

2.10 OPTIC NERVE

Objectives/ Plan/ Summary:

Clinical anatomy & physiology: page 2

Terms used: page 2

Difference between optic neuropathy & optic atrophy: page 3

Symptoms of optic nerve disease: page 3

Details of Types of neuropathy: page 4-8

Group A- Optic neuropathies causing primary optic atrophy:

A1- Hereditary

A2- Nutritional

A3- Toxic

A4- Traumatic

A5- Compressive

A6- Infiltrative

Group B- Optic neuropathies causing secondary optic atrophy:

(preceded by disc swelling so irregular margins of optic atrophy)

B1- Ischemic

B2- Inflammatory (**Optic neuritis**)

B3- Increase intra cranial pressure (**Papilledema**): papilledema is one type of disc swelling

Group C- Optic neuropathies causing consecutive optic atrophy

C1- Retinal diseases like retinitis pigmentosa

Group D- Optic neuropathies causing glaucomatous optic atrophy

D1- Glaucoma

Disc swelling (papilledma is just one type of disc swelling): page 8

What is optic atrophy: page 9

Important
Please spend 5 minutes to
understand objectives/plan

Optic neuropathy

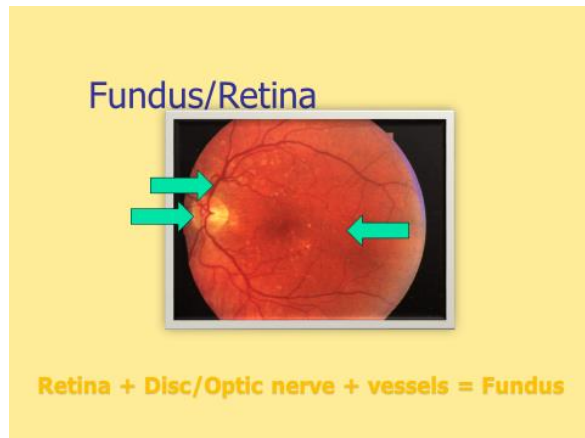
Any disease of optic nerve

Optic atrophy

(This is clinical sign)

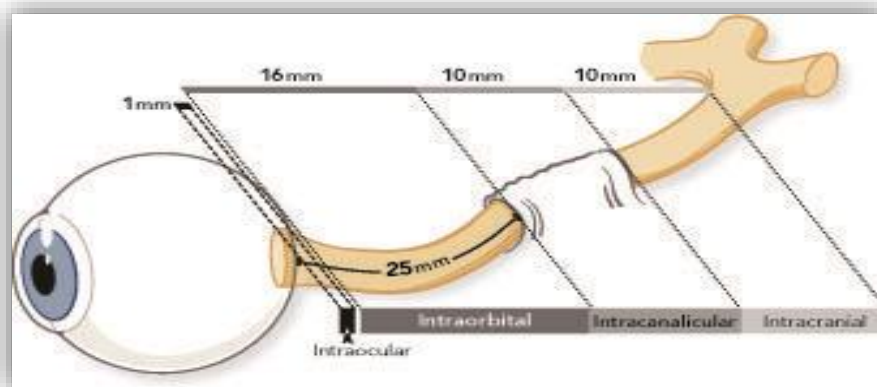
optic neuropathy may or may not
lead to degeneration of optic nerve

Clinical anatomy:



Four parts of optic nerve

- 1- Intraocular: Further divided by lamina cribrosa in to prelamellar, lamellar & post lamellar parts
- 2- Orbital
- 3- Intracanalicular
- 4- Intracranial



Terms used:

Optic Disc: That part of optic nerve which is clinically visible

Optic neuropathy: Any disease of optic nerve

Optic neuritis: Optic neuropathy because of inflammation

Papillitis: (type of optic neuritis) Inflammation/swelling of optic disc

Retro bulbar neuritis: (type of optic neuritis) Inflammation of cranial optic nerve

Neuroretinitis: (type of optic neuritis) Inflammation of retinal nerve fibers

Optic atrophy: Clinical sign. Degeneration of optic nerve because of neuropathy

Disc edema: Any swelling of optic disc

Diabetic papillopathy: Swelling of optic disc because of diabetes

Papilledema: Swelling of optic disc because of increased intra cranial pressure

Optic neuropathy:

Any disease, injury, compression or any insult of optic is optic neuropathy.

(some books classify optic nerve diseases as optic neuritis (inflammatory) & optic neuropathy (non-inflammatory including ischemic, hereditary, nutritional, toxic, compressive & infiltrative))

If optic neuropathy genetic, we call it hereditary neuropathy.

If optic neuropathy is because of nutrition, we call it nutrition neuropathy.

If optic neuropathy is because of toxicity, we call it toxic neuropathy.

If optic neuropathy is because of trauma, we call it traumatic neuropathy.

If optic neuropathy is because of compression, we call it compressive neuropathy.

If optic neuropathy is because of infiltration, we call it infiltrative neuropathy.

If optic neuropathy is because of ischemia, we call it ischemic neuropathy.

If optic neuropathy is because of inflammation, we call it **optic neuritis**.

If optic neuropathy is because of Intracranial, we call it **papilledema**.

If optic neuropathy is because of glaucoma, we call it glaucomatous neuropathy.

If optic neuropathy is because of retinal disease, we call consecutive neuropathy.

Optic atrophy:

Any optic neuropathy may lead to degeneration of optic nerve which is called optic atrophy.

Optic atrophy is a clinical term which means optic nerve has been turned whitish instead of pinkish red in color because of degeneration. There are four types of optic atrophy.

Optic neuropathy may or may not lead to optic atrophy

If optic atrophy is treated at early stage, then optic nerve can recover without degeneration of its fibers with no optic atrophy. If optic atrophy treated late or not treated, then optic atrophy can develop.

Symptoms of optic nerve disease:

EVALUATION OF OPTIC NERVE DISEASE:

SIGNS OF OPTIC NERVE DYSFUNCTION:

- Reduced visual acuity
- Afferent pupillary defect
- Decreased colour vision
- Visual field defects
- Diminished light brightness sensitivity

Types of optic neuropathy:

All may lead to optic atrophy

Optic neuropathy

- **A1- Hereditary neuropathy:** Leber's optic neuropathy
- **A2- Nutritional neuropathy:** Tobacco, Alcohol, Vitamin B
- **A3- Toxic neuropathy:** Methanol
- **A4- Traumatic neuropathy** Lead to primary optic atrophy
- **A5- Compressive neuropathy:** secondary to orbital lesion
- **A6- Infiltrative neuropathy:** Inflammatory like sarcoidosis, Tumours, Infections
- **B1- Ischemic neuropathy:**
 - Anterior arteritic, Ant non-arteritic, Post Ischemic, Diabetic papillitis
- **B2- Inflammatory neuropathy –Neuritis (Preceding disc swelling)**
 - Clinical: Papillitis, Retrobulbar
 - Etiological: Demyelinating, Parainfectious, infectiousLead to secondary optic atrophy
- **B3- Papilledema: (Preceding disc swelling)** Neuropathy secondary to increased intra cranial pressure Lead to glaucomatous optic atrophy
- **C- Glaucomatous neuropathy due to glaucoma**
- **D- Optic neuropathy due to glaucoma** Lead consecutive optic atrophy

Optic neuropathies

Group A- Optic neuropathies causing primary optic atrophy:

All optic neuropathies in group A (Except anterior ischemic optic neuropathy) Plus retrobulbar neuritis from group B may lead to primary optic atrophy if not arrested or treated.

Diabetic papillopathy

Disc swelling because of diabetes

A1- Hereditary optic neuropathy: Leber's Hereditary Optic Neuropathy (LHON)

A2- Nutritional optic neuropathy: Secondary to poor health & avitaminosis

A3- Toxic optic neuropathy: Tobacco, Methyl alcohol, Lead, Ethambutol

A4- Traumatic optic neuropathy: Trauma causing direct damage

A5- Compressive optic neuropathy: Orbital and cranial tumors

A6- Infiltrative optic neuropathy: Diseases like sarcoidosis infiltrate optic nerve

Group B- Optic neuropathies causing secondary optic atrophy

(preceded by disc swelling so irregular margins of optic atrophy)

All optic neuropathies in group B (Except retrobulbar neuritis) may lead to secondary optic atrophy if not arrested or treated.

B1- Ischemic optic neuropathy

B2- Inflammatory (optic neuritis)

B3- Because if increased intracranial pressure (Papilledema)

B1- Ischemic optic neuropathy

There are 4 types of ischemic optic neuropathy

Arteritic anterior ischemic optic neuropathy

There is decreased perfusion of short posterior ciliary arteries causing swelling of optic disc head and infarction of optic nerve.

Predisposing factors: Giant cell arteritis

Non-arteritic Anterior ischemic optic neuropathy

Same as AION but not associated with giant cell arteritis. It accounts for 90% of ischemic optic neuropathy.

Predisposing factors: collagen vascular disease, Diabetes, Hypertension

Posterior ischemic optic neuropathy

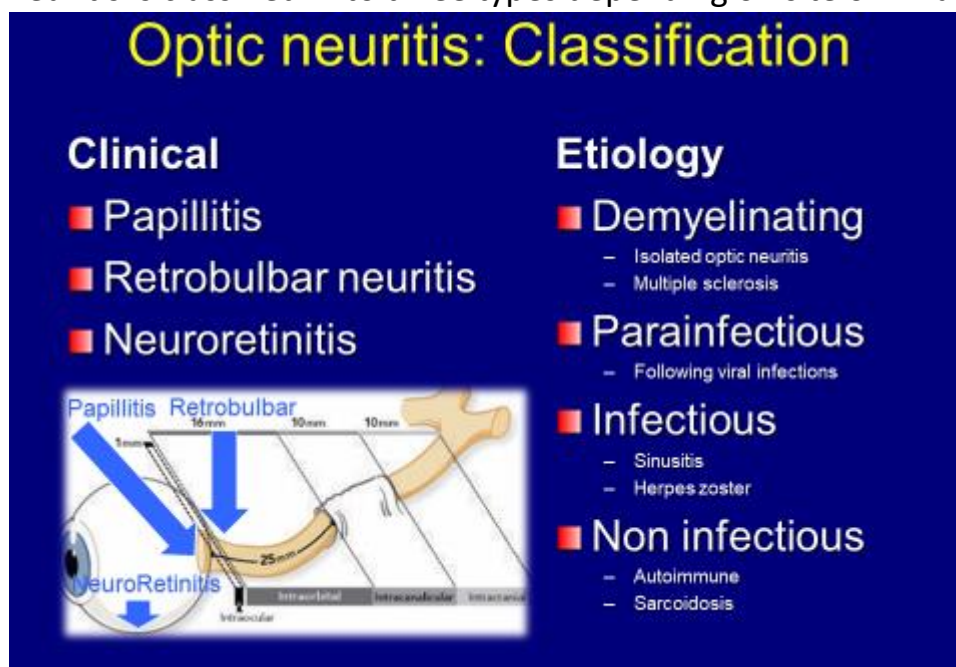
Same as AION except no disc swelling

Diabetic papillopathy

Same as AION

B2- Inflammatory (Optic neuritis)

Optic neuritis is classified in to three types depending on site of inflammation.



Papillitis:

It is common in children. Inflammation is mainly optic nerve head. It is characterized by hyperemia and swelling of optic disc.

Etiology: Etiology not exactly known but tonsillitis, sinusitis or febrile illness may precipitate this condition.

Symptoms: Sudden and sometimes marked decrease in vision which is painless.

Signs: All signs of optic nerve dysfunction like decrease vision, afferent pupil defect, visual field defect, defective color vision and diminished contrast sensitivity. Disc is also hyperemic with flame shaped hemorrhages and congested retinal vessels.

Treatment: precipitating factors should be treated. Role of steroids is controversial but systemic and intravenous steroids may be given in severe and bilateral disease.

Retrobulbar neuritis:

This is more frequent type in adults. It is usually acute but may be chronic. Inflammation is just behind optic disc so named retrobulbar neuritis.

Etiology: Frequently associated with multiple sclerosis.

Symptoms: There is sudden drop in vision along with pain around orbit and pain on ocular movements.

Signs: All signs of optic nerve dysfunction like decrease vision, afferent pupil defect, visual field defect, defective color vision and diminished contrast sensitivity. Optic disc looks normal (patient can not see and doctor can not see)

Treatment: Treatment is same as optic neuritis

Neuroretinitis:

It is least common type of optic neuritis. It is characterized by inflammation of retinal nerve fibers.

Etiology: not known.

Symptoms: Decrease in vision which may not be very severe.

Signs: All signs of optic nerve dysfunction like decrease vision, afferent pupil defect, visual field defect, defective color vision and diminished contrast sensitivity. Because of retinal nerve fibers inflammation there is also retinal edema and hard exudates in hard. Hard exudates may gather as macular star.

Treatment: Treatment is same as optic neuritis.

B3- Papilledema

Definition:

This is defined as disc swelling secondary to increased intracranial pressure. It is usually bilateral though asymmetrical. All patients of papilledema should be investigated for intracranial mass lesions.

Causes of papilledema:

- Idiopathic (Benign) intra cranial hypertension
- Systemic hypertension (**Malignant hypertension**)
- Ventricular obstruction; **Mass lesion**
- Impaired CSF absorption: **meningitis, sub arachnoid hemorrhage**
- Cerebral venous thrombosis
- Cerebral edema: **Head injury**

Pathology:

Interference with axoplasmic flow of nerve fibers leads to disc swelling.

Stages:

- EARLY papilledema
 - Difficult to diagnose with certainty
 - Visual acuity normal or mild reduction
 - Mild swelling and hyperemia of optic disc
- 2- Established papilledema
 - Transient visual obstruction lasting few seconds
 - Hyperemic optic disc with indistinct margins
 - Venous engorgement, Flame shaped hemorrhages, cotton wool spots
- 3- Longstanding papilledema
 - Constriction of visual fields
 - Marked elevation of optic disc (Champagne cork appearance)
- 4- Atrophic papilledema
 - Atrophic papilledema
 - Severely impaired vision
 - Indistinct and irregular disc margins (secondary optic atrophy)

Investigations:

- MRI OR CT SCAN immediately to exclude intra cranial tumors
- Lumber puncture to measure pressure & for cytology of CSF to establish cause

Treatment:

- Treatment of cause like meningitis, thyroid ophthalmopathy
- Treatment of mass lesions
- Shunt may be needed to treat intra cranial pressure

Group C-Optic neuropathies causing consecutive optic atrophy

C1- Retinal disease

Retinal diseases like retinitis pigmentosa and vascular occlusion may lead to consecutive optic neuropathy.

Group D- Optic neuropathy causing glaucomatous optic atrophy

(causing optic atrophy with increased cu disc ratio)

D1- Glaucoma

All types of glaucoma if treated may or may not lead to optic atrophy called glaucomatous optic atrophy.

Disc changes: Disc swelling, shunts, atrophy

Disc swelling causes:

Disc swelling

- Pseudo papilledema (Disc drusen, Myelinated fibers, Tilted disc, hypermetropic disc)
- Increase intracranial pressure: papilledema
- Optic neuritis
- Anterior Ischemic neuropathies
- Infiltrative neuropathies (occasionally)
- Compressive neuropathies (occasionally Tumours)
- Mitochondrial optic neuropathies
- Ophthalmic (CRVO, Uveitis, Scleritis, Hypotony)

Causes of papilledema
under papilledema

Disc swelling is
non specific term

Optic atrophy: It is clinical sign not disease

All optic neuropathies may lead to optic atrophy if untreated

primary optic atrophy
Clear disc margins



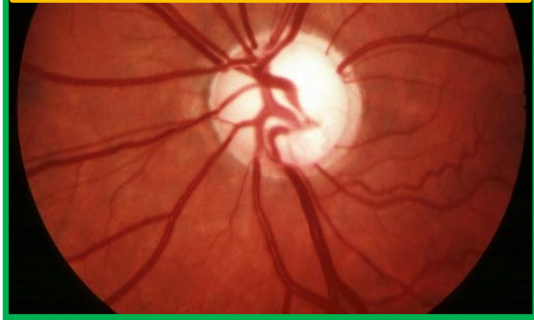
Secondary optic atrophy
Blurry disc margins



Consecutive optic atrophy
Atrophy with retinal lesions



Glaucomatous optic atrophy
Clear disc margins with cupping



Primary optic atrophy: Ischemic (anterior ischemic), hereditary, nutritional, toxic, traumatic, compressive and infiltrative optic neuropathies do not cause initial swelling of optic nerve so optic disc margins are clear and smooth.

In addition retrobulbar neuritis also leads to primary optic atrophy.

Secondary optic atrophy: Inflammation of optic nerve (optic neuritis) and increased intracranial pressure can cause optic disc swelling. Because of pressure created by swelling optic nerve fibers can degenerate resulting in optic atrophy with blurred margins.

In addition, anterior ischemic optic neuropathy also leads to secondary optic atrophy.

Consecutive optic atrophy: This is optic atrophy secondary to retinal disease.

Glaucomatous optic atrophy: All types of glaucoma may lead to optic atrophy with high cup disc ratio with nasal shifting of retinal vessels.