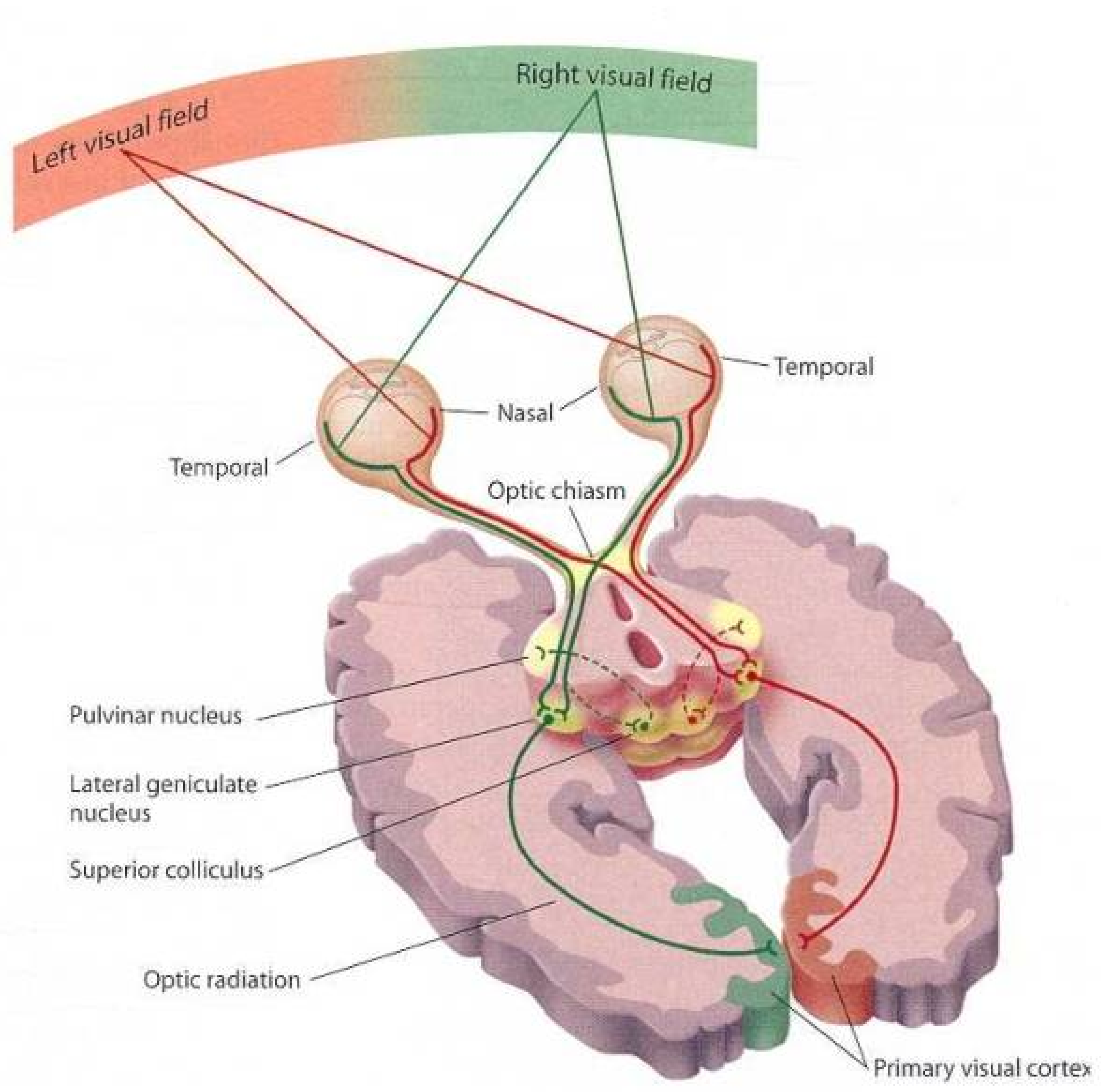
Optic tract



(from the Latin tractus opticus) is a part of the visual system in the brain. It is a continuation of the optic nerve that relays information from the optic chiasm to the ipsilateral lateral geniculate nucleus (LGN), pretectal nuclei, and superior colliculus.

It is composed of two individual tracts, the left optic tract and the right optic tract, each of which conveys visual information exclusive to its respective contralateral half of the visual field. Each of these tracts is derived from a combination of temporal and nasal retinal fibers from each eye that corresponds to one half of the visual field. In more specific terms, the optic tract contains fibers from the ipsilateral temporal hemiretina and contralateral nasal hemiretina.

The optic tracts are also attached to two different locations. Anteriorly, they are posterolateral extensions of the optic chiasm, which lies almost wholly over the diaphragma sellae. Posteriorly, the optic tracts are attached to the cerebrum and cerebral peduncles. Unlike the anterior aspect, which is firmly anchored to the optic canal through the optic nerve, the posterior aspect of the optic tract offers relatively little resistance to brain movement. Therefore, they can be retracted with brain movement due to severe blunt trauma [1)].

Visual field defects (VFDs) due to optic radiation (OR) injury are a common complication of temporal lobe surgery. Faust and Vajkoczy analyzed whether preoperative visualization of the optic tract would reduce this complication by influencing the surgeon's decisions about surgical approaches. The authors also determined whether white matter shifts caused by temporal lobe tumors would follow predetermined patterns based on the tumor's topography.

One hundred thirteen patients with intraaxial tumors of the temporal lobe underwent preoperative diffusion tensor imaging (DTI) fiber tracking. In 54 of those patients, both pre- and postoperative VFDs were documented using computerized perimetry. Brainlab's iPlan 2.5 navigation software was used for tumor reconstruction and fiber visualization after the fusion of DTI studies with their respective magnetization-prepared rapid gradient-echo (MP-RAGE) images. The tracking algorithm was as follows: minimum fiber length 100 mm, fractional anisotropy threshold 0.1. The lateral geniculate nucleus and the calcarine cortex were employed as tract seeding points. Shifts of the OR caused by tumor were visualized in comparison with the fiber tracking of the patient's healthy hemisphere.

Temporal tumors produced a dislocation of the OR but no apparent fiber destruction. The shift of white matter tracts followed fixed patterns dependent on tumor location: Temporolateral tumors resulted in a medial fiber shift, and thus a lateral transcortical approach is recommended. Temporopolar tumors led to a posterior shift, always including Meyer's loop; therefore, a pterional transcortical approach is recommended. Temporomesial tumors produced a lateral and superior shift; thus, a transsylvian-transcisternal approach will result in maximum sparing of the fibers. Temporocentric tumors also induced a lateral fiber shift. For those tumors, a transsylvian-transopercular approach is recommended. Tumors of the fusiform gyrus generated a superior (and lateral) shift; consequently, a subtemporal approach is recommended to avoid white matter injury. In applying the approaches recommended above, new or worsened VFDs occurred in 4% of the patient cohort. Total neurological and surgical morbidity were less than 10%. In 90% of patients, gross-total resection was accomplished.

Preoperative visualization of the OR may help in avoiding postoperative VFDs [2].

[1]
Sim KB, Park SQ, Choi HA, Kim DH. Demonstration of traumatic subarachnoid hemorrhage from the anterior choroidal artery. J Korean Neurosurg Soc. 2014 Dec;56(6):531-3. doi: 10.3340/jkns.2014.56.6.531. Epub 2014 Dec 31. PubMed PMID: 25628818; PubMed Central PMCID: PMC4303734.
[2]
Faust K, Vajkoczy P. Distinct displacements of the optic radiation based on tumor location revealed using preoperative diffusion tensor imaging. J Neurosurg. 2015 Oct 2:1-10. [Epub ahead of print] PubMed PMID: 26430843.