Neuro-Ophthalmology in Emergency Medicine

J. Stephen Huff, MD*, Everett W. Austin, MD

KEYWORDS

• Anisocoria • Ptosis • Diplopia

KEY POINTS

- Understanding the anatomy and physiology of the eye, the orbit, and the central connections is key to understanding neuro-ophthalmologic emergencies.
- Anisocoria is an important sign that requires a systematic approach to avoid misdiagnosis of serious conditions, including carotid dissection (miosis) and aneurysmal third nerve palsy (mydriasis).
- Ptosis may be a sign of either Horner syndrome or third nerve palsy.
- An explanation should be pursued for diplopia since the differential diagnosis ranges from the trivial to life-threatening causes.

INTRODUCTION

Neuro-ophthalmologic emergencies are inexactly defined but may be thought of as neurologic emergencies where findings of the eyes or vision predominate and there is some urgency for evaluation or treatment. There is overlap with other neurologic and ophthalmologic disorders. This discussion is a brief overview directed at the emergency physician. Findings on the neuro-ophthalmologic system do not exist in isolation and must be viewed in context of the entire presentation of the patient. A patient's level of consciousness, comorbidities, and associated conditions or injuries frequently direct the tempo of evaluation.

Examination of the neuro-ophthalmologic system allows a sampling of the general neurologic examination. Motor function, sensory findings, coordination, several of the cranial nerves, and even cortical and higher cerebral functions are tested. Although the neuro-ophthalmologic examination is often straightforward, it is occasionally perplexing. Like the general neurologic examination, the history informs the key portions of the physical examination and these clinical findings together suggest the anatomic localization of abnormalities within the central nervous system, which is critical to

Department of Emergency Medicine, University of Virginia, PO Box 800699, Charlottesville, VA 22902, USA
* Corresponding author.
E-mail address: jshuff@virginia.edu

Emerg Med Clin N Am 34 (2016) 967–986
http://dx.doi.org/10.1016/j.emc.2016.06.016 **emed.theclinics.com**

determine if addition work-up is necessary. Funduscopic examination allows visualization of blood vessels and the neural tissue in the optic disc.

With neuro-ophthalmologic emergencies, the emergency physician is faced with determining the need for prompt consultation, imaging, or hospital admission. This article presents examination techniques and findings as well as summaries of several clinical entities that are encountered in emergency medicine practice. Emphasis is on do-not-miss causes.

ANATOMY AND PHYSIOLOGY

An understanding of anatomy aids both with examination and formulation of a clinical impression. The eye developmentally is an amalgam of neural elements and connective tissues. The globes are moved by the extraocular muscles, and disorders of muscles or the neuromuscular junction may affect eye movements. Because muscles are controlled by the nervous system, disorders of cranial nerves, the cranial nerve nuclei, and neural systems controlling the cranial nerve nuclei may also affect eye movements. The coordination needed to maintain visual fixation of 2 eyes simultaneously in a moving environment is complex, and the interaction and coordination of extraocular movements and conscious interpretation of visual information is complex as well as involving extra-ocular muscles, their innervation, cerebellum and cerebellar pathways, and cortical and subcortical structures.

Vision involves light entering the pupil, having an impact on the retina with photochemical conversion of light energy to electrical impulses and transmission of the visual information by the optic nerves via the optic chasm and optic tracts to the thalamus. At the optic chiasm, partially crossing fibers form the optic tracts in route to the lateral geniculate bodies of the thalamus (Fig. 1). Pupillary reactivity with efferent responses through parasympathetic and sympathetic systems is supplied by specialized ganglion cells, which leave the optic tract to reach the pupillary centers in the dorsal midbrain. Transmission via the optic radiations through the temporal lobes to the occipital cortex is the pathway for conscious awareness of vision and

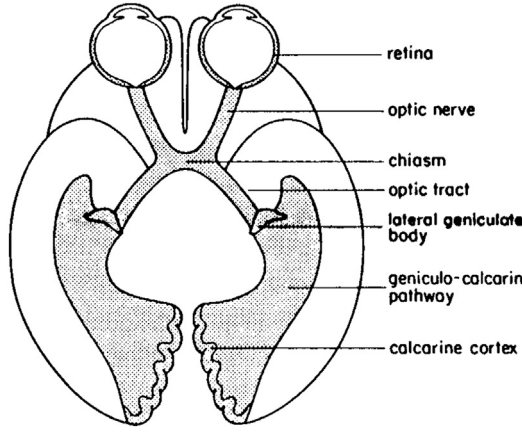

Fig. 1. Visual pathway with light impacting the retina where it is converted to electrical energy prior to being transmitted along the optic nerve, partially crossing at the chiasm, and down the optic tract to the lateral geniculate bodies. (*From* Pellock JM, Myer EC. Neurologic emergencies in infancy and childhood. 2nd edition. Philadelphia: Butterworth-Heinemann; 1993; with permission.)