Anterior visual pathway

The anterior visual pathway (AVP) (i.e., retina, optic nerves, chiasm, and optic tracts).

The anterior visual pathway refers to structures involved in vision before the lateral geniculate nucleus. The posterior visual pathway refers to structures after this point.

An opsin absorbs a photon (a particle of light) and transmits a signal to the cell through a signal transduction pathway, resulting in hyper-polarization of the photoreceptor.

There are two pathways for sight in the retina – one based on classic photoreceptors (rods and cones) and the other, newly discovered, based on photo-receptive ganglion cells which act as rudimentary visual brightness detectors.

Retina is the fundamental structure involved in the transduction of light into visual signals, i.e. nerve impulses in the ocular system of the central nervous system. In the presence of light, the retinal molecule changes configuration and as a result a nerve impulse is generated.

The information about the image via the eye is transmitted to the brain along the optic nerve. Different populations of ganglion cells in the retina send information to the brain through the optic nerve. About 90% of the axons in the optic nerve go to the lateral geniculate nucleus in the thalamus. These axons originate from the M, P, and K ganglion cells in the retina.

This parallel processing is important for reconstructing the visual world; each type of information will go through a different route to perception. Another population sends information to the superior colliculus in the midbrain, which assists in controlling eye movements (saccades) as well as other motor responses.

A final population of photosensitive ganglion cells, containing melanopsin for photosensitivity, sends information via the retinohypothalamic tract (RHT) to the pretectum (pupillary reflex), to several structures involved in the control of circadian rhythms and sleep such as the suprachiasmatic nucleus (SCN, the biological clock), and to the ventrolateral preoptic nucleus (VLPO, a region involved in sleep regulation).

A recently discovered role for photoreceptive ganglion cells is that they mediate conscious and unconscious vision – acting as rudimentary visual brightness detectors as shown in rodless coneless eyes.

The optic nerves from both eyes meet and cross at the optic chiasm, at the base of the hypothalamus of the brain. At this point the information coming from both eyes is combined and then splits according to the visual field. The corresponding halves of the field of view (right and left) are sent to the left and right halves of the brain, respectively, to be processed. That is, the right side of primary visual cortex deals with the left half of the field of view from both eyes, and similarly for the left brain.

A small region in the center of the field of view is processed redundantly by both halves of the brain.

Information from the right visual field (now on the left side of the brain) travels in the left optic tract. Information from the left visual field travels in the right optic tract. Each optic tract terminates in the lateral geniculate nucleus (LGN) in the thalamus.

Isolated primary central nervous system lymphoma arising from anterior visual pathway is very rare.

A 76-year-old immunocompetent previously healthy man presented bilateral decreased visual acuity in 1 month. Pituitary magnetic resonans imaging (MRI) showed a lobulated mass with homogeneous enhancement after gadolinium administration that arising from optic chiasm suggested that inflammatory disease or an optic glioma. The patient underwent an extended endoscopic endonasal transsphenoidal surgery. Postoperative course and outcomes were wonderful. Histopathological diagnosis was diffuse large B-cell lymphoma. The patient underwent investigations for systemic lymphomatous involvement, did not detect any evidence of systemic disease.

In this case, we claimed that differential diagnoses of anterior visual pathway lesions are difficult because of similarity of lesions on clinical and radiological examinations. Biopsy is essential for these lesions. As a biopsy technique, endoscopic endonasal transsphenoidal approach is safer and more effective than open procedures [1)].

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Ozdemir ES, Yildirim AE, Can AY. Primary Central Nervous System Lymphoma of Optic Chiasma: Endoscopic Endonasal Treatment. J Craniofac Surg. 2017 Oct 23. doi: 10.1097/SCS.0000000000004059. [Epub ahead of print] PubMed PMID: 29065048.