

# Argyll Robertson Pupil and Pre-Optic Chiasm Enhancement

Sagar Matharu, Aamna Siddiqui, Sourabh Vellala, Emma Seipp, BA, Dr. Harpal S. Mangat, MD, Dr. Raymond Tu, MD, FACR  
University of Maryland, College Park, McDaniel University, Assistant Professor at Howard College of Medicine, Washington, DC,  
Germantown Medical Center Maryland, US

## Abstract

**Background:** The Argyll Robertson pupil occurs when small bilateral pupils do not constrict when exposed to bright light, but do on accomodation. Previous morphological studies define the pathophysiology of this condition as a syphilitic lesion at the internuncial neuron between the Edinger-Westphal nucleus and the pretectal nucleus. This study aims to propose an alternative explanation on the manifestation of AR pupil by looking at the pre-optic chiasm, or cause of pre-optic chiasm enhancement by MRI. **Materials/Methods:** A database was created based on patient-by-patient observational studies for use in data extrapolation and statistical analysis. Data was included from patients with a history of Neuroborreliosis and separated based on whether the subjects had Argyll Robertson pupil, enhancement at the pre-optic chiasm, and an MRI of the orbits, cavernous sinus, and/or internal auditory canal. **Results:** Out of 167 patients diagnosed with Neuroborreliosis, 147 were diagnosed with Argyll Robertson pupil. An MRI was taken in 87 of the patients diagnosed with Neuroborreliosis, of which 66 tested positive for pre-optic chiasm enhancement. Out of these 66 patients, 64 patients exhibited Argyll Robertson pupil. Post-statistical analysis, correlations between AR pupil and enhancement at the pre-optic chiasm were found to be significant with a  $p < 0.0001$ . **Conclusion:** Based on the statistical significance, AR pupil strongly suggests an anatomically compromised pre-optic chiasm in patients with neuroborreliosis.

## Study Aim

The pre-optic chiasm lays in an area posterior to the optic chiasm, directly above the cavernous sinus. The subarachnoid space is synonymous throughout the midbrain. The purpose of this paper is to study the relationship between Argyll Robertson pupil and inflammation of the pre-optic chiasm, radiologically termed pre-optic chiasm enhancement in patients with Neuroborreliosis.

## Hypothesis

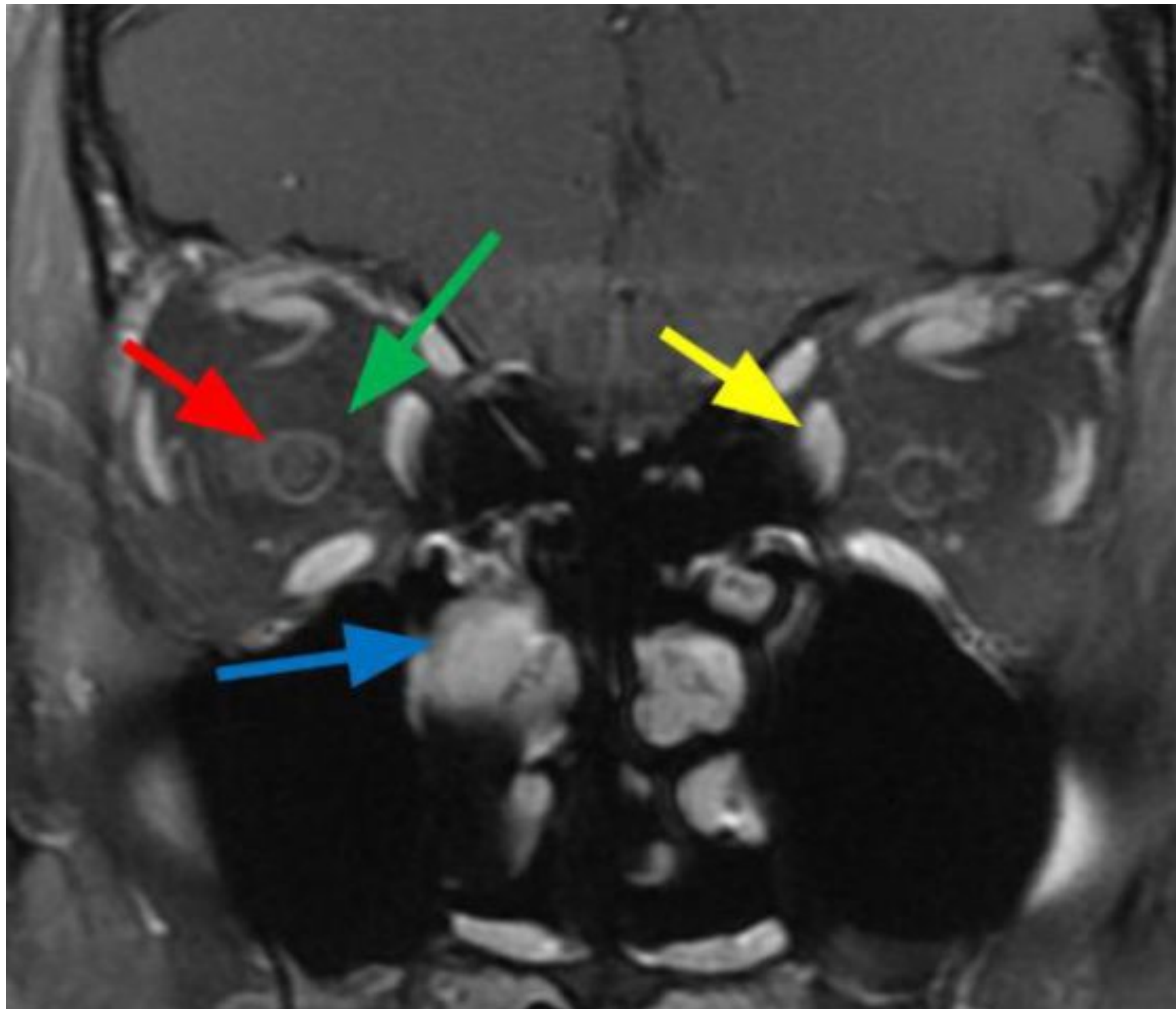
- Null - There is no correlation between the Argyll Robertson pupil and inflammation of the pre-optic chiasm.
- Experimental - Inflammation in pre-optic chiasm caused by lyme-concentrated CSF causes a clinical manifestation of Argyll Robertson pupil. There is a significant correlation between Argyll Robertson pupil and pre-optic chiasm enhancement.

## Results

- Of the 167 patients diagnosed with neuroborreliosis, 147 exhibited Argyll Robertson pupil, while 87 of these had an MRI taken.
- The most accurate data came from the 87 patients with MRA data of the orbits. 66 of these patients tested positive for pre-optic chiasm enhancement. Additionally, of the 66, 64 patients exhibited Argyll Robertson pupil.
- In a post-statistical analysis, correlations between AR pupil and enhancement at the pre-optic chiasm were found to be significant with a  $p < 0.0001$ .

## Methods

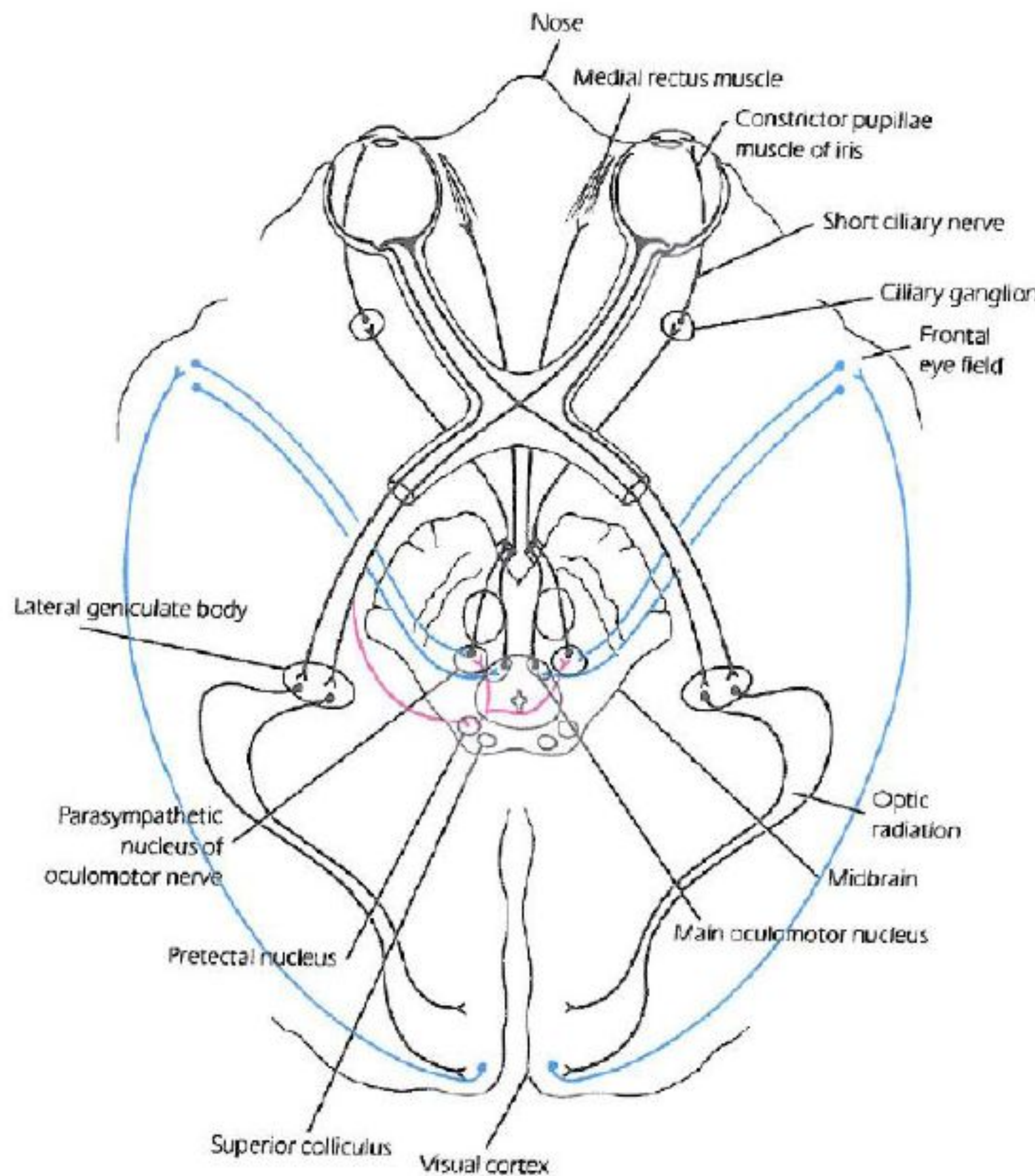
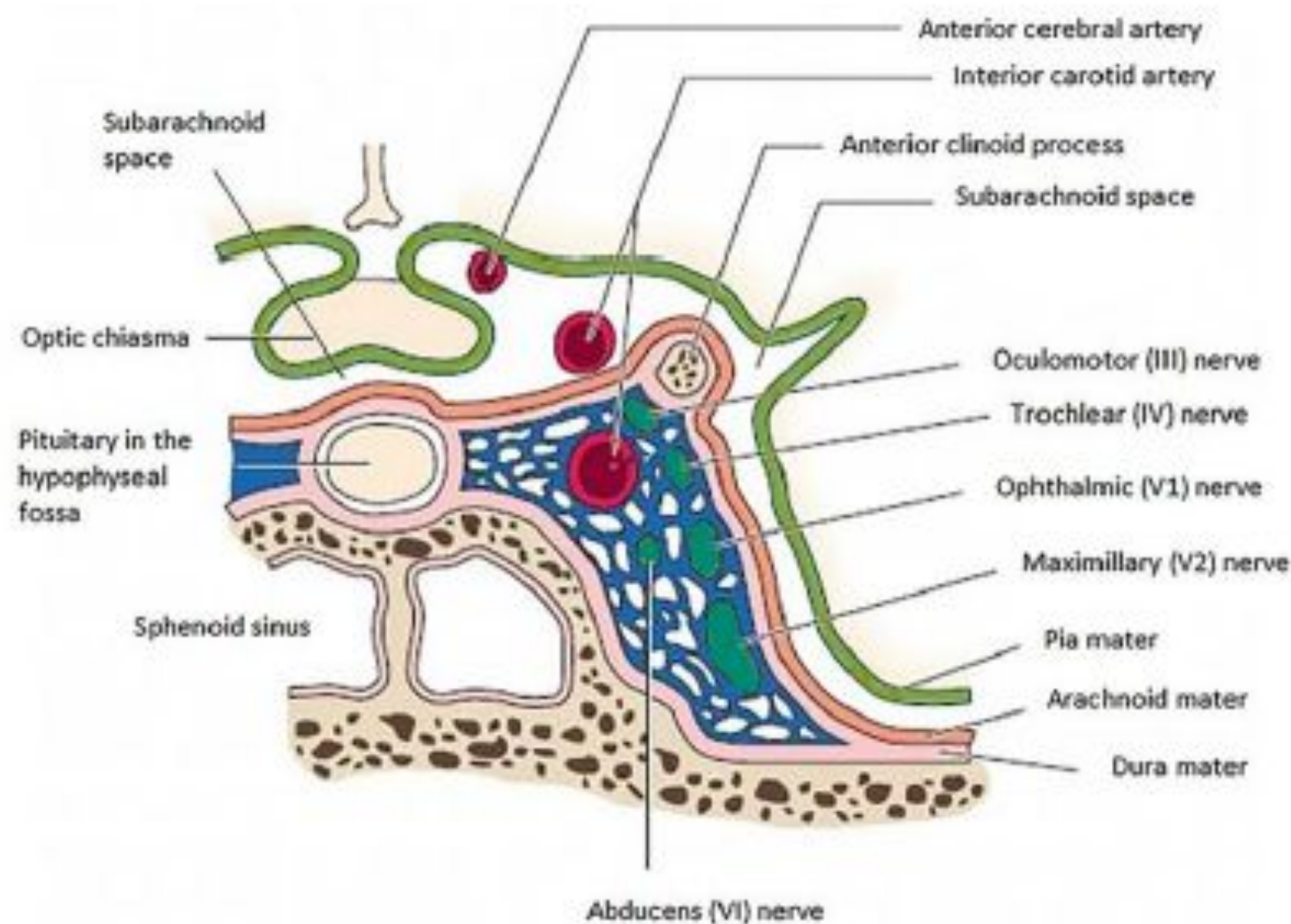
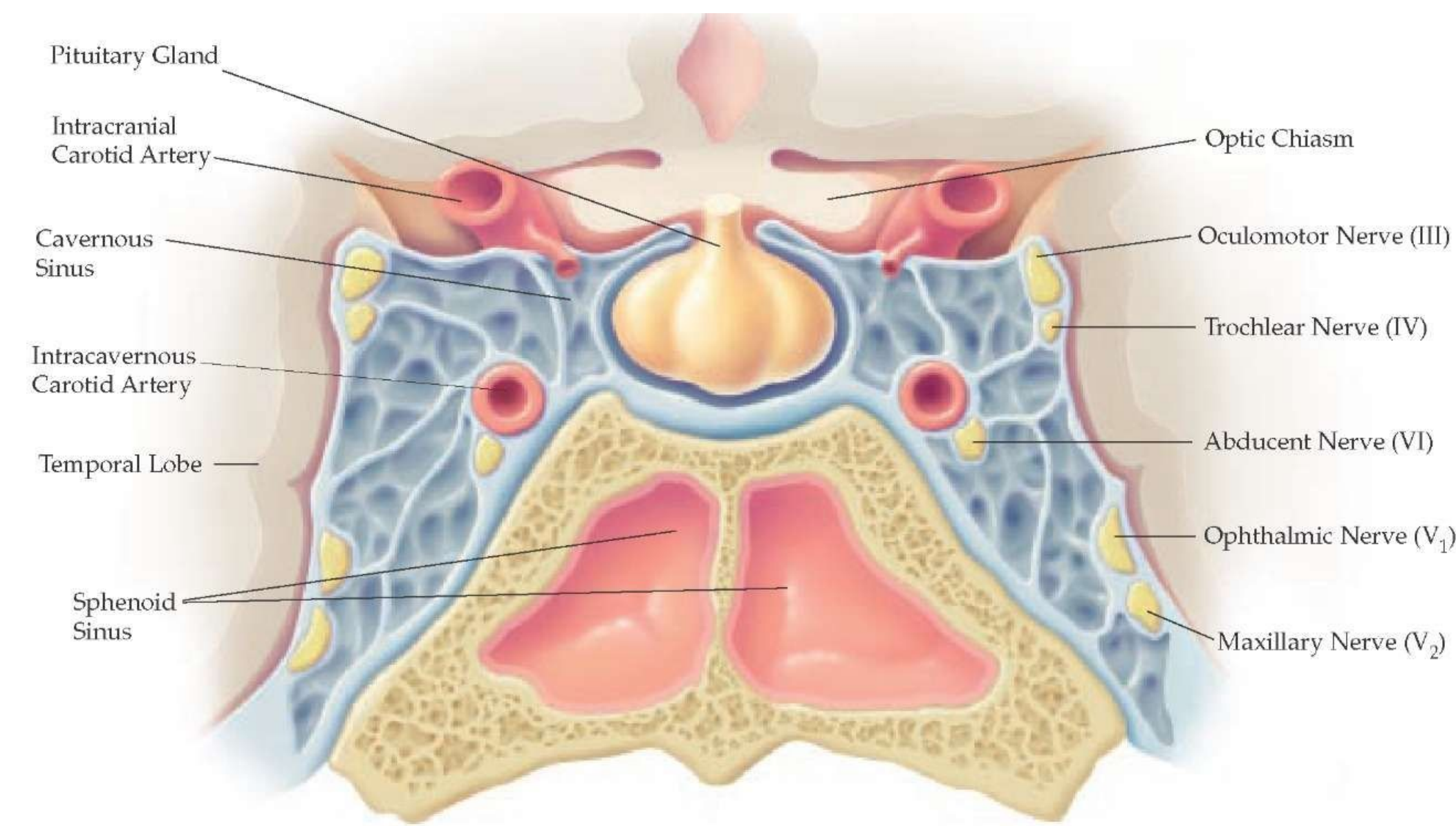
- ❖ 167 patients were assessed medical centers in two lyme endemic communities in maryland.
- ❖ A retrospective cohort study was used to collect medical data from patients with confirmed neurological Lyme Disease.
- ❖ MRIs of the orbits, cavernous sinus, and internal auditory canal were taken in 87 patients diagnosed with Neuroborreliosis and Argyll Robertson pupil.
- ❖ Patients were assessed for enhancement at the pre-optic chiasm and cross referenced with Argyll Robertson pupil diagnosis.
- ❖ Patients who had MRIs taken of the pituitary or the brain were excluded from the study.



## Discussion

The Argyll Robertson pupil, defined as a compromised accommodation reflex, correlates to an inflamed pre-optic chiasm. To explain this, it is best to understand that Lyme can cause elevated intracranial pressure. Now, the question is, how? Lyme is attracted to areas of low-oxygen tension, and the area around the pre-optic chiasm is bathed in CSF from the subarachnoid space. The spirochete rapidly populates this area, resulting in inflammation at the pre-optic chiasm (internuncial neuron) and therefore, elevated intracranial pressure. This inflammation manifests as AR pupil.

Figure 1. Cavernous Sinus



## References

- Miljic D, Pekic S, Popovic V. Empty Sella. 2018 Oct 1. In: De Groot LJ, Chrousos G, Dungan K, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK532084/>
- Ghatnatti V, Sarma D, Saikia U. Empty sella syndrome – beyond being an incidental finding. *Indian J Endocrinol Metab.* 2012;16(Suppl 2):S321–3.
- Snell R, Lemp M. The Orbital Nerves. In: *Clinical Anatomy of the Eye*, 1st edn. Blackwell Sciences Publishing Ltd: Malden, MA, USA, 1989, pp 267–296