

OPTIC NERVE

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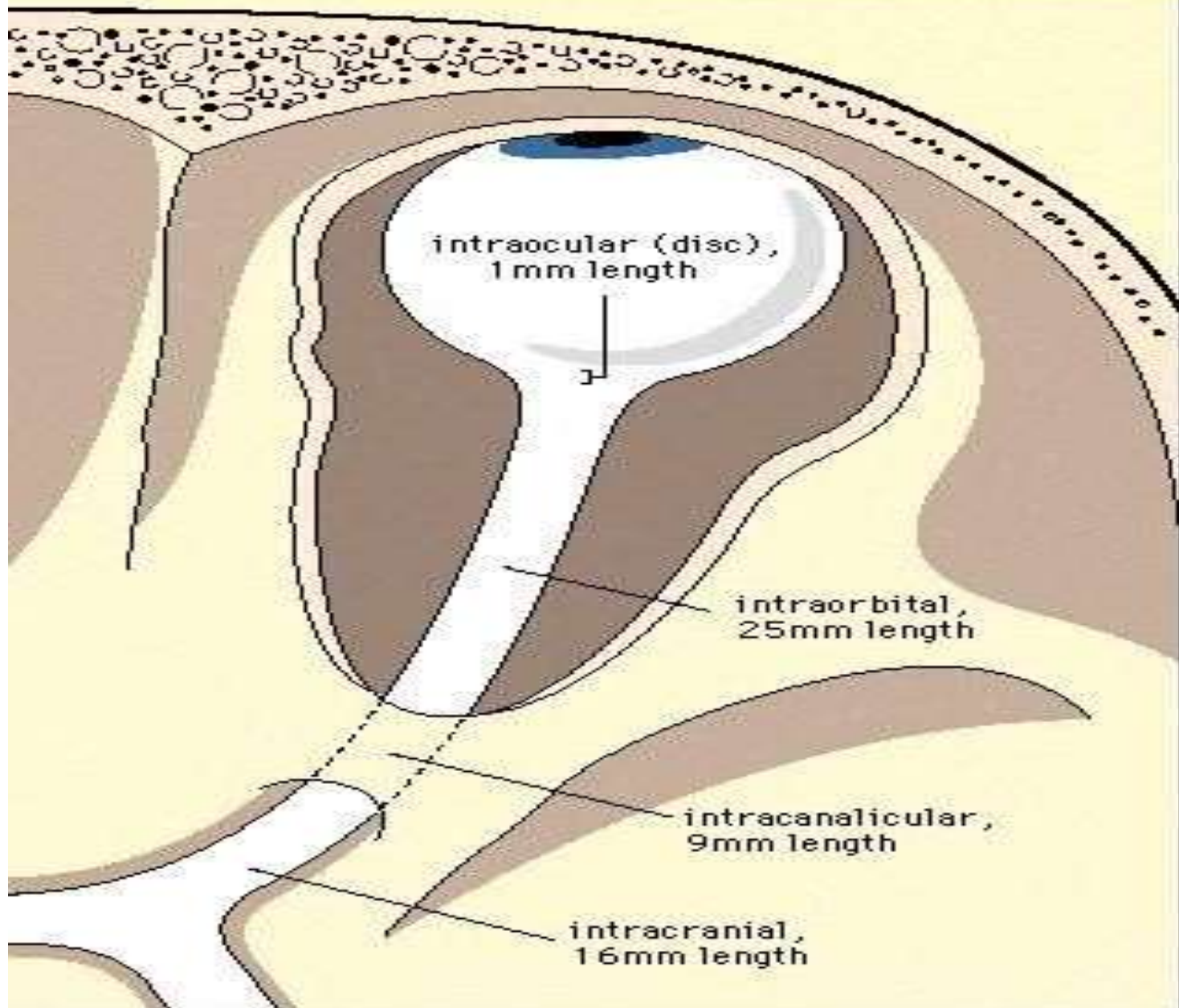
Anatomy of optic nerve

- Optic nerve- more than 1 million axons.
- Starts from optic disc upto optic chiasma.
- Backward continuation of the nerve fiber layer of retina.
- Consisting of axons originating from ganglion cells.
- Contains the afferent fibers of light reflex.
- Elongated tract of white matter
- Not covered by neurilemma.

Contd...

- Optic nerve divided in topographic areas.
 - Intraocular portion of optic nerve- optic disc or nerve head, pre laminar and post laminar.
 - Intraorbital portion.
 - Intra canalicular portion.
 - Intracranial portion.

THE FOUR PORTIONS OF THE OPTIC NERVE



Intraocular optic nerve

- 1 mm in length.
- 1.5 mm diameter.
- Which expands approximately 3-4 mm behind the sclera.
- Optic nerve head divided in 4 parts(ant to post)

Intraorbital optic nerve

Relation of ophthalmic artery

Initially infero-lateral-medially

At the optic foramen-inferior and lateral

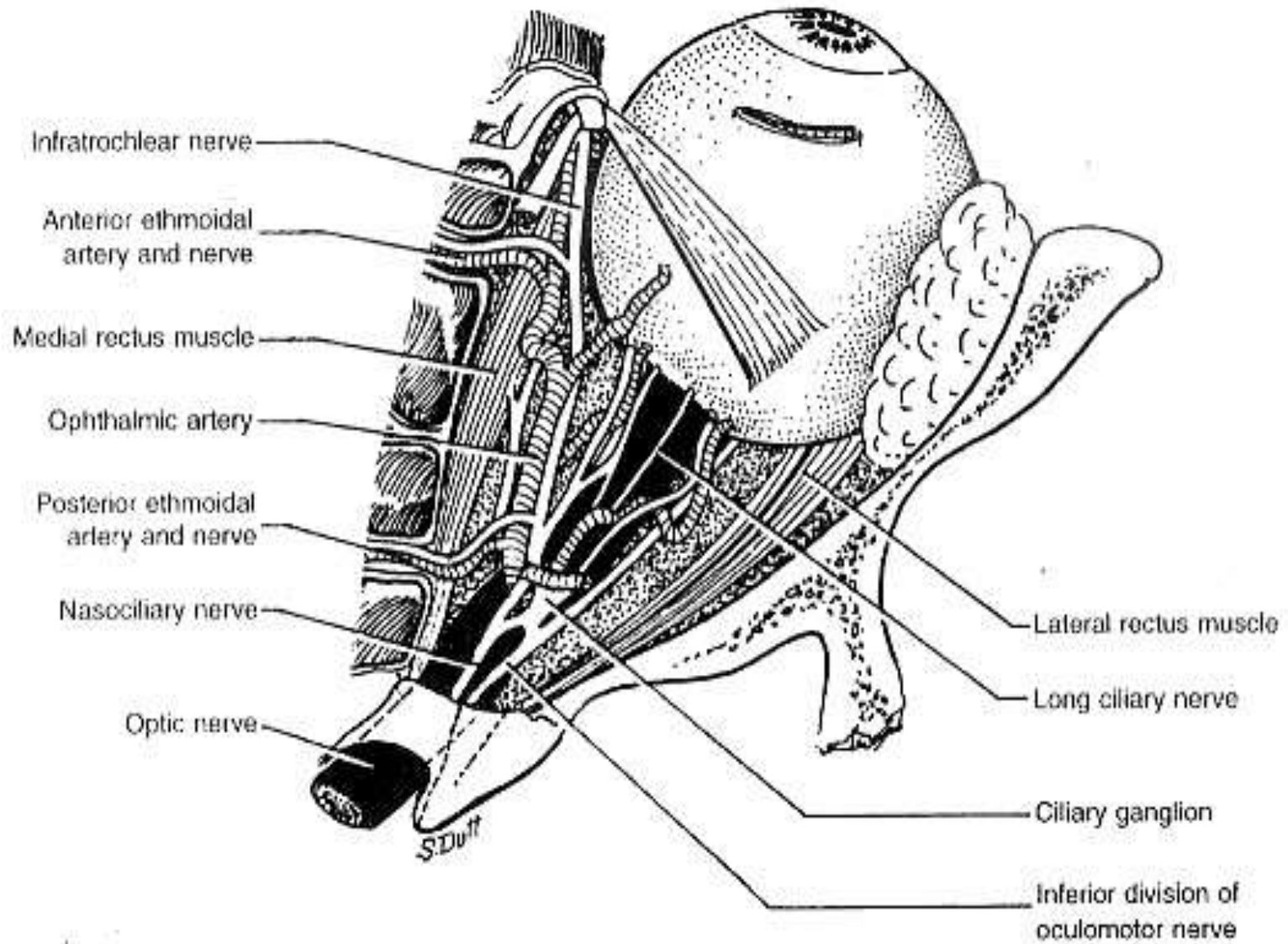
Lateral to optic nerve (in posterior orbit)

-Inferior division of 3rd nerve

-Nasociliary artery

-Sixth Nerve

-Ciliary ganglion



Intraorbital optic nerve

At the orbital apex – optic nerve surrounded by annulus of Zinn.

Blood supply - Ophthalmic artery with meningeal branches

Intracanalicular optic nerve

- 9 mm
- Tightly fixed within the canal (compressive optic neuropathy)
- Blunt trauma
- Optic nerve edema
- Blood supply - pial branches from ophthalmic artery.

Intracranial optic nerve

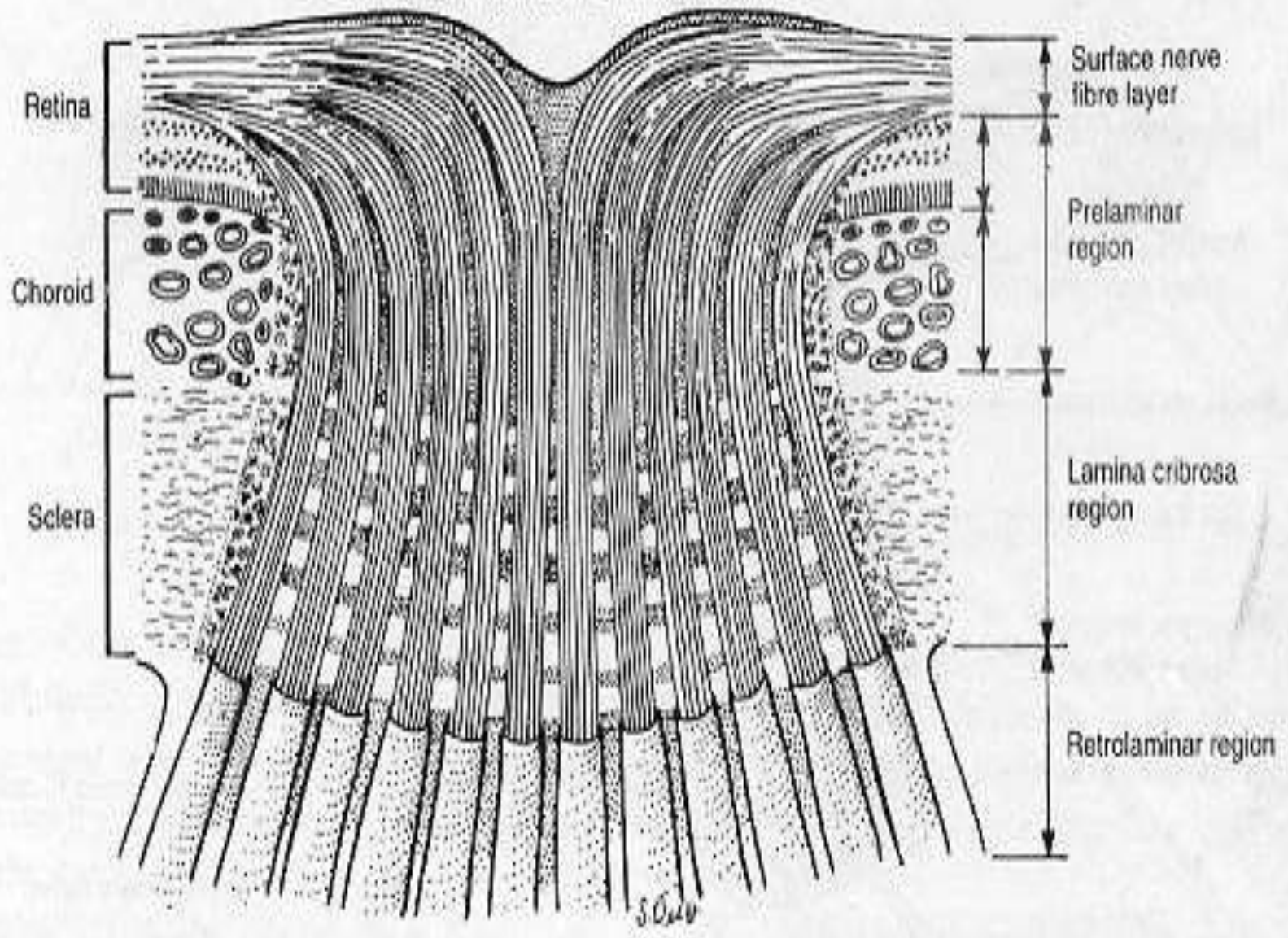
- Length-10mm
- Dm-4.5mm
- Extends post & medially ascending at an angle of 45° to join the chiasma
- Blood supply- pial vessels arising from ICA branches from ant cerebral and anterior communicating artery

Optic nerve head

⊖ 4 layers of Optic Nerve Head:

- Surface nerve fiber layer.
- Prelaminar layer consisting of retinal nerve fibres angled posteriorly from the plane of retina visible only within the central cup.
- Laminar layer: Lamina cribrosa and nerve fibre bundles running through it.
- Retro laminar layer.

OPTIC NERVE HEAD

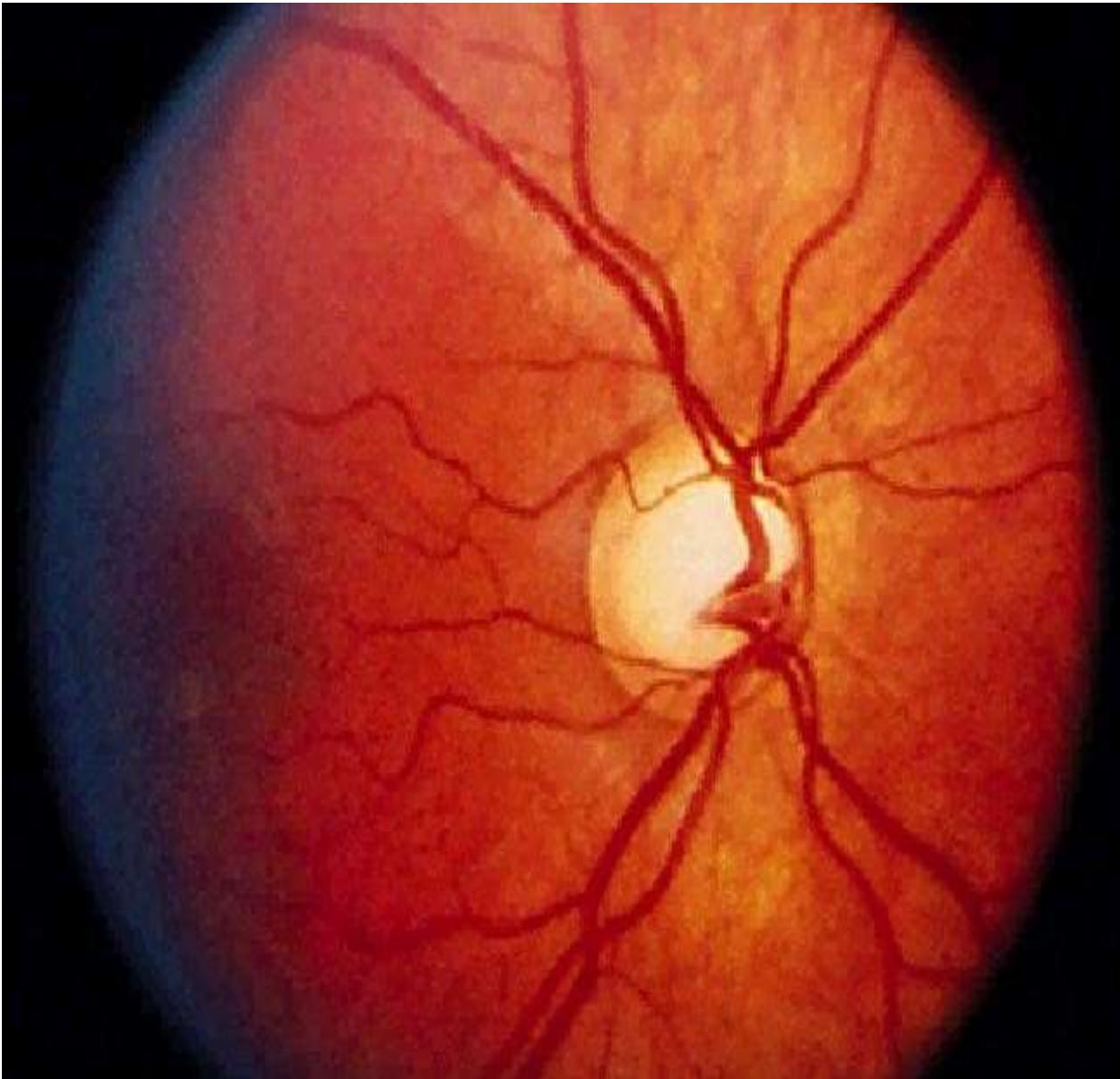


Optic nerve head

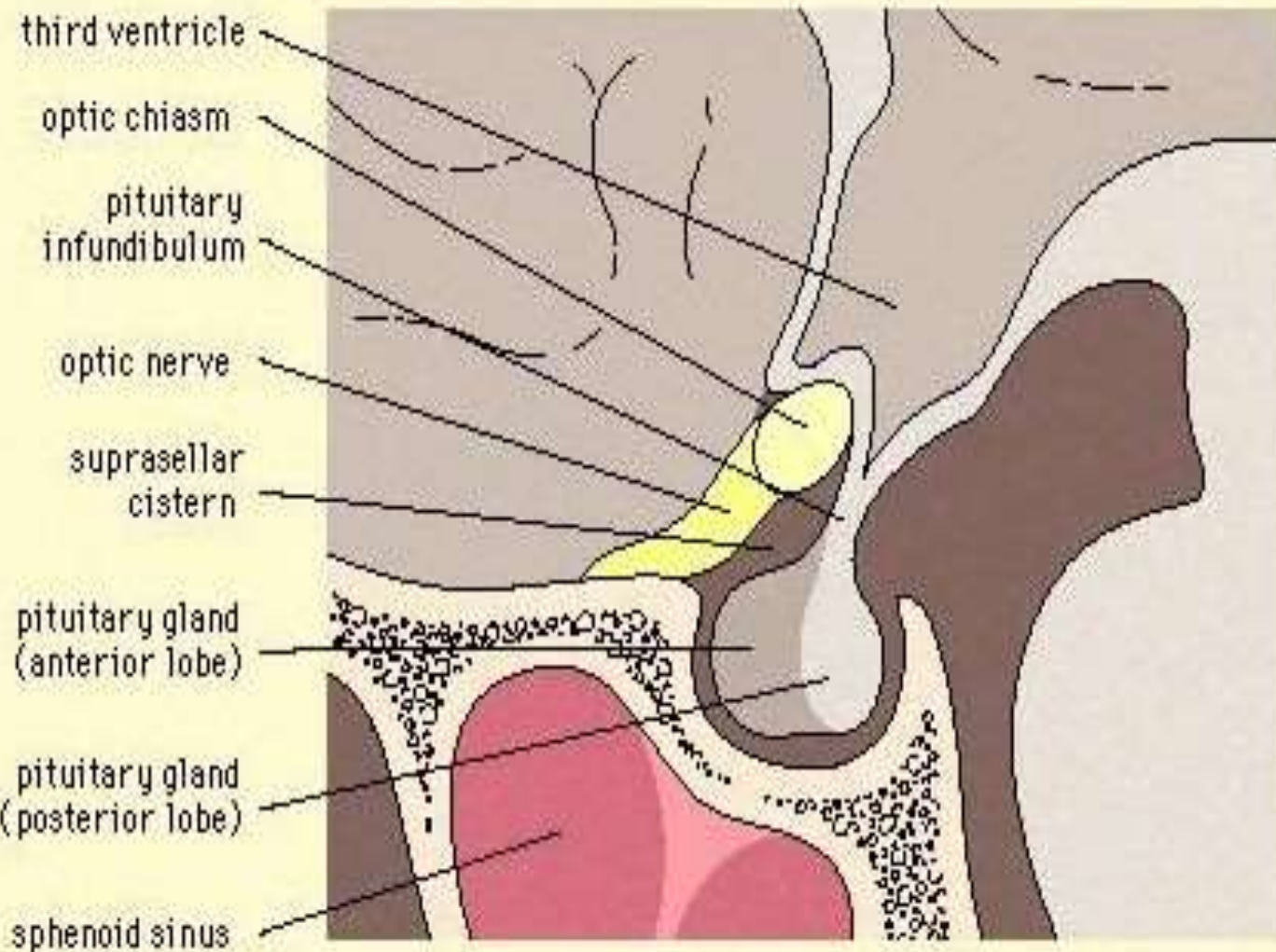
- Lamina Cribrosa - Consists of series of plates of collagenous connective tissues.
- -Perforated by 200 - 400 openings.
- -Superficial openings – appear as grey dots deep within the optic cup.
- -Large pores have thin connective tissue supports and contain large nerve fibres.

Contd...

- Optic Cup - 3-dimensional pale depression in the centre. Size of the cup related to dm of the disc.
- Neuroretinal rim- tissue between outer edge of the cup and outer margin of the disc.
- Orange or pink colour
- Uniform width
- Retinal blood vessels



RELATIONSHIP OF CHIASM TO NEIGHBORING STRUCTURES (MEDIAN SAGITTAL SECTION)



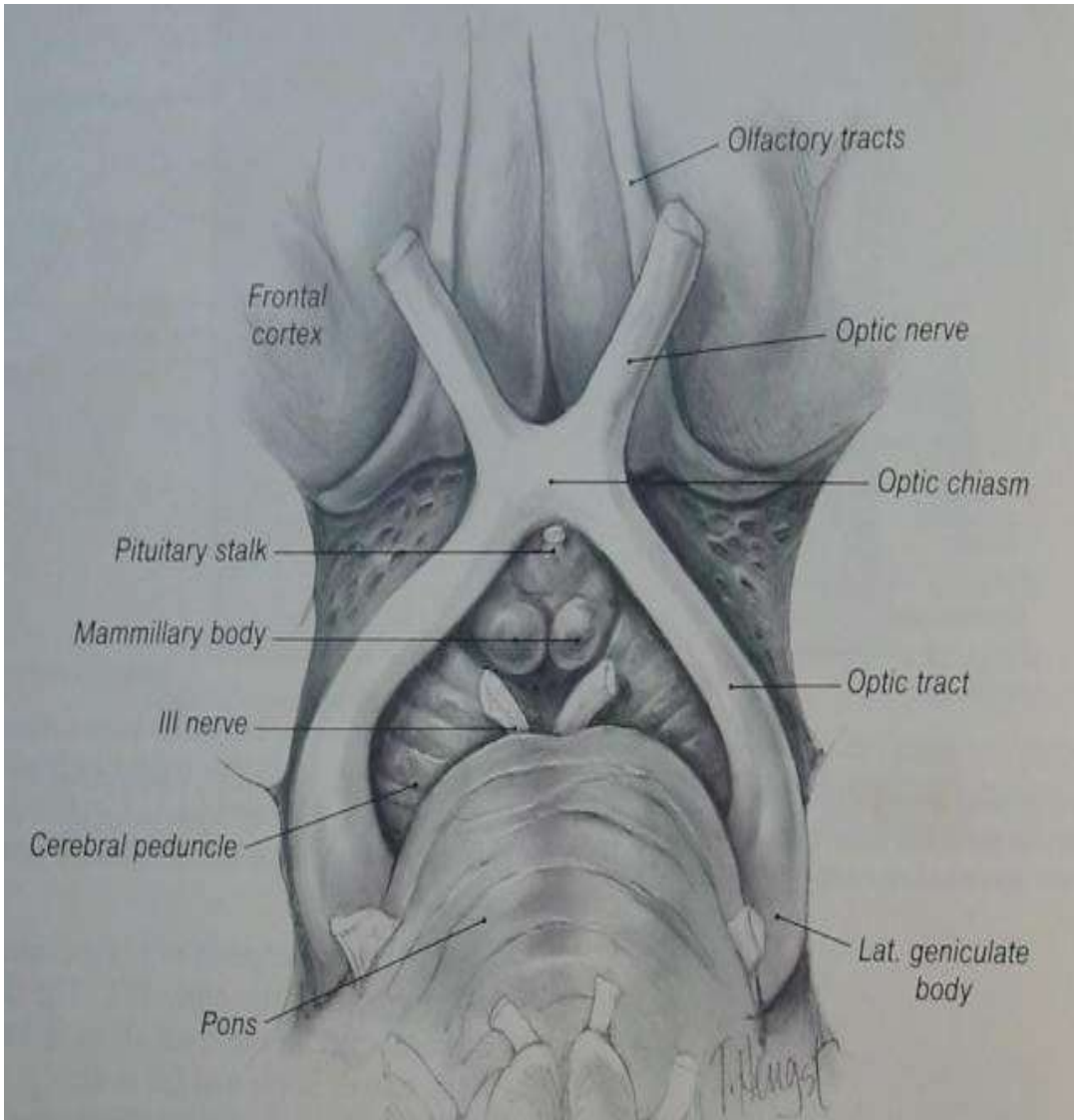
Optic chiasma

Nerve fibres:-

Lower nasal fibres traverse the chiasma low and anteriorly (vulnerable-expanding intrasellar lesions)

Upper nasal fibres traverse high and posteriorly (craniopharyngioma)

Crossing fibres from infero-nasal quadrant loop ant into post part of contralateral optic nerve –Wilbrand's Knee



Optic tract

- Each optic tract contains ipsilateral temporal & contralateral nasal fibres from optic nerves.
- Nerve fibres rotate a 90° so that superior fiber – medially & inferior – laterally .
- Macular fibres - dorsolateral orientation.
- Blood supply - anterior choroidal artery & branches from posterior communicating artery.

Contd...

- Visual field defects in optic tract lesion
- incongruous homonymous hemianopia
- Bilateral retinal layer atrophy / optic atrophy
- Pupillary reflex – RAPD in contralateral eye

Lateral geniculate body

Part of Thalamus

- Site of termination of afferent fibres
- 6 major layers:-
 - Magnocellular (1 ,2)
 - Parvocellular (3,4,5,6)
- Visual field defect in lesions of LGB
- Incongruous homonymous hemianopia
- No pupillary change

Optic radiation

- 3 main groups:-
 - Inferior portion (serving superior V.F.)
 - Superior portion (serving inferior V.F.)
 - Central portion (macular fibres)
- As they exit from LGB the rotation of fibres occurs in reverse 90° so superior fibres lie superiorly and inferior fibres lie inferiorly.
- Blood supply:- anterior choroidal artery & posterior cerebral artery

Visual cortex

- Thinnest portion of cerebral cortex
- Area - 20-45 sq cm
- Occupies 3-5% of brain
- Situated along calcarine fissure on medial side
- Macular fibres – tip of occipital lobe and tip of lateral side
- Ocular Dominance Column

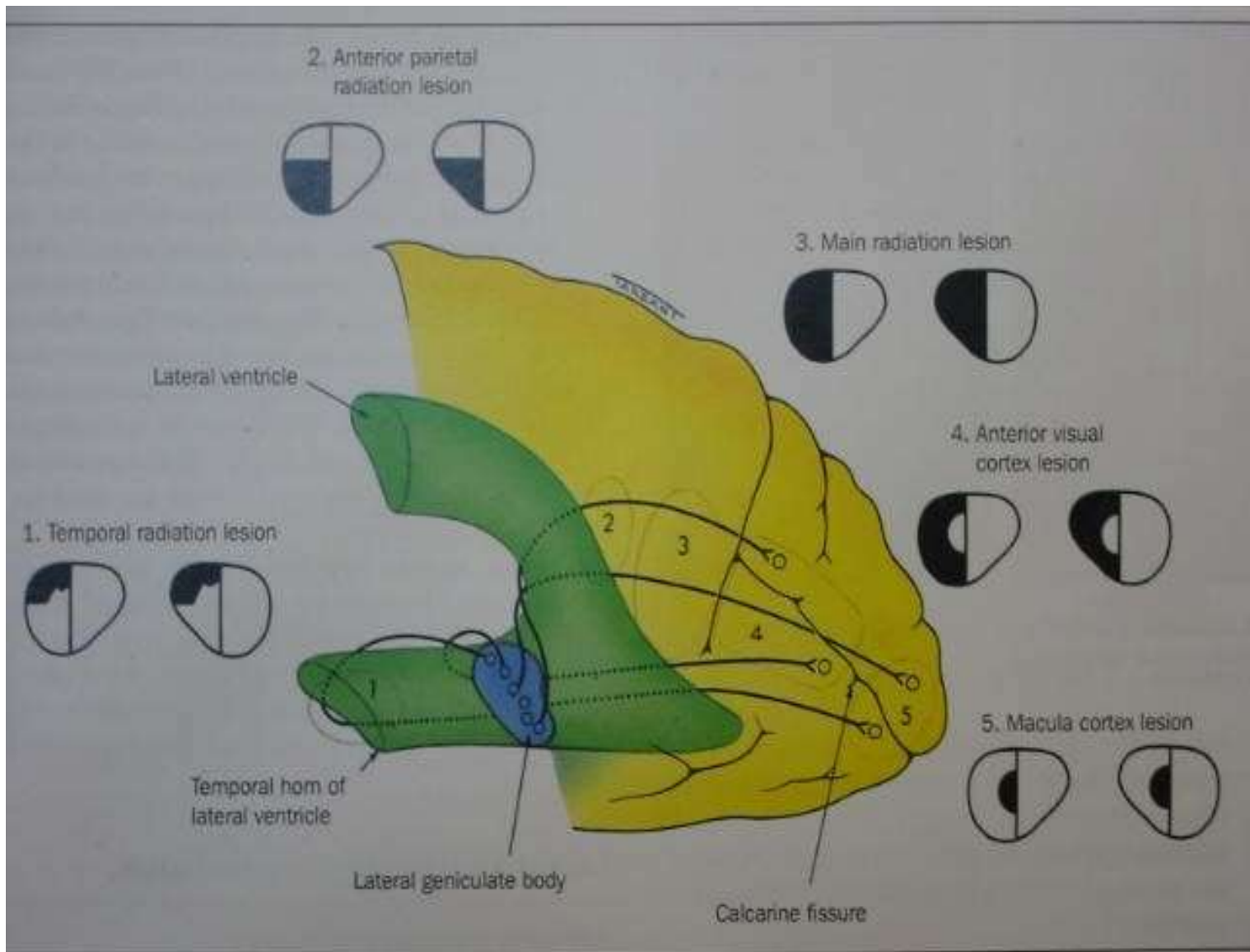
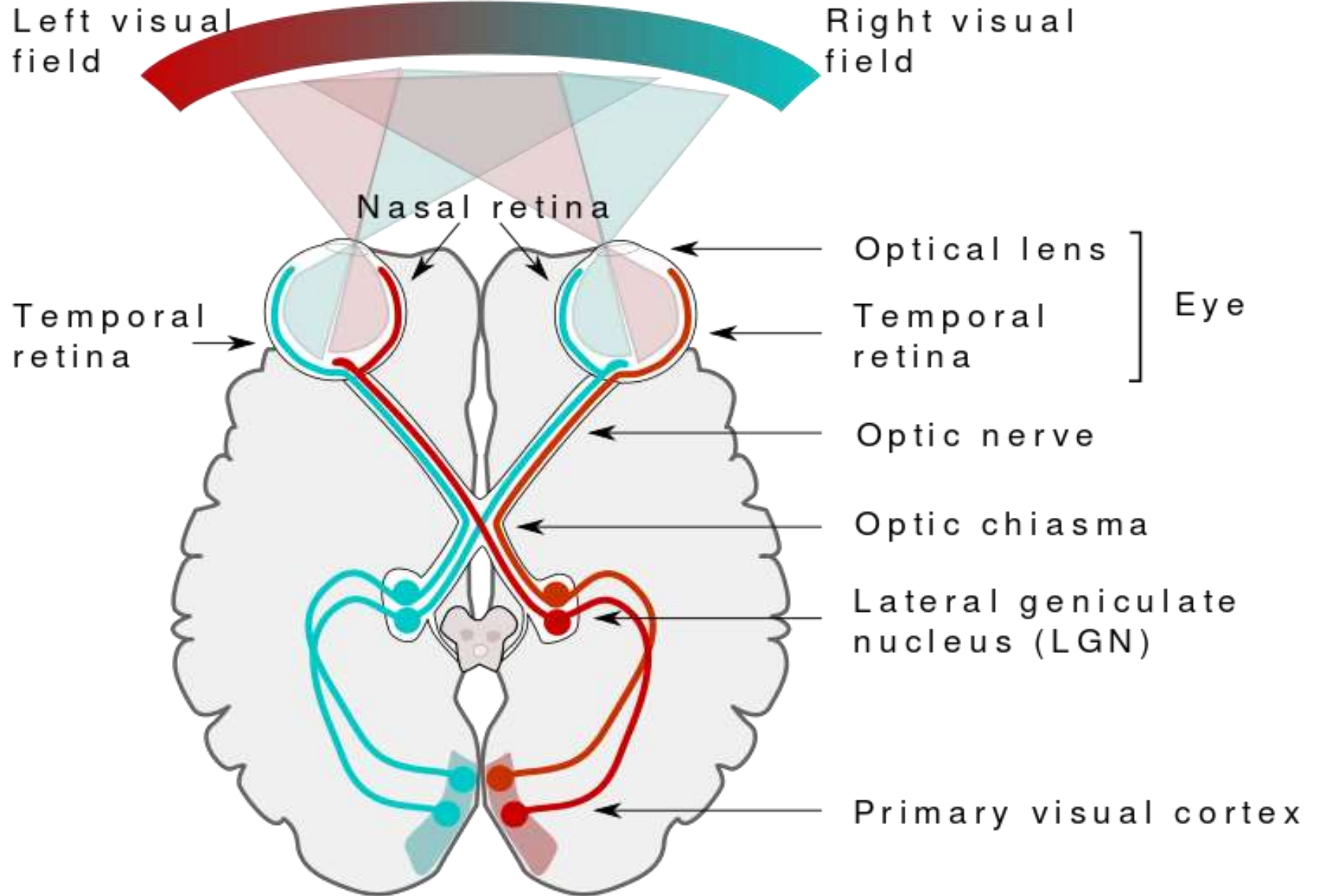


Figure 15.104 Visual field defects caused by lesions of the optic radiations and visual cortex

Visual cortex

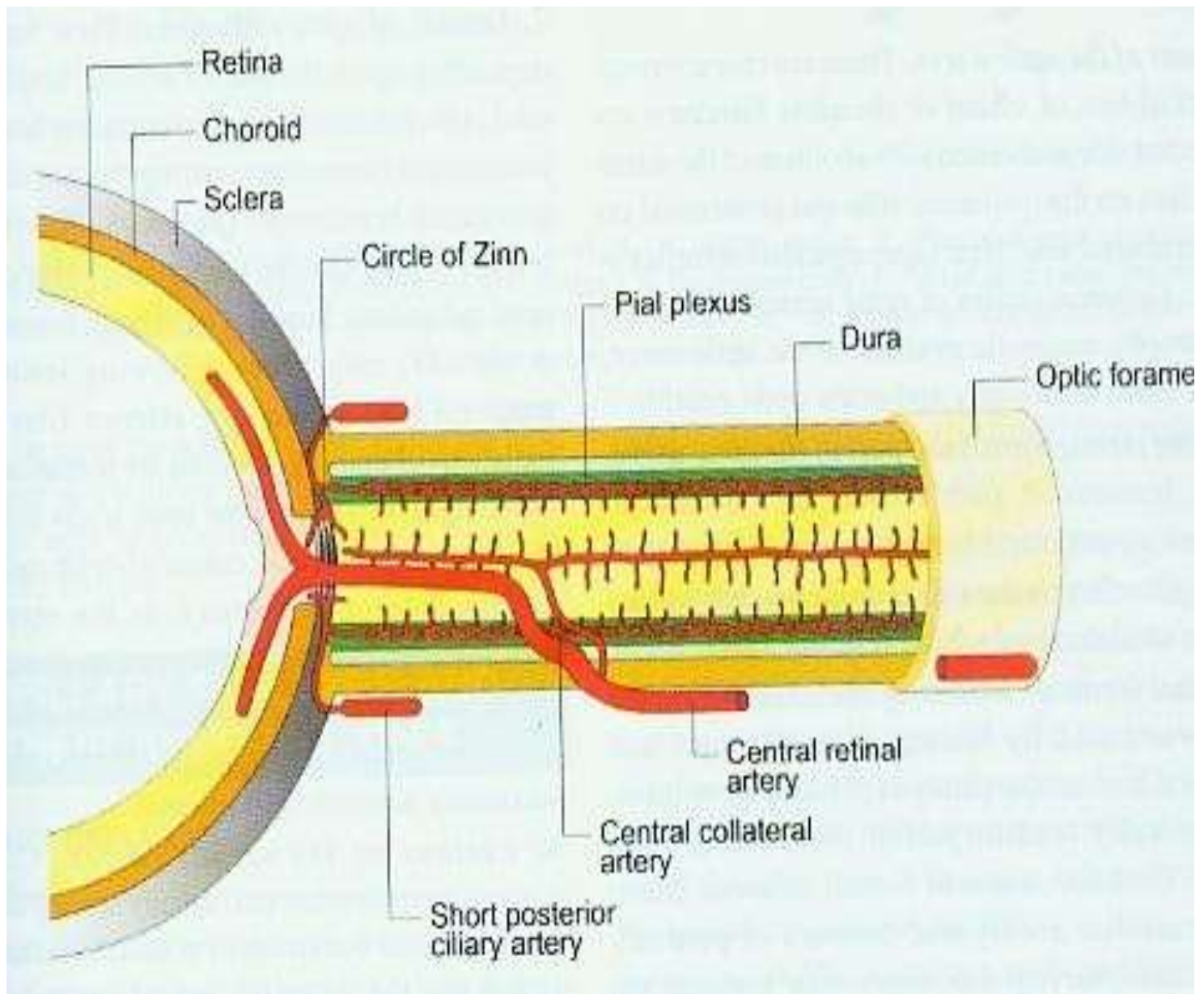
- Blood supply: Middle cerebral artery
Posterior cerebral artery
- Visual field defect - occlusion of the Posterior cerebral artery - congruous homogeneous hemianopia
- Head injury, gun shot injury, cerebral tumours.

Visual pathway



Blood supply

- Intraocular part-
 - a) surface nerve fiber-capillaries from retinal artery.
 - b) prelaminar-short post ciliary artery.
 - c) lamina cribrosa-short post ciliary artery and circle of Zinn-Haller.
 - d) retrolaminar-ciliary and retinal circulation.



Venous drainage

- Primarily by central retinal vein.
- Orbital part –pial plexus and central retinal vein.
- Intracranial part- anterior cerebral and basal vein.

Diseases of Optic Nerve

Evaluation of optic nerve disease

Reduced visual acuity

Afferent pupillary defect

Dyschromatopsia

Diminished bright sensitivity

Diminished contrast sensitivity

Visual field defect

OPTIC NEURITIS

Optic neuritis include inflammatory and demyelinating disorders of optic nerve

Optic neuritis-causes

Demyelinating-Multiple sclerosis, Devic disease, Schilder disease

Parainfectious-following viral illness or immunization

Infectious-cat-scratch fever, Lyme disease, cryptococcal meningitis, AIDS & H. Zoster.

Immune mediated

Metabolic disorders

Symptoms

Diminution of vision

Pain-deep orbital, retro-ocular or brow pain **aggravated by eye movement**

Tenderness over SR

Lowered dark adaptation

Visual obscuration

Impaired colour vision (red desaturation)

Phosphenes

Obscuration of vision on exercise/heat (**Uhthoff** sign)

Pulfrich's phenomenon (altered perception of moving objects)

Signs

Reduced visual acuity

Impaired colour vision

RAPD

Ill sustained pupillary reaction

Visual field changes

Reduced contrast sensitivity

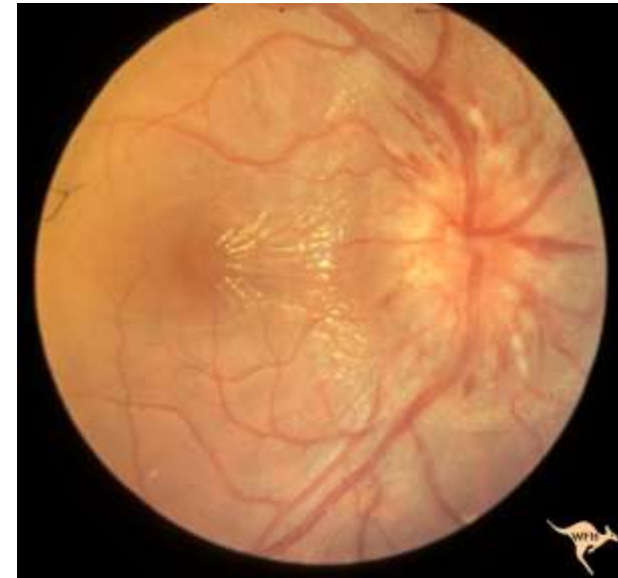
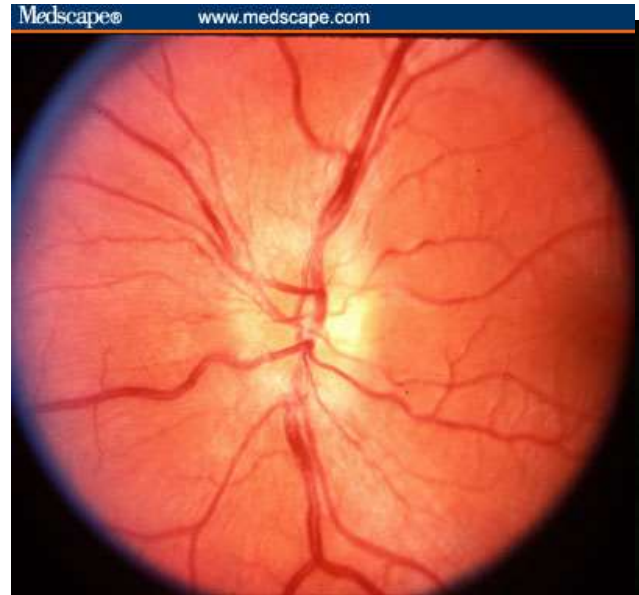
VER changes

Clinical presentations

Retrobulbar neuritis

Papillitis

Neuroretinitis



RETROBULBAR NEURITIS : Characterized by involvement of optic nerve behind the eyeball. Clinical features of acute retrobulbar neuritis are essentially similar to that of acute papillitis except for the fundus changes and ocular changes.

PAILLITIS: It refers to involvement of the optic disc in inflammatory and demyelinating disorders. This condition is usually unilateral but sometimes may be bilateral.

NEURORETINITIS: refers to combined involvement of optic disc and surrounding retina in the macular area.

D-D

Ischaemic optic neuropathy

Papilloedema

Leber's hereditary neuropathy

Toxic & metabolic neuropathy

Compressive lesion on the orbit or I/Cranial

Atypical Optic Neuritis

Patient out of the age range of 20-50 years

No pain on eye movement

Poor vision persisting beyond 2 weeks

Progressive DOV beyond 1 week

Investigations

MRI

Visual fields

VEP

CBC

ESR

CRP

FTA-ABS

ANA

Treatment

Patient with profound visual loss or if MRI shows at least one area of demyelination

I/V Methylprednisolone 1g daily for 3 days followed by oral prednisolone 1mg/kg daily for 11 days.

Oral CS are **contraindicated**.

If MS or previous episode of ON then observation

OPTIC ATROPHY

Definition

Optic atrophy refers to degeneration of the optic nerve, which occurs as an end result of any pathologic process that damages axons in the anterior visual system, i.e., from retinal ganglion cells to the lateral geniculate body.

Primary Optic atrophy

Primary optic atrophy occurs without antecedent swelling of the optic nerve head. It may be caused by lesions affecting the visual pathways at any point from the retrolaminar portion of the optic nerve to the lateral geniculate body. Lesions anterior to the optic chiasm result in unilateral optic atrophy, whereas those involving the chiasm and optic tract will cause bilateral changes.

Signs:

- Flat chalky white disc with clearly delineated margins.
- Reduction in the number of small blood vessels on the disc surface.
- Attenuation of peripapillary blood vessels and thinning of the retinal nerve fibre layer (RNFL).

Consecutive optic atrophy

Consecutive optic atrophy is caused by disease of the inner retina or its blood supply. The cause is usually obvious on fundus examination. Causes are:

- Extensive retinal photocoagulation,
- Retinitis pigmentosa
- Central retinal artery occlusion.
- Diabetic Retinopathy.
- Extensive Retino-choroiditis.
- Pathological myopia etc.

Differences between clinical features of primary, secondary & consecutive optic atrophies

Feature	Primary	Secondary	Consecutive
APPEARANCE	Chalky white	Dirty grey white	Waxy pallor
MARGINS	Well defined	Ill defined	Well defined
LAMINA CRIBROSA	Well seen	Obscured	Well seen
VESSELS	Normal	Peripapillary sheathing	Attenuation
SURROUNDING RETINA	Healthy	Hyaline bodies/ drusen	Pathology seen

Total Optic atrophy

- Clinical Features: (i) Pupil dilated, fixed, non-reacting (Bilateral).
- (ii) Consecutive consensual reaction exaggerated (unilateral).
- Vision: No perception of light (NPL).

Partial Optic atrophy

- Clinical features:

- (i) Vision: Reduced to counting finger (CF) 5';7'
- (ii) Conscentric contraction of visual field with or without scotoma. That means tubular vision.

Most forms of partial optic atrophy , involve a loss of temporal fibres including the papillomacular bundles. This results in 'temporal pallor'. But this should be confirmed by special investigations, since, temporal side is normally pale, because the retinal vessels emerge from the nasal side, and the temporal side is normally less vascular.

Treatment

Treatment of underlying cause may help in preserving some vision in patients with partial optic atrophy. However, once complete atrophy has set in, the vision cannot be recovered.

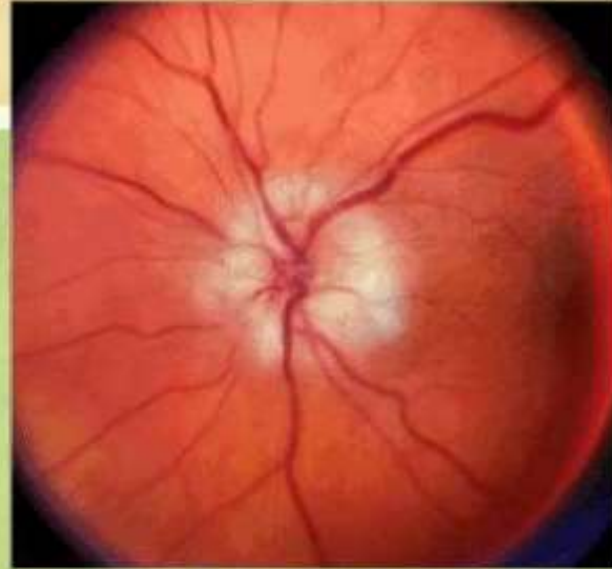
Treatment is according to cause. However, high dose of vitamin B₁, B₆, B₁₂ is given. Hydroxocobalamine (vitamin-B₁₂) 1000 µg is administered for atrophy due to toxic optic neuritis.

ANTERIOR ISCHAEMIC OPTIC NEUROPATHY (AION)

It refers to ischaemic damage to the optic nerve head from occlusion of the short posterior ciliary arteries.

It is of 2 types:

- Arteritic anterior ischaemic optic neuropathy &
- Non-Arteritic anterior ischaemic optic neuropathy



Left: Nonarteritic anterior ischemic optic neuropathy. Note the hyperemic swelling of the optic disc associated with the flame-shaped peripapillary hemorrhage. Right: Arteritic anterior ischemic optic neuropathy. Note the pallid swelling of the optic disc and a peripapillary cotton-wool spot.

AION

	ARTERITIC AION	NON ARTERITIC AION
MEAN AGE	70 years	60 years
GENDER	Female > male	No relation
ASSOCIATED SYMPTOMS	Headache, scalp tenderness, jaw claudication	Occasional orbital pain
VISUAL ACUITY	<6/60 in 76%	>6/60 in 61%
OPTIC DISC APPEARANCE	Pale more than hyperemic edema Normal to large cup	Hyperemic more than pale edema Small cup
ESR	>70 (highly raised)	20-40 (mildly raised)
FFA	Choroidal (> 30 – 69 s) and disc filling delay	Disc filling delay
NATURAL HISTORY	Poor prognosis for recovery Fellow eye involved in upto 95%	Upto 3 line improvement in about 43% cases Fellow eye involved in <30% cases
TREATMENT	Urgent administration of corticosteroids	Doubtful role of corticosteroids

Papilloedema

Swelling of the optic nerve head secondary to raised intracranial pressure.

Almost always bilateral.

Develops due to stasis of axoplasm in the prelaminar region of the optic disc.

Causes

Congenital

ICSOLs

Intracranial infections

Intracranial hemorrhages

Obstruction of CSF absorption

Idiopathic intracranial hypertension

Tumors of the spinal cord

Systemic conditions

Cerebral edema

Pathology

Passive edema

Axoplasmic stasis

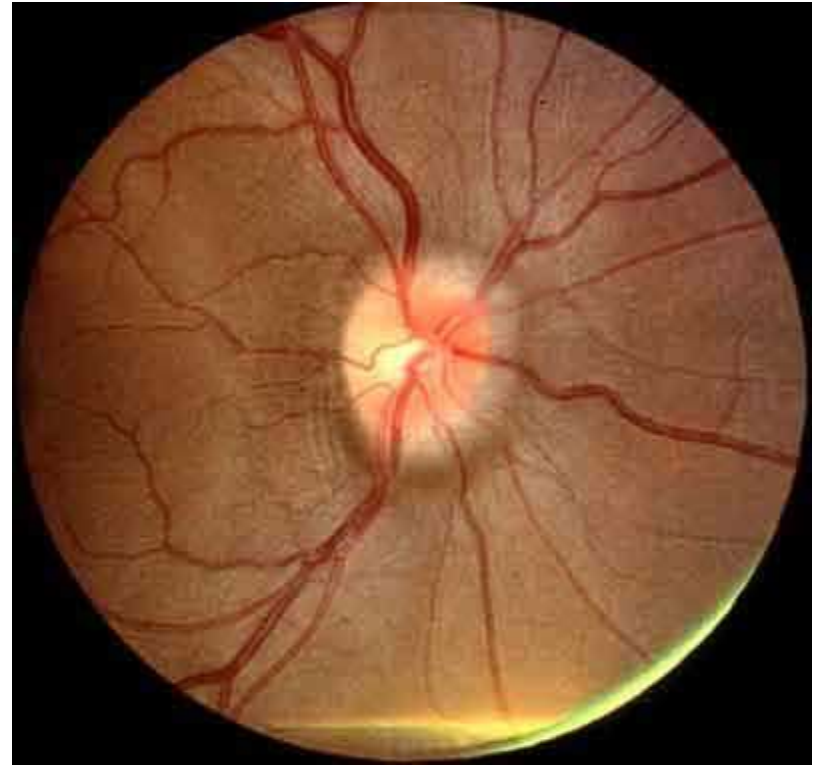
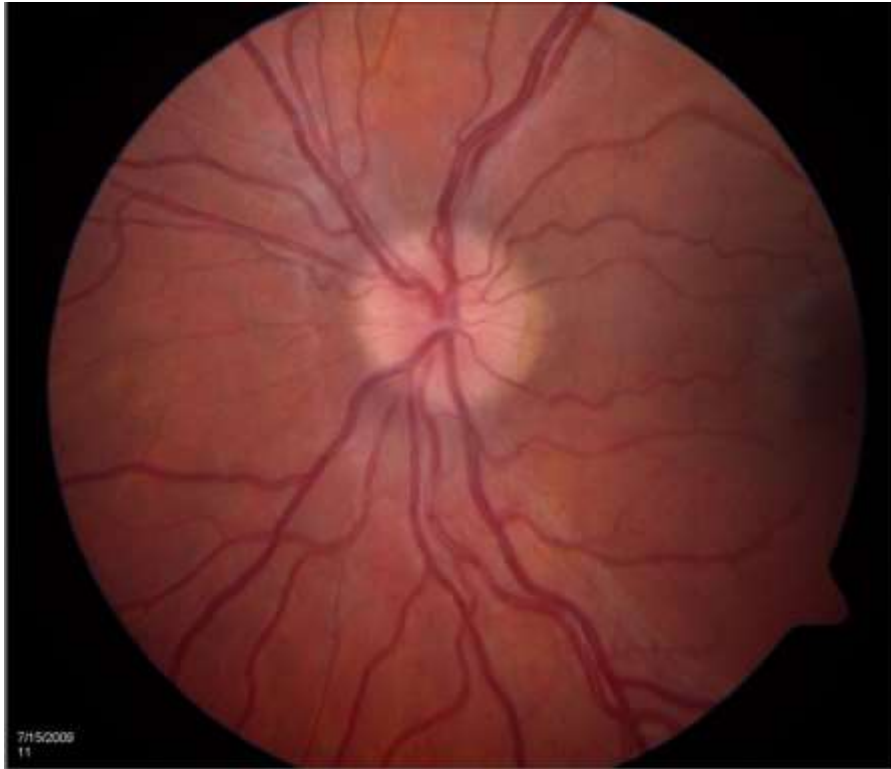
Edema of the surrounding retina

ILM raised into folds

Clinical features

- Episodes of transient attacks of blurred vision
- Blackouts often ppted by change in posture
- Enlargement of blind spot
- Visual loss if condition persists

Clinical features-early papilloedema



VA - normal

Mild disc hyperemia

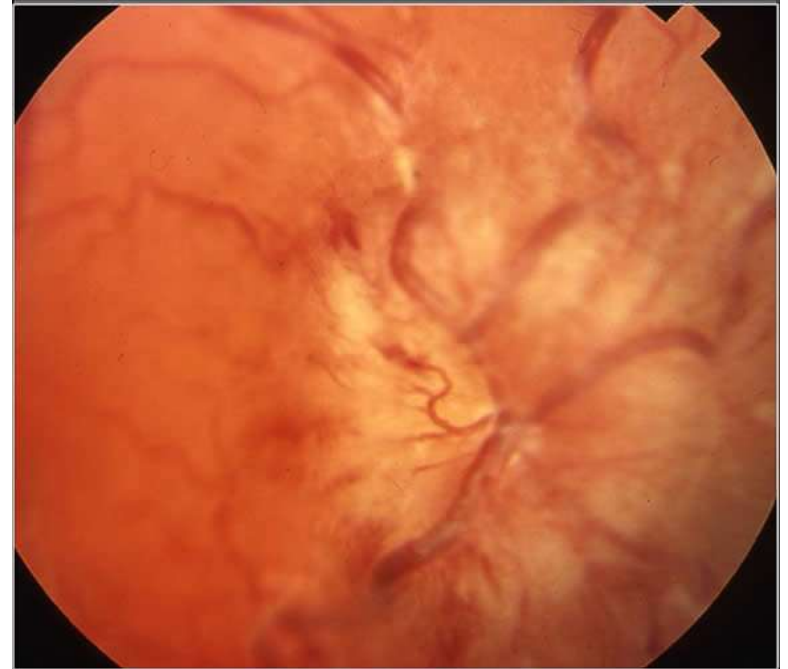
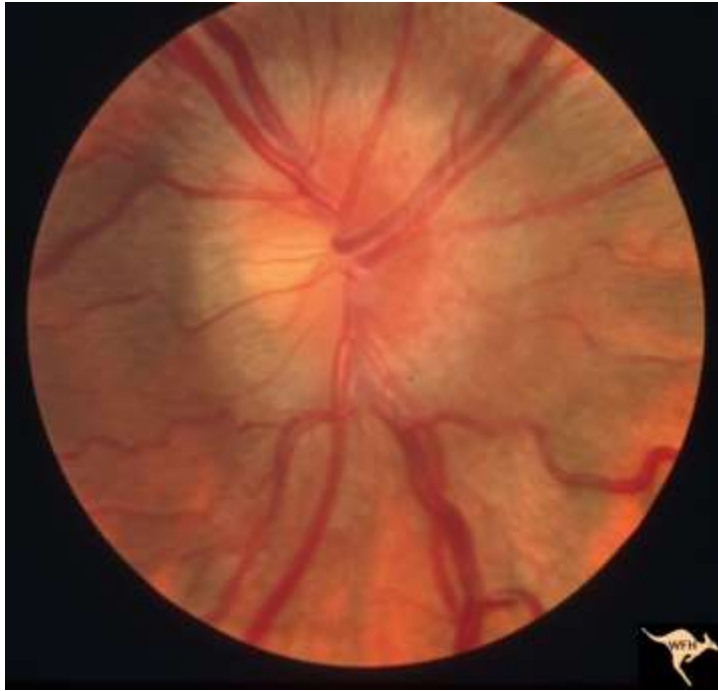
Indistinct disc margins - initially nasal

Mild venous engorgement

Normal optic cup

Spontaneous venous pulsation - absent (also absent in 20% of normal)

Established papilloedema



VA - usually normal

Severe disc elevation and hyperemia

Very indistinct disc margins

Obscuration of small vessels on disc

Marked venous engorgement

Reduced or absent optic cup

Hemorrhages + cotton-wool spots

Macular star

D-D


Optic disc drusen

Hypermetropia

Persistent hyaloid tissue

Ischaemic optic neuropathy

Orbital diseases



THANK YOU