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Diagnostic imaging in neuro-ophthalmology☆

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Abstract Neuro-ophthalmology is a field combining neurology and ophthalmology that studies diseases that affect the visual system and the mechanisms that control eye movement and pupil function. Imaging tests make it possible to thoroughly assess the relevant anatomy and disease of the structures that make up the visual pathway, the nerves that control eye and pupil movement, and the orbital structures themselves. This article is divided into three sections (review of the anatomy, appropriate imaging techniques, and evaluation of disease according to clinical symptoms), with the aim of providing useful tools that will enable radiologists to choose the best imaging technique for the differential diagnosis of patients' problems to reach the correct diagnosis of their disease.

PALABRAS CLAVE
Órbita;
Vías visuales;
Técnicas de imagen oftalmológicas;
Enfermedades oculares

Diagnóstico por la imagen en neuroftalmología

Resumen La neuroftalmología es la parte de la neurología y la oftalmología que se encarga del estudio de las enfermedades que afectan al sistema visual y a los mecanismos que controlan la motilidad ocular y la función pupilar. Las pruebas de imagen permiten realizar una adecuada valoración anatómica y patológica de las estructuras que conforman la vía visual, los nervios que controlan la motilidad ocular y pupilar, y las propias estructuras orbitarias. Este artículo se divide en tres apartados (recuerdo anatómico, técnicas de imagen apropiadas y valoración patológica en función de la sintomatología clínica) con el propósito de proporcionar herramientas útiles que permitan al radiólogo elegir en cada momento la técnica de imagen más adecuada para el correcto diagnóstico de las enfermedades y un ajustado diagnóstico diferencial.

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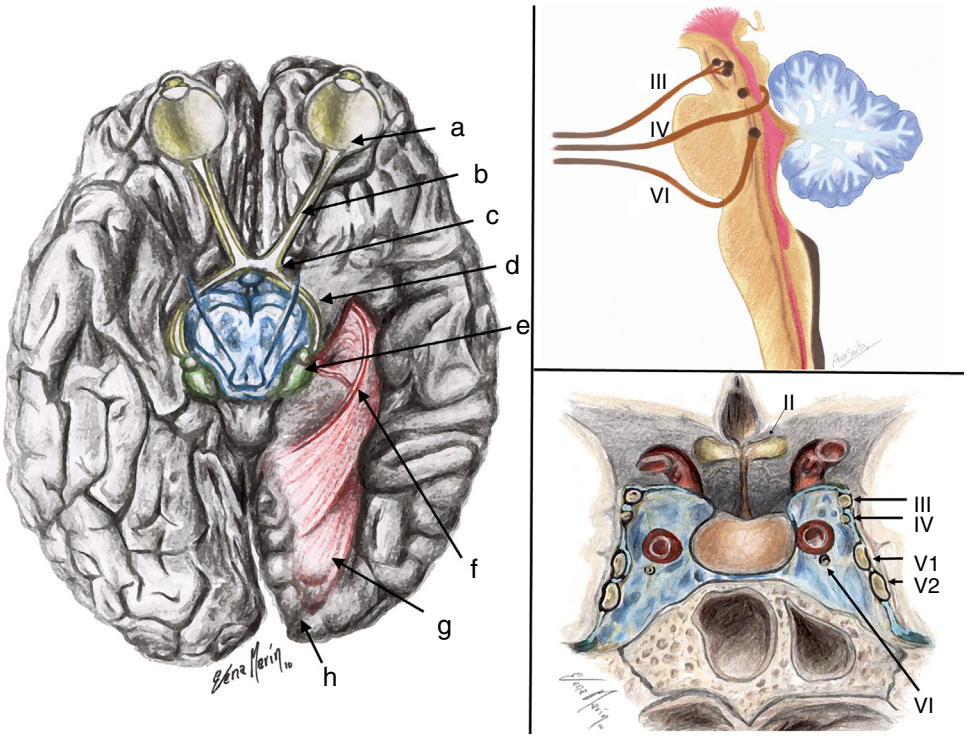

Figure 1 (a) Drawing representing the optic pathways. (b) Drawing showing the location of the nuclei of the oculomotor cranial pairs relative to the mesencephalon and the pons. (c) Schematic drawing of the correlations of the cranial pairs with the cavernous sinus and the intracavernous internal carotid artery. a: Retina; b: optic nerve; c: optic chiasm; d: optic tract; e: lateral geniculate ganglion; f: inferior geniculocalcarine tracts or Meyer's loop; g: superior geniculocalcarine tracts; h: occipital cortex; II: optic nerve; III: common oculomotor nerve; IV: trochlear nerve; VI: abducens nerve; V1: first branch of the trigeminal nerve; V2: second branch of the trigeminal nerve.

Introduction

The pathology of optic pathways and the orbital structures varies widely, but it has little global incidence, therefore its study and assessment represent a small volume of cases in a radiologist's standard practice, making it a not very well-known condition and, at times, difficult to manage. That is why it is useful to review the anatomy (Fig. 1), expose which are the imaging modalities suitable for its evaluation and make the right differential diagnosis based on the symptoms.

Visual pathways

There are photoreceptors, cones and rods in the retina in charge of making the synapses with the first neurons or bipolar cells, and in turn these make second synapses with ganglion cells, whose axons make up the optic nerve fibers.[1] The nasal hemiretina receives information from the temporal visual field, and the temporal information is received from the nasal visual field. There also occurs a superior–inferior crossing, so that the information from the superior visual field is collected by the inferior hemiretinas, and vice versa.[1,2] The optical nerve runs through the orbit and into the skull via the optic foramen. It is surrounded by meningeal layers in continuity with the intracranial meninges and by cerebrospinal fluid.

The intracranial segments of both optic nerves converge forming the optic chiasm. The temporal fibers of each retina (nasal visual fields) remain on the same side (homolateral), and the medial ones (temporal visual fields) decussate toward the contralateral side. Only one half the macular fibers decussate; the rest remain on the homonymous side.[1,3]

The optic tracts start from the chiasm and, surrounding the mesencephalon, reach the lateral geniculate body, the thalamic nucleus located behind the pulvinar nucleus.

The geniculo-calcarine tracts (optic radiations) connect the lateral geniculate nuclei with the visual cortex. The superior axons relay information from the inferior visual fields, run lateral to the atrium and the posterior horn of the lateral ventricle, pass through the parietal white matter and reach the occipital cortex on the calcarine sulcus. Inferior fibers, with information from the superior visual fields, curve antero-laterally, pass through the caudal portion of the internal capsule, continue along the temporal white matter (Meyer's loop) surrounding the temporal horn of the ventricle, and posteriorly aim at occipital cortex located under the calcarine sulcus[3,4] (Table 1).

Oculomotor nerves

The nuclei of the common oculomotor nerve or third cranial nerve (CN III) are located in the periaqueductal region of the mesencephalon at the level of the superior quadrigeminal