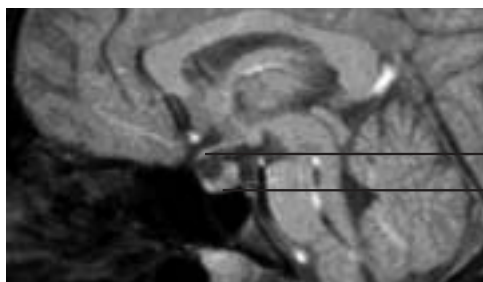


Optic nerve

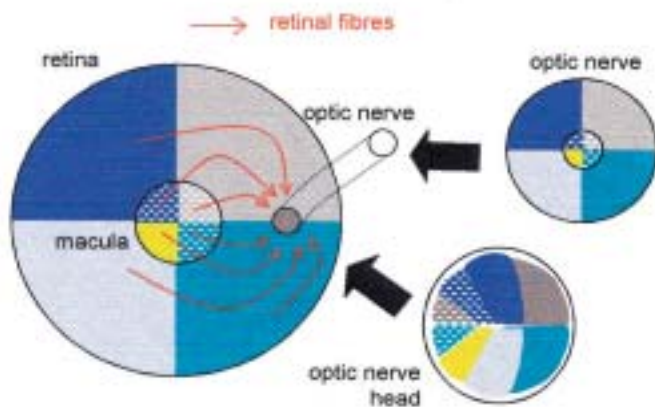
The Basics. The optic nerve runs from the optic nerve head at the back of the eye to the optic chiasm. It contains about one million axons from the ganglion cells of the retina, half of which cross over in the chiasm, to proceed as the optic tract to synapse in the lateral geniculate body, pulvinar, and superior colliculus.

The optic nerve develops as an offshoot of the brain and is covered by a sheath, made up of the full three layers of meninges in continuity with the leptomeninges of the brain, which transmits the cerebrospinal fluid (CSF). Raised intracranial pressure is therefore communicated through to the optic nerve head and is visible as papilloedema on fundoscopy. Its blood supply comes from the ophthalmic artery, a branch of the internal carotid artery. As in the rest of the central nervous system, its nerve fibres are myelinated by oligodendrocytes rather than Schwann cells, which myelinate peripheral nerves. The optic nerve is therefore the only cranial nerve vulnerable to inflammatory demyelination in multiple sclerosis.

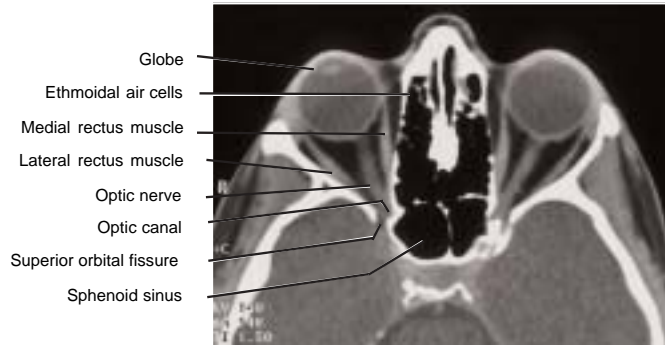


Optic chiasm
Pituitary gland

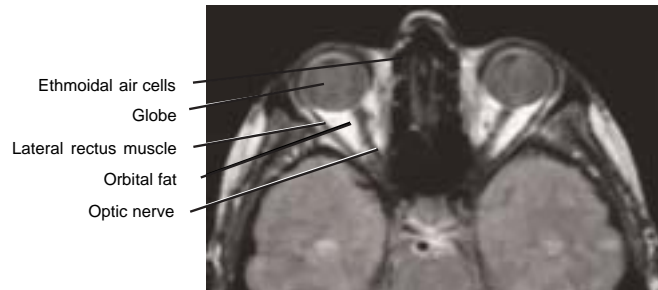
Organisation of ganglion cell fibres from the right retina within the right fundus and optic nerve



CT scan of the optic nerves



MRI scan of the optic nerves



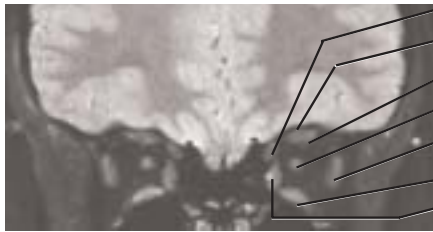
Organisation of nerve fibres within the optic nerve

Nerve fibres from the macula project directly to the temporal side of the optic nerve head, with peripheral retinal input converging more indirectly from the nasal side. Hence atrophy of the macular fibre bundles leads to temporal pallor of the disk. Within the first few millimetres of the optic nerve itself, the fibres are rearranged to form a retinotopic distribution.

The macular fibre bundle is vulnerable to demyelination, toxins and metabolic deficiency leading to a central scotoma. Branch occlusions of the retinal artery however cause field defects which respect the meridian. Lesions of part of the macular bundle, such as occur in glaucoma, cause arcuate scotomata.

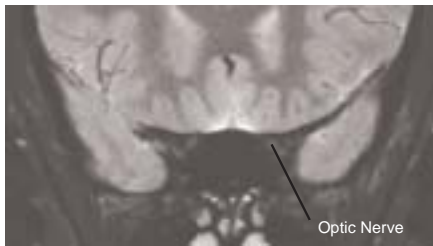
Within the optic nerve, the macular fibres are most vulnerable to pressure. Hence compression of the optic nerve anywhere along its course usually first causes a central scotoma.

Simon J. Hickman and Alasdair Coles



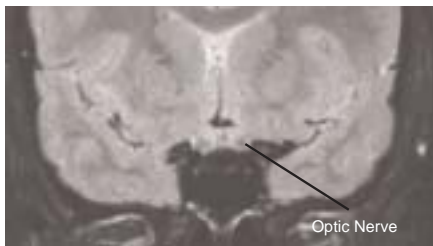
- Superior oblique muscle
- Superior rectus muscle
- Superior ophthalmic vein
- Optic nerve
- Lateral rectus muscle
- Inferior rectus muscle
- Medial rectus muscle

Optic Canal



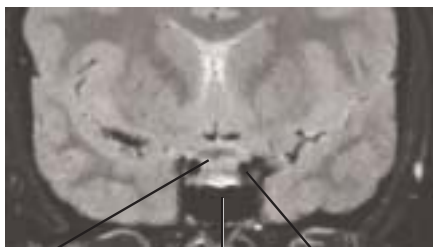
Optic Nerve

Intracranial portion of the optic nerve



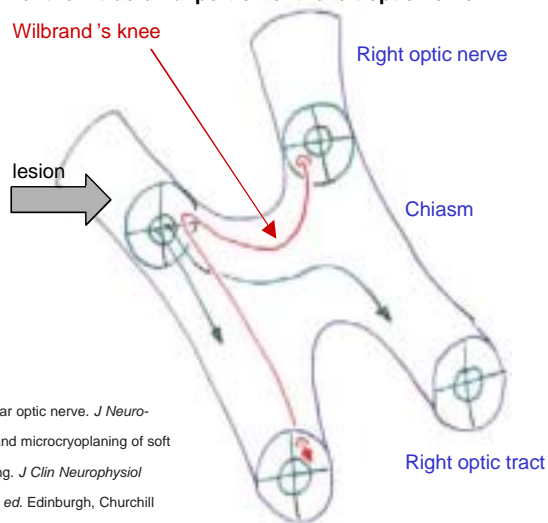
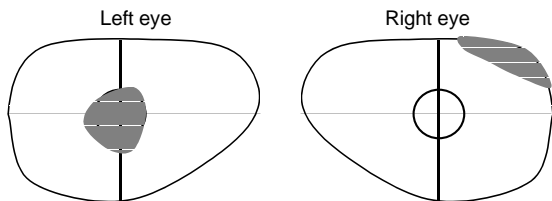
Optic Nerve

Optic Chiasm



Optic chiasm Pituitary Internal carotid A.

Central and "Junctional" Scotoma



Divisions of the optic nerve.

The optic nerve is about 40-50mm long and is subdivided into four parts.

The **intraocular portion** of the optic nerve measures 1.8 mm by 1.5 mm in diameter and 1 mm in length. The ganglion cell axons turn posteriorly to exit the globe perpendicular to the surface layer. They are divided into bundles by Müller cells in the retina and continue as bundles separated by fibrous septa.

The **orbital portion of the optic nerve** is 20-30 mm long and has about 6mm of slack to accommodate orbital movements. It is contained within an outer sheath of dura mater and an inner sheath from the arachnoid. The surrounding orbital fat contains the ciliary vessels and nerves. 6-12 mm from the globe, the central artery of the retina perforates the optic nerve with its accompanying vein, and runs within it to the retina. As the nerve enters the **orbital (or "optic") foramen** its dural sheath becomes continuous with that lining the orbit and the optic foramen. The **optic canal** is formed by the union of the two roots of the lesser wings of the sphenoid bone. The limited space within the canal and its bony walls makes the nerve vulnerable to damage here from blunt trauma. In the optic canal the ophthalmic artery lies below and to its lateral side.

The **intracranial portion of the optic nerve** is about 10 mm long and culminates in the optic chiasm. Compressive lesions here usually first give a central scotoma and then a "junctional scotoma". Traditionally this latter is ascribed to involvement of "Wilbrand's knee": lower nasal fibres from the unaffected nerve, which sweep forward as they cross over at the chiasm. However, these fibres were demonstrated in patients who had had enucleations and therefore may be artefactual. Junctional scotomas could arise through chiasmal involvement.

Lesion of the intracranial portion of the left optic nerve

References

- Chou P-I, Sadun AA, Lee H. Vasculature and morphometry of the optic canal and intracanalicular optic nerve. *J Neuro-Ophthalmol* 1995;15:186-190.
- Goldberg RA, Hannani K, Toga AW. Microanatomy of the orbital apex: Computed tomography and microcryoplaning of soft and hard tissue. *Ophthalmology* 1992;99:1447-1452.
- Tamraz J. Neuroradiologic investigation of the visual system using magnetic resonance imaging. *J Clin Neurophysiol* 1994;11:500-518.
- Williams PL, Warwick R, Dyson M, Bannister LH. The cranial nerves. In: *Gray's Anatomy 37th ed.* Edinburgh, Churchill Livingstone. 1989, pp1094-1121.

