting.(
- Normal Vision.
- Bilateral.
- Enlarged blind spot.
- Disc swelling up to 9 dioptres.
- Vitreous is clear.

Optic neuritis(papillitis(

- No Symptoms.
- Diminished Vision.
- Unilateral.
- Central scotoma for Red and green
- Disc swelling less than 3 dioptres.
- Cells in vitreous (hazy.(

Treatment

- Treatment of the cause
- Decompression of optic nerve

Optic neuritis

- Ophthalmoscopic classification:
 1. Retrobulbar neuritis.
 2. Papillitis.
 3. Neuroretinitis
- Aetiological classification:
 1. Demyelinating diseases particularly D.S.
 2. Parainfectious , following viral infection or immunization
 3. Infectious due to sinusitis , syphilis , lyme disease , mumps and cat scratch fever.

SYMPTOMS

**RAPID DIMINUTION OF VISION (DAYS.)
CENTRAL SCOTOMA FOR RED AND GREEN.**

Signs

**Unilateral swelling of the disc but not more than
3 D.**

Cells in the vitreous.

Treatment

- Treatment of the cause.
- Systemic Steroids.
- Anti-inflammatory drugs.
- Large doses of vitamin B.

Optic papillitis



Chronic Retro-Bulbar Neuritis

Toxic Amblyopias

- Toxins produce central scotoma as tobacco and ethyl alcohol.
- Toxins produce peripheral contraction of the field as quinine , salicylates and barbiturates.
- Toxins which produce severe optic atrophy as methyl alcohol , arsenic, and lead.

Tobacco amblyopia

- It is due to decomposition products of nicotine which selectively affect the papillomacular bundle (centrocaecal scotoma.)
- Treatment: vasodilators and vitamins and stop smoking.

Quinine amblyopia

- It is used in treatment of Malaria
- Idiosyncrasy play an important role in intoxication.
- Vision is lost and fundus shows marked attenuation of retinal vessels.
- A clinical picture similar to central retinal artery occlusion.
- Most cases recover partially but some pass to optic atrophy with concentric field contraction.
- Treatment by vasodilators

Optic Atrophy

Primary optic atrophy

- Causes:

1. Syphilis.

2. D.S.

3. Toxic amblyopia.

4. Severe blood loss.

5. Pituitary tumours causing pressure.

6. Trauma to optic nerve.

Clinical picture:

- Milky white in colour.
- Well defined edges.
- Large atrophic cup.
- Lamina cribrosa are well seen.
- Normal retinal vessels.

Primary optic atrophy

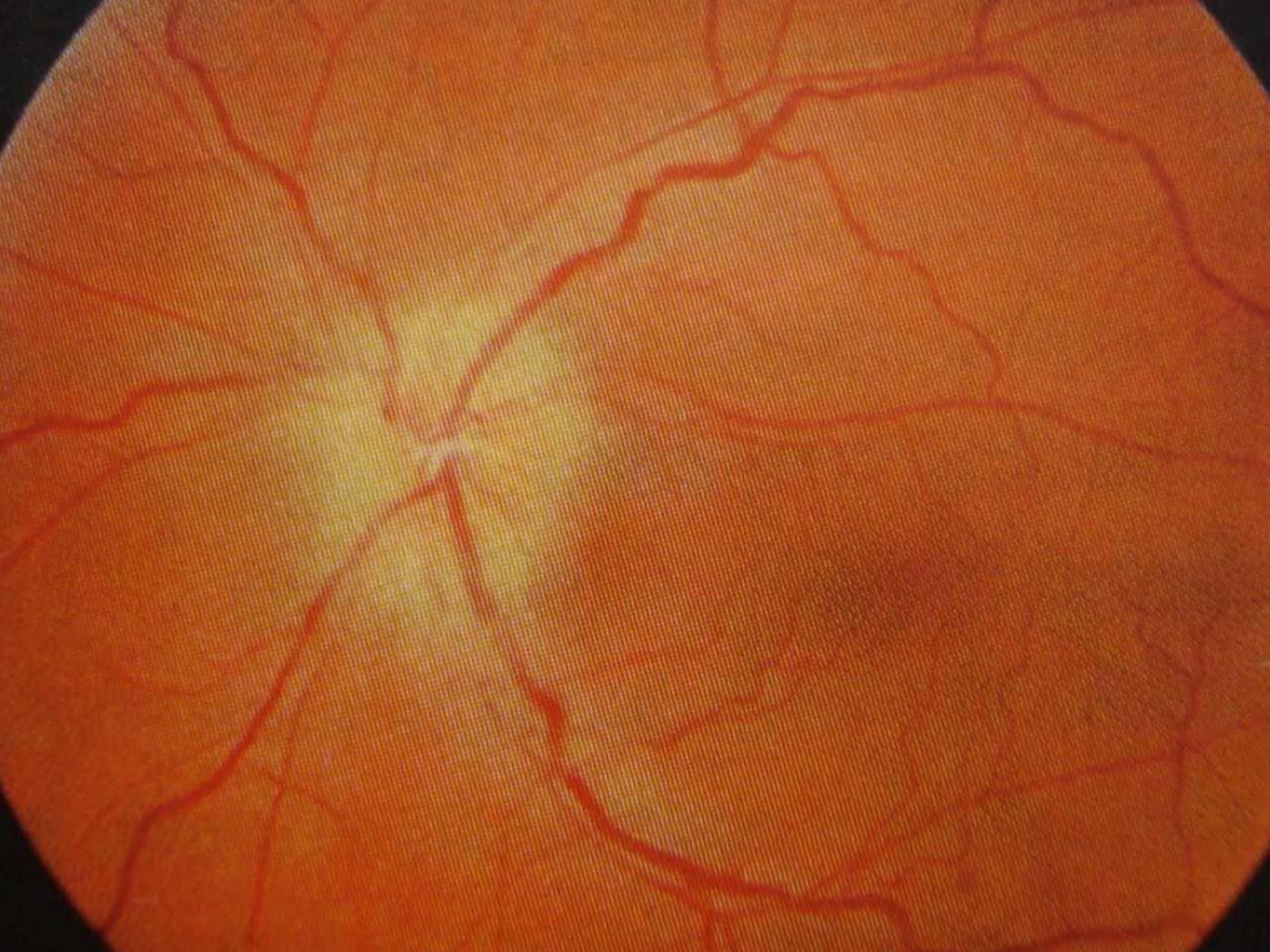


Secondary optic atrophy

- Causes:
 1. Post-papilloedema.
 2. Post-neuritic.

Clinical picture

- Grey white in colour
- Irregular edges
- Obliterated cup (filled with C.T).
- Lamina not seen
- Retinal vessels are attenuated and sheathed with fibrous tissue.



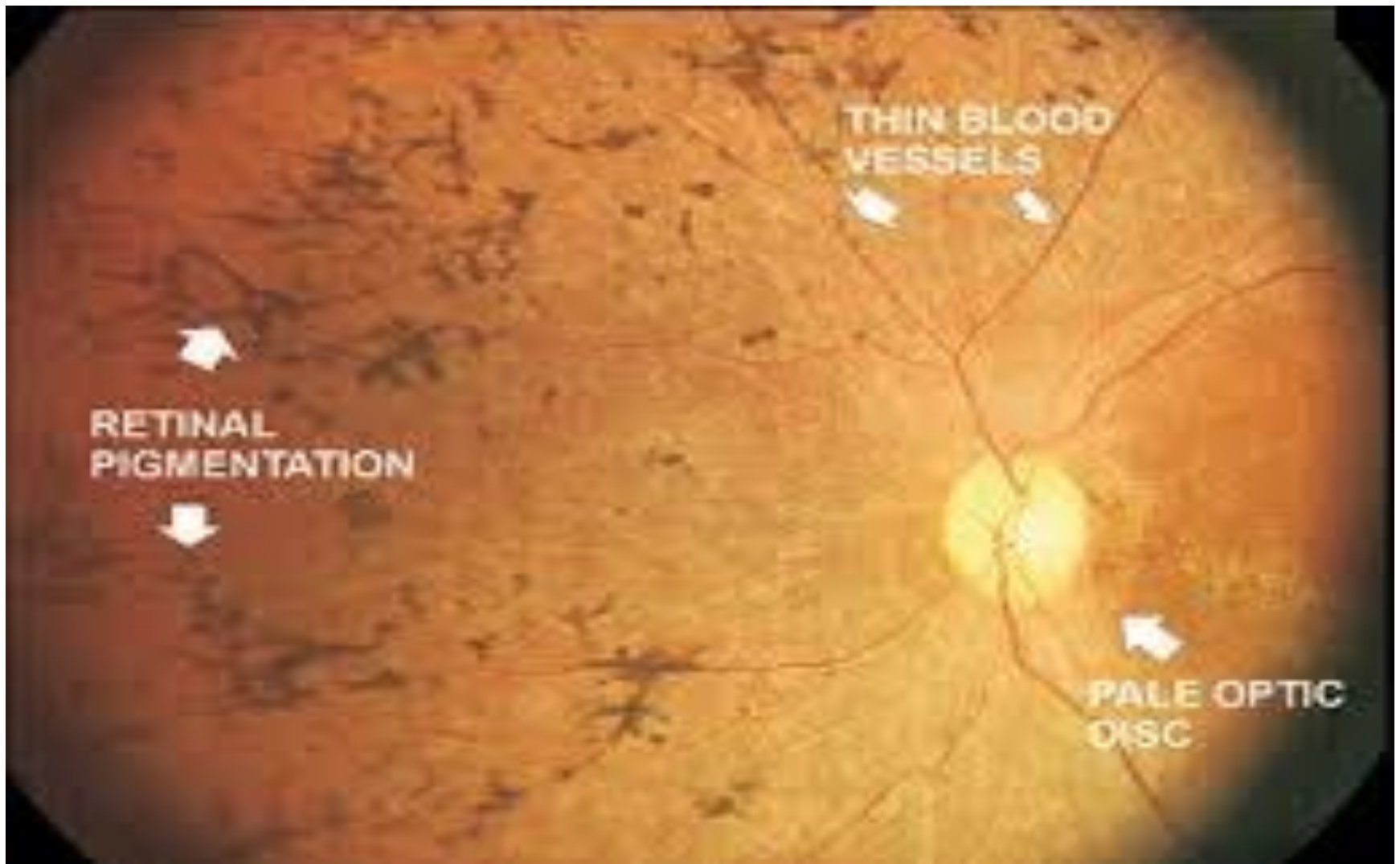
Consecutive optic atrophy

- Optic atrophy secondary to retinal degeneration , because the nerve fibres are the axons of the ganglion cells in the retina.
- It commonly follows:
 1. Retinitis pigmentosa.
 2. Chorio-retinal degeneration in malignant myopia.
 3. Central retinal artery occlusion.
 4. Amaurotic family idiocy.

Clinical picture

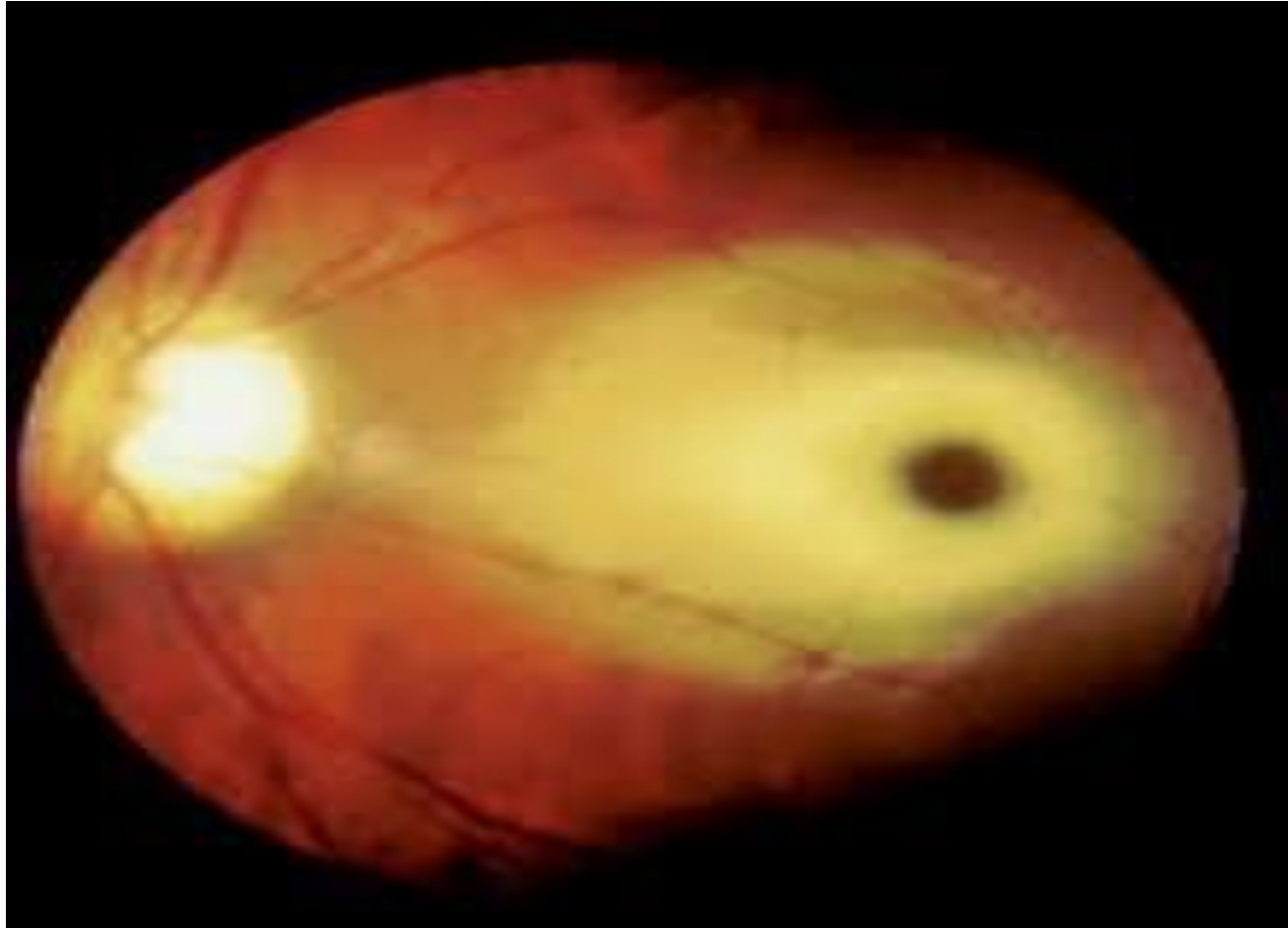
- Yellowish waxy colour.
- Slightly irregular edges.
- Filled cup
- Retinal vessels are markedly attenuated.
- Retina shows the causative disease.

Consecutive optic atrophy



Amaurotic family idiocy

(Tay- Sachs disease)lipoid degeneration of the retina



Post-glaucomatous optic atrophy

- Pale disc.
- Lamina cribrosa are well seen.
- Typical glaucomatous cupping:
 1. Large cup
 2. Deep cup
 3. Overhanging edge



Treatment of optic atrophy

- Treatment of the cause
- Vasodilators
- Antiglaucomatous drugs that have neuroprotection effect.

Visual pathway

- The rods and cones in the retina.
- The optic nerve (axons of ganglion cells.)
- The optic chiasma where the nasal fibres cross to the opposite optic tract while the temporal fibre continue on the same side.
- The optic tract.
- Lateral geniculate body where relay occurs.
- Optic radiation.
- Occipital cortex , area V (visuo-sensory), area V^A and V^P (visuo-psychic.)

Right

Left

Temporal retina

Nasal retina

Temporal retina

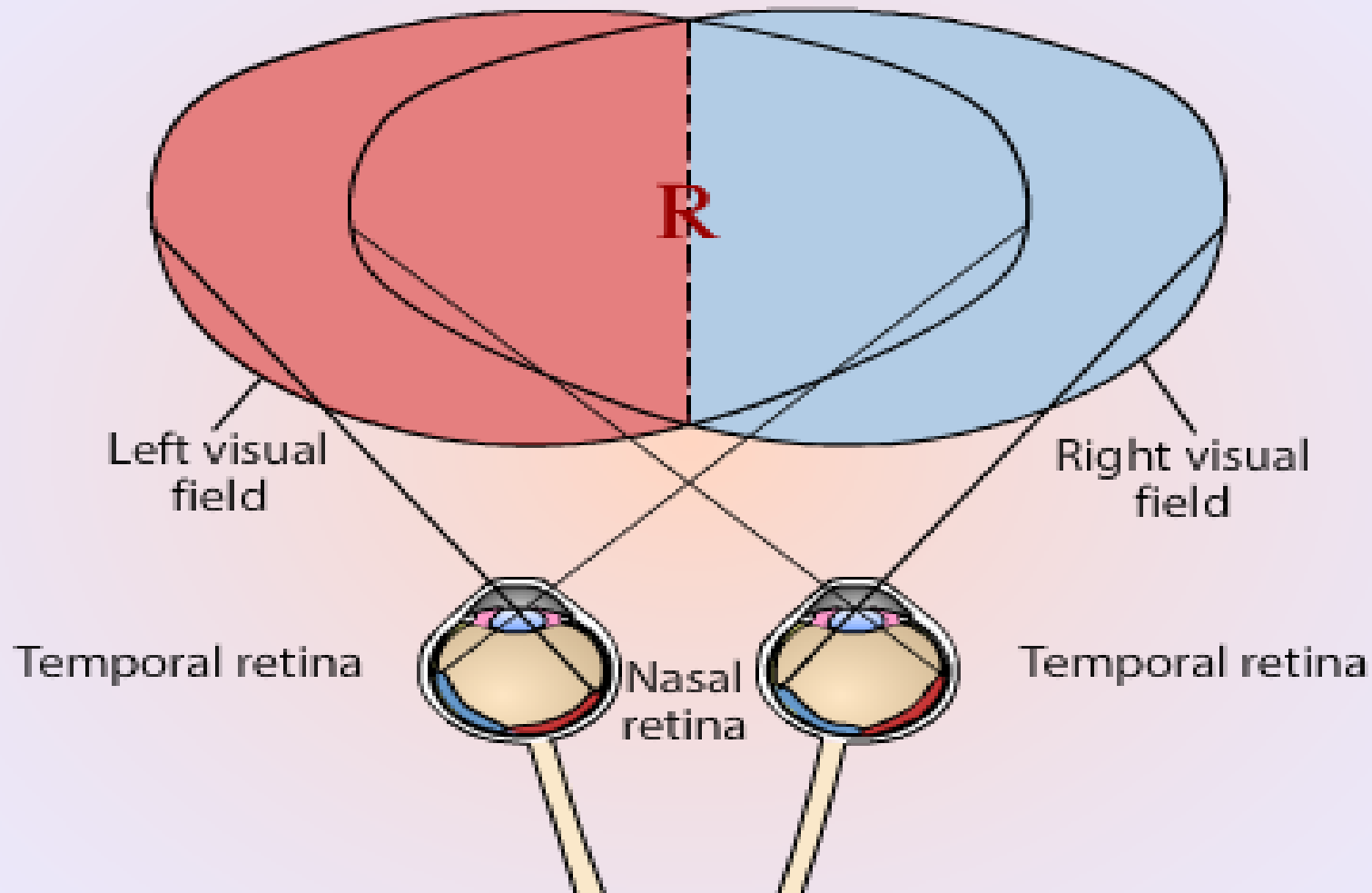
Optic tract

Optic chiasm

The vast majority of axons of the optic tract terminate in the lateral geniculate nucleus (LGN), which is the visual part of the thalamus. However, the axons of retinal ganglion cells also project to several other brain regions.

Visual field

It is projection outwards of all seeing points in the retina . Or the part of the outerworld that can be seen at one time.



The visual field can also be divided vertically into superior and inferior divisions. Note that the visual fields of both eyes overlap extensively in the central portion of each visual hemifield. This region defines the binocular field of view. Vision in the periphery of the field of view is strictly monocular, mediated by the most medial portion of the nasal retina.

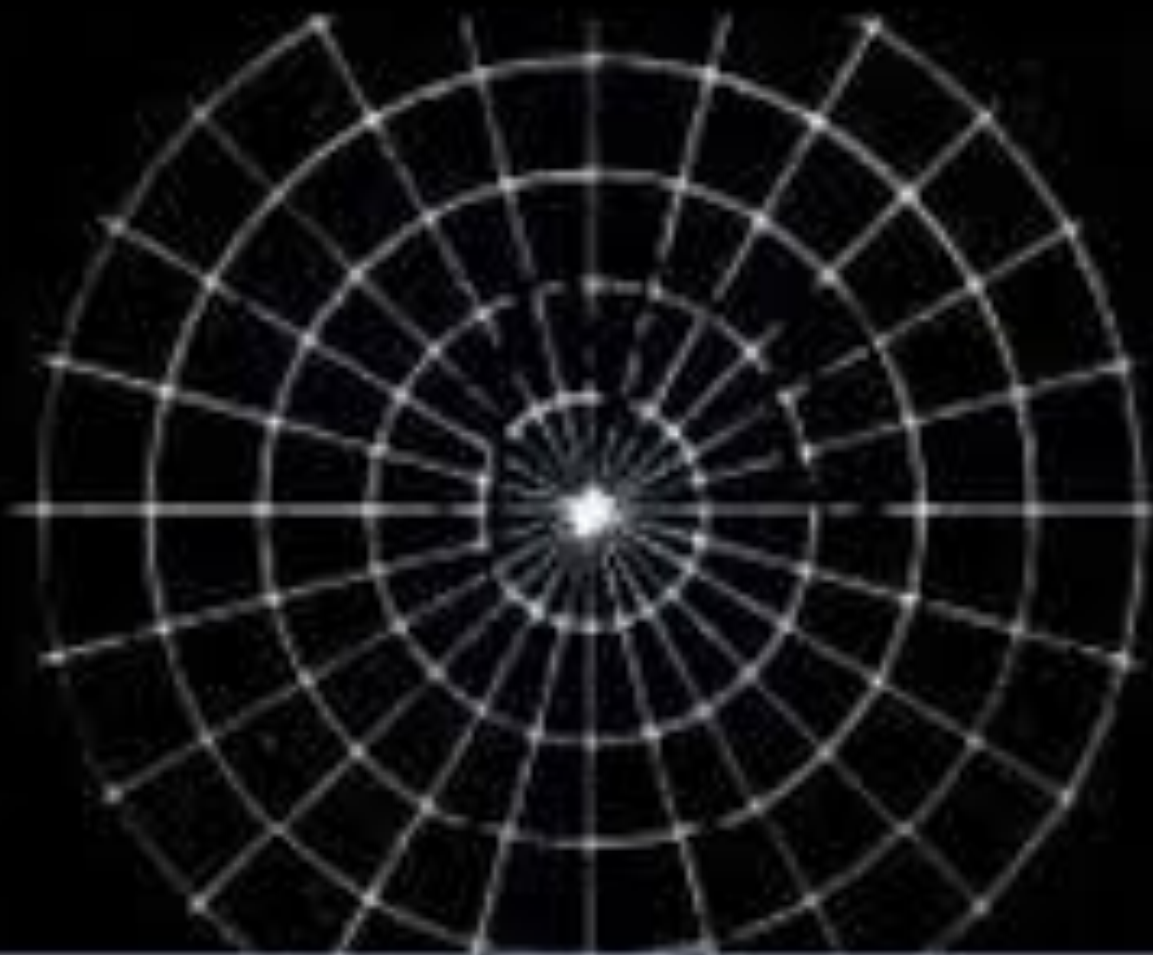
Testing the field of vision

- Confrontation method :the observer compares his field with that of the patient at 60 cm.
- The perimetry :metal arc with a radius of 33cm the can be rotated in different meridia , the angle at which an object is seen can be read in degrees on the arc.
- Campimetry (Bjerrum screen): Bjerrum screen is a black white screen whith a white dot in the centre .three circles are present around the point of fixation at 10, 20 and 30 degrees. There are two types small 1 by 1 meter patient sits at 1 meter andlarge 2 by 2 meters patient sits at 2 meters.

Automated perimetry



BJERRUM'S SCREEN



Normal visual field

- The point of fixation corresponds to the fovea.
- The blind spot of Mariotte : corresponds to the optic disc it is vertical oval 5 to 8 degrees in size and 12 – 17 degrees temporal to point of fixation.
- Limits of the normal field: up 50 degrees, in 60 degrees, down 70 degrees, and out 90 degrees.

Abnormalities of the visual field

- Scotoma: is an island of field defect , it may be positive (patient is aware of it) or negative .also it may be absolute scotoma (does not change if the size or colour of the test object is changed) or relative.
- Site and causes of scotoma:
 1. Central scotoma :toxic amblyopia, papilloedema ,optic neuritis ,maculopathies, central choroiditis and retinitis.
 2. Centro-caecal scotoma in tobacco amblyopia.
 3. Enlarged blind spot: papilloedema and papillitis, seidel sign in glaucoma and myopic crescent.
 4. Arcuate scotoma :.Bjerrum scotoma in glaucoma
 5. Annular scotoma: in central field in glaucoma and peripheral field in retinitis pig

Central scotoma



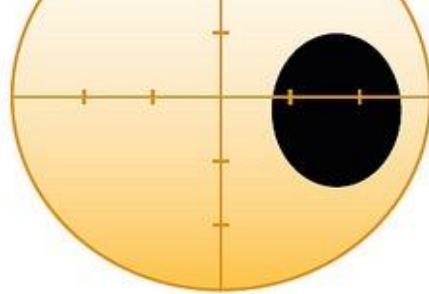
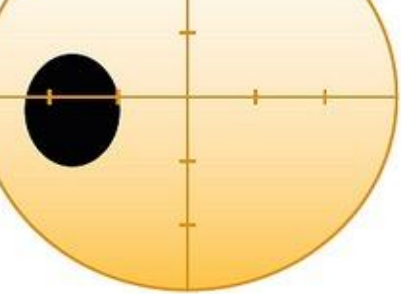
- Concentric contraction : it occurs in primary optic atrophy , secondary optic atrophy ,retinitis pigmentosa and quinine amblyopia.
- Tubular field :marked concentric contraction of the field tp become few degrees around point of fixation as in advanced glaucoma and advanced retinitis pig.

- Sectorial defects:
 1. Sector defects due to local eye disease as Rönne nasal step in glaucoma , localised R.D, and branch artery or vein occlusion.
 2. Quadrantic defects typical of temporal lobe lesions.
 3. hemianopia.

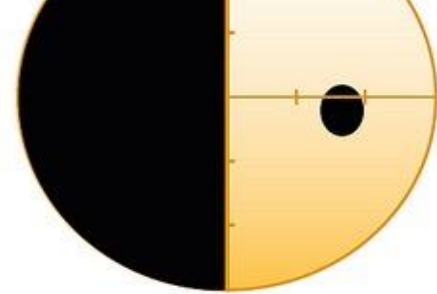
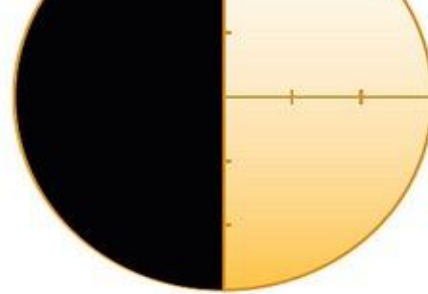
Hemianopia: is a loss of vertical one half of the visual field it may spare the macula in lesions of the occipital cortex

- Types:

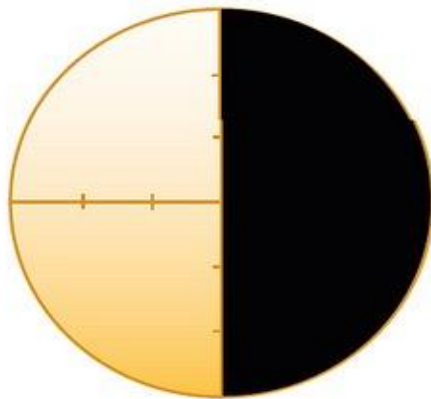
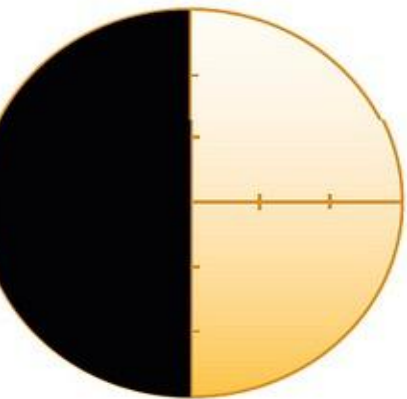
1. Homonymous hemianopia: is the loss of the right or left temporal half one eye and the nasal of the other. It occurs in lesion of the optic tract (anterior two third is associated with wernicke pupillary reaction after that pupil is normal), lateral geniculate, optic radiation (not symmetrical) and occipital cortex (macular sparing). Lesion is always on the opposite side.
2. Heteronymous hemianopia: here the two nasal or temporal fields are lost. Binasal are very rare bitemporal are due to lesions of the chiasma as in pituitary tumours.



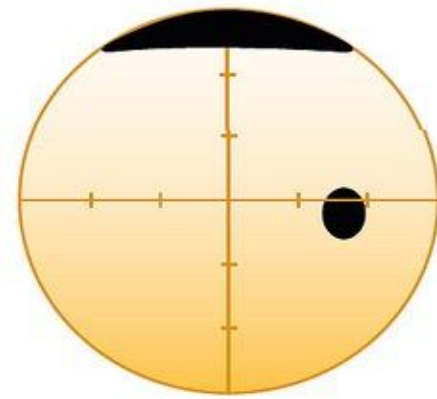
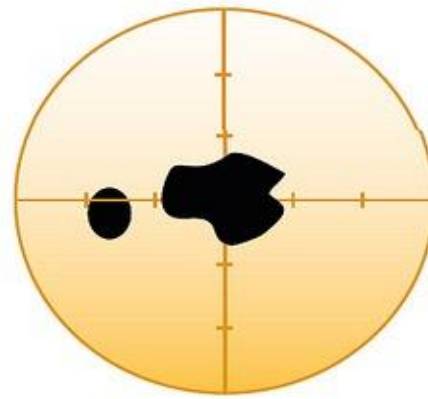
a) Enlarged blind spots (e.g. papilloedema)



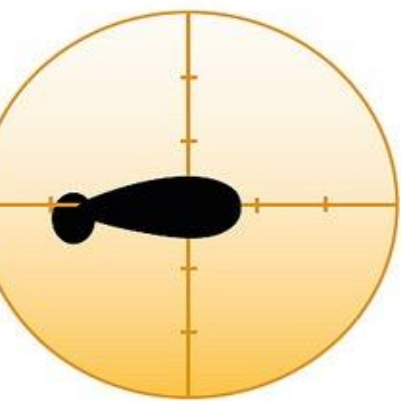
(b) Left homonymous hemianopia (e.g. stroke)



c) Bitemporal hemianopia (e.g. pituitary tumour)



(d) Left central scotoma (e.g. central macular disease) and right upper eyelid artefact



e) Centrocaecal scotomata (e.g. toxic optic neuropathy) and right lens rim artefact



(f) Spiral visual fields (the functional or hysterical visual loss associated with malingering)