OPTIC NEUROPATHIES

Nancy J. Newman, MD
Emory University School of Medicine
Atlanta, GA

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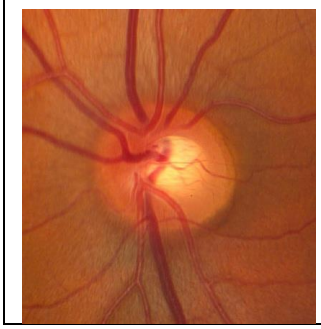
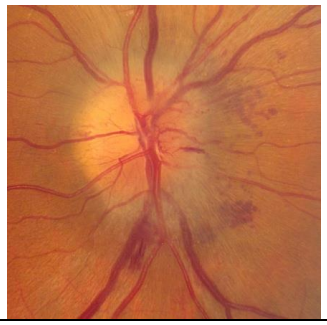
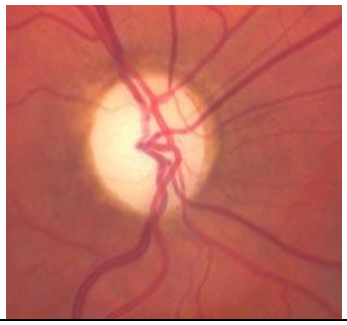
Disorders of the optic nerve are called “optic neuropathies”.
-Optic neuropathies with optic nerve head swelling are called “anterior optic neuropathies”.
-Optic neuropathies associated acutely with a normal optic nerve are called “posterior or retrobulbar optic neuropathies”.
-In almost all cases, the optic nerve becomes pale (optic atrophy) 4 to 6 weeks after the onset of visual loss, even in cases when vision recovers.

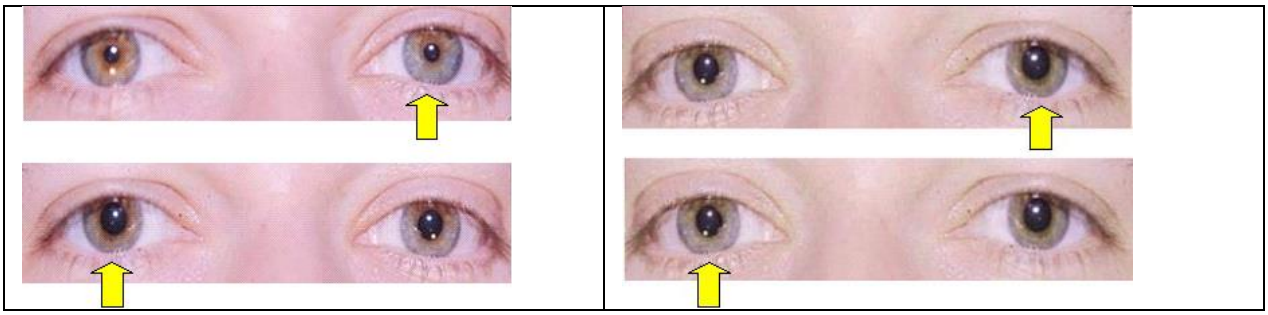
Figure 1A: Normal left optic nerve appearance in posterior optic neuropathy (onset less than 6 weeks)	**Figure 1B:** Right optic nerve head swelling (edema) in anterior optic neuropathy	**Figure 1C:** Right optic nerve pallor in chronic optic neuropathy (more than 6 weeks)
		

DIAGNOSIS OF AN OPTIC NEUROPATHY

The diagnosis of optic neuropathy is based on clinical examination:

-Visual loss
-Impaired color vision
-Abnormal visual field
-Relative afferent pupillary defect in all unilateral or asymmetric optic neuropathies
-Optic nerve head appearance:
    Acutely: normal or swollen
    Late (after 4 to 6 weeks): pale

Figure 2A: Right relative afferent pupillary defect from a right optic neuropathy. When the light is shone in the left eye, both pupils constrict briskly; both pupils dilate when the light is shone in the right eye.	**Figure 2B: Pupillary reaction in bilateral and symmetric optic neuropathies.** There is no relative afferent pupillary defect, but both pupils are sluggish in response to light stimulation.



Localization of the lesion:

The optic nerve may be affected in the orbit, at the level of the optic canal, or in its intracranial portion. In the orbit, the optic neuropathy may be isolated. The presence of associated symptoms or signs such as diplopia, ptosis or proptosis suggests a process involving more than just the optic nerve, such as inflammation, infection, or neoplasm.

Figure 3A: Isolated right inflammatory optic neuropathy. There is a large central scotoma seen as diffuse depression on a 24-2 HVF.

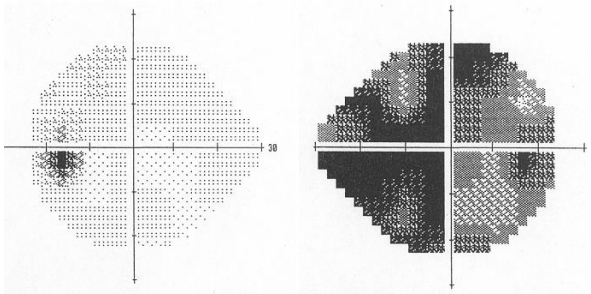


Figure 3B: Coronal and axial T1-MRI (fat suppression) with contrast, showing enhancement of the orbital portion of the right optic nerve.

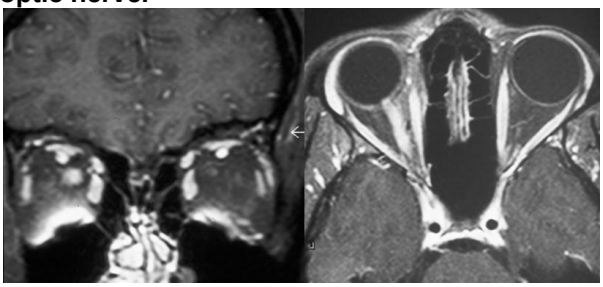


Figure 4A: Left orbital apex syndrome. There is visual loss in the left eye from an optic neuropathy (relative afferent pupillary defect), with associated pain (V_1), ptosis and ophthalmoplegia from left IIIrd, IVth and VIth nerve palsies.

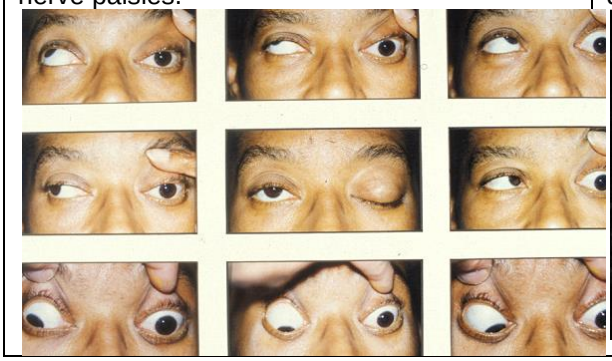
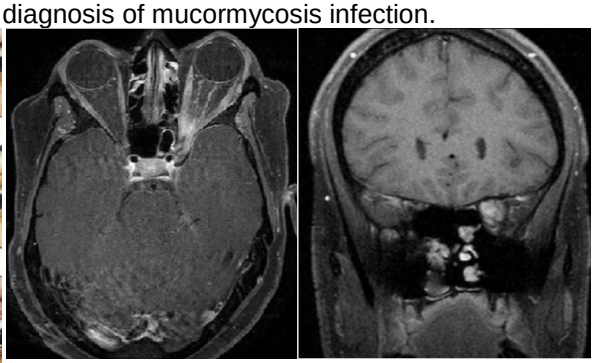


Figure 4B: Axial and coronal T1-MRI (fat suppression) with contrast, showing left optic nerve enhancement at the level of the orbital apex. Note the adjacent sphenoid sinusitis. The patient is diabetic. A sphenoid biopsy confirmed the diagnosis of mucormycosis infection.



The differential diagnosis of an optic neuropathy

Anomalous optic nerve
- Congenitally anomalous

Drusen Inflammatory
- Idiopathic inflammatory optic neuritis (associated with multiple sclerosis)
- Systemic inflammatory and autoimmune diseases
- Infectious diseases

Vascular: Ischemic optic neuropathy
- Anterior / posterior
- Arteritic / nonarteritic

Compressive / infiltrative
- Neoplastic
- Non-neoplastic

Toxic / nutritional
Hereditary
Traumatic
Raised intracranial pressure (papilledema)
Glaucoma

A number of clinical characteristics are particularly helpful to determine the mechanism of the optic neuropathy, such as:

1) Mode of onset of visual loss:
- .acute in ischemic and inflammatory
- .progressive in compressive or toxic optic neuropathies

2) Color vision
- .often relatively spared in ischemic optic neuropathies
- .usually very abnormal in inflammatory optic neuropathies

3) Presence of pain with eye movements
- .highly suggestive of inflammatory mechanism

4) Funduscopic appearance
- .variable in inflammatory optic neuropathies
- .swollen optic nerve in all cases of anterior ischemic optic neuropathy
- .sometimes cupped optic nerve in compressive and hereditary optic neuropathies
- .with associated retinal changes in neuroretinitis.

Approach to the patient with suspected optic neuropathy:

1) Confirm the diagnosis of optic neuropathy by clinical examination
2) Look for associated symptoms and signs
3) Try to localize the optic nerve lesion (anterior, posterior in the orbit, orbital apex, intracranial)
4) Determine the presumed etiologic diagnosis
5) Obtain ancillary testing such as imaging and laboratory workup to confirm the diagnosis prior to initiating treatment.

MRI of the brain and orbits with gadolinium (orbital images should be with fat suppression)

Blood tests vary based on the presumed diagnosis. Helpful tests include testing for syphilis, sarcoidosis (ACE), testing for cat scratch disease (Bartonella antibodies), for Lyme disease, HIV test, inflammatory biologic syndrome (CBC, CRP, ESR), autoantibodies for auto-immunes diseases (ANA, ANCA), neuromyelitis optica antibodies (NMO) if severe visual loss, no recovery, recurrent optic neuropathy, or associated with transverse myelitis, vitamin B12 and folate (bilateral and progressive painless optic neuropathies), genetic testing for Leber hereditary optic neuropathy (severe unilateral or bilateral optic neuropathies), genetic testing for dominant optic atrophy (bilateral and progressive painless optic neuropathies)

CSF analysis (lumbar puncture) is helpful in cases of bilateral optic neuropathies, or when an infectious, systemic inflammatory or neoplastic cause is suspected.

Clinical characteristics of common optic neuropathies

	OPTIC NEURITIS	AION	COMPRESSIVE/ INFILTRATIVE	TOXIC/ NUTRITIONAL	HEREDITARY	PAPILLEDEMA
Age of patients	Younger	Older (> 50 years)	30-40: meningioma Childhood: glioma	Any age	Younger	Any age
Laterality	Unilateral	Unilateral	Unilateral	Bilateral	Bilateral	Bilateral
Visual loss	Rapidly progressive Acuity rarely spared	Acute Acuity variable	Progressive	Slowly progressive	Subacute (LHON) Slowly progressive (DOA)	Acuity preserved until late
Pain	Orbital pain frequent with eye movements	Pain infrequent (except in GCA)	Absent	Absent	Absent	Headache (raised intra-cranial pressure)
Color vision	Abnormal	Variably spared	Abnormal	Affected early	Abnormal	Preserved until late
Visual field	Central defects	Altitudinal defect	Variable	Ceco-central scotoma	Ceco-central scotoma	Peripheral constriction
Optic disc						
Acute	Normal (2/3) or disc edema (1/3)	Disc edema, +/- segmental Small cup to disc ratio	Variable	Hyperemic	Pseudo-edema in LHON	Disc edema
Late	Temporal pallor	Segmental pallor	Pale	Pale	Pale	Pale with peripapillary changes
Visual prognosis	Good	Variable 15% risk for the other eye within 5 years	Variable	May improve	Poor	Reversible if treated early
Systemic diseases	Risk of development of multiple sclerosis	HTN (51%), DM (24%) GCA to be ruled out	Neurofibromatosis Malignancy	Poor nutrition Peripheral neuropathy	Mitochondrial diseases DIDMOAD syndrome	Any cause of raised intra-cranial pressure

AION: anterior ischemic optic neuropathy. GCA: giant cell arteritis. HTN: hypertension. DM: diabetes mellitus. LHON: Leber hereditary optic neuropathy. DOA: dominant optic atrophy.DIDMOAD: Diabetes insipidus, diabetes mellitus, optic atrophy, and deafness.

DIFFERENTIATION OF OPTIC NERVE FROM MACULAR DISEASE

Optic neuropathies and maculopathies have overlapping presentations. Both cause central visual loss and dyschromatopsia. Many chronic maculopathies are associated with mild optic nerve pallor. When the macula appears normal, it may be difficult to differentiate an optic neuropathy from a maculopathy

Differentiation of optic nerve from macular disease

	Optic nerve	Macula
Visual acuity	Variable	Variable
Color vision	Very reduced	Mildly reduced
Amsler grid	Scotoma	Metamorphopsia
Visual field	Variable	Central scotoma or diffuse depression
Pupils	Relative afferent pupillary defect if optic neuropathy is unilateral or asymmetric	No relative afferent pupillary defect, unless the entire macula is affected
Photostress recovery	Normal	Delayed
Visual evoked responses	Abnormal	Normal or mildly abnormal
Electroretinogram	Normal	Abnormal (full field ERG often normal; multifocal ERG is usually abnormal)

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