



# Inferior Divisional Oculomotor Nerve Palsy Due to Orbital Lymphoma

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Dear Editor,

The third cranial (oculomotor) nerve divides into superior and inferior divisions upon passing through the anterior cavernous sinus.<sup>1</sup> The superior division innervates the levator palpebrae and superior rectus muscles, while the inferior division innervates the sphincter pupillae and extraocular muscles that include the medial rectus, inferior rectus, and inferior oblique.<sup>2</sup> This anatomic arrangement has resulted in divisional patterns of oculomotor palsy being considered a sign of a lesion involving the anterior cavernous sinus or the orbit.<sup>3</sup> Orbital lymphoma may present as various patterns of ophthalmoplegia, but to the best of our knowledge isolated inferior divisional oculomotor nerve palsy has not previously been described in association with orbital lymphoma.<sup>4,5</sup> We report a patient in whom the inferior divisional pattern of oculomotor nerve palsy in isolation guided the localization of a tiny lymphoma restricted to the inferior division of the oculomotor nerve in the orbit. This case further highlights the localizing value of divisional patterns of oculomotor palsy even when modern imaging technologies are available.

A 59-year-old male with diffuse large B-cell lymphoma presented with acute binocular vertical diplopia. He denied ocular pain or headache, and his past medical history was unremarkable except for lymphoma. A physical examination revealed right exo- and hypertropia along with a nonreactive pupil enlarged at 54 mm and restriction of depression and adduction of the right eye. He showed no ptosis. Elevation, abduction, and intorsion upon attempted depression were preserved in the right eye (Fig. 1A). The eyelid, pupillary, and ocular motor functions were intact in the left eye (Fig. 1A). These findings were consistent with isolated right inferior divisional oculomotor nerve palsy. A serologic evaluation was negative for paraneoplastic antibodies and markers for vasculitis and viral infections. The findings of a cerebrospinal fluid examination were normal for glucose and protein, with no malignant cells detected. Contrast-enhanced T1-weighted orbital MRIs disclosed a gadolinium-enhanced swelling in the inferior division of the right oculomotor nerve in the orbit (Fig. 1B). Chemotherapy resulted in resolution of the vertical diplopia, and the lesion had markedly decreased in size on the follow-up MRIs obtained 1 month later (Fig. 1C). Over the following 2 years the patient experienced recurrences of lymphoma involving the lymph nodes and soft tissues.

Our patient developed isolated inferior divisional palsy of the oculomotor nerve due to a small lymphoma restricted to the inferior branch of the oculomotor nerve in the orbit (Fig. 1D). Thus, without knowledge of the detailed anatomy of the oculomotor nerve and localizing value of the divisional patterns of oculomotor nerve palsy, this small lesion restricted to a branch of the oculomotor nerve in the orbit might have been missed even in neuroimaging.

Orbital lymphoma may present various patterns of oculomotor nerve palsy.<sup>4</sup> The relative rarity and diverse clinical features of orbital lymphoma may delay its diagnosis.<sup>5-7</sup> These observations indicate that recognizing the divisional patterns of oculomotor palsy is important

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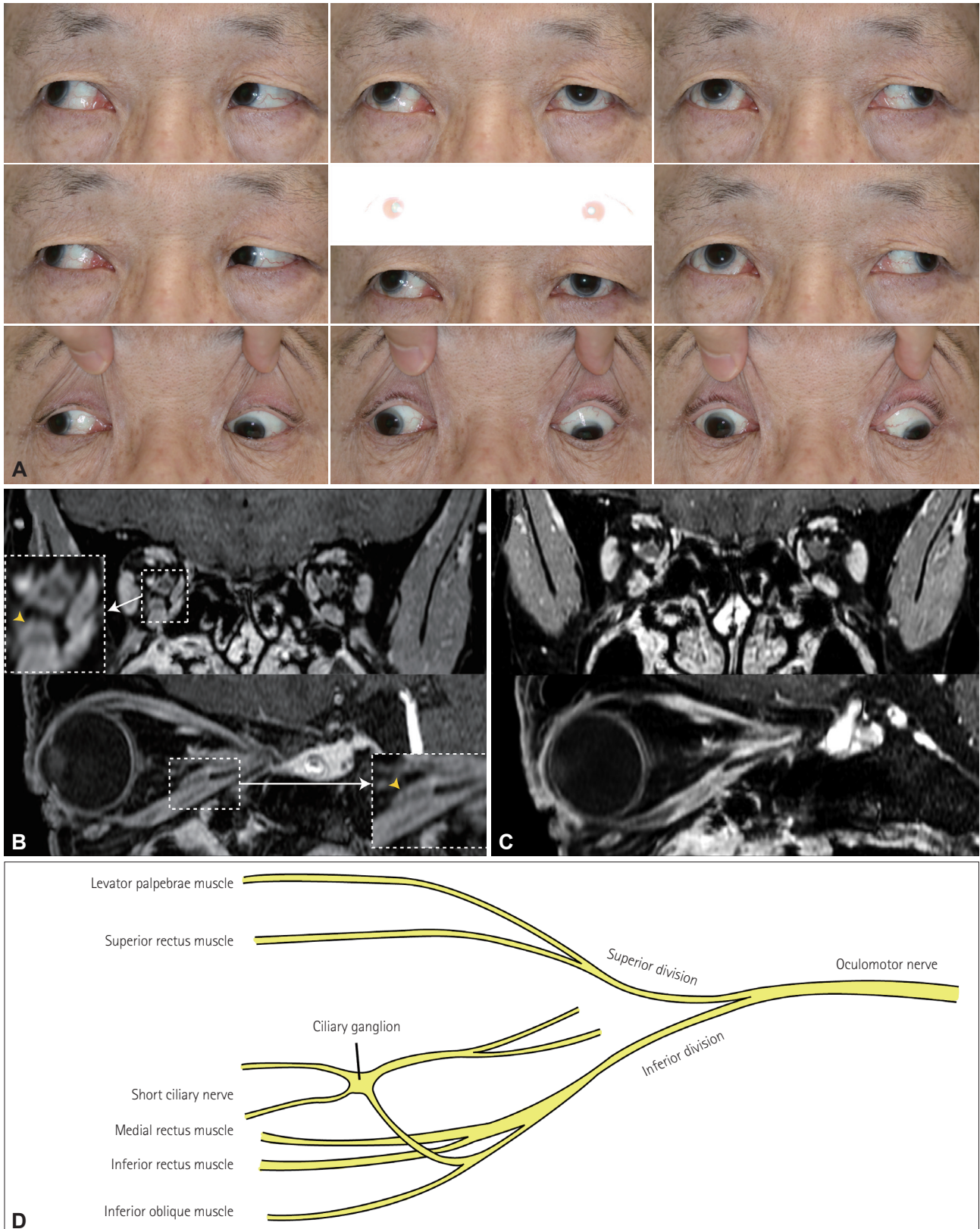
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**Fig. 1.** Eye-movement and MRI findings. A: The patient shows mydriasis along with exo- and hypertropia with impaired adduction and depression of the right eye. B: Contrast-enhanced T1-weighted MRIs using a 3D turbo field echo sequence with a thickness of 1 mm show a gadolinium-enhanced swelling in the inferior division of the right oculomotor nerve (arrowheads) in the orbit. C: Resolution of the lesion 1 month after chemotherapy. D: Anatomy of the oculomotor nerve.

in localizing and detecting small lesions—such as lymphoma—restricted to each division of the oculomotor nerve in the orbit, as was the case in our patient.<sup>5,8,9</sup>

Divisional patterns of oculomotor nerve palsy have rarely been described in lesions involving the oculomotor fascicle in the midbrain or the nerve in the subarachnoid space. The present patient further highlights the localizing value of divisional patterns of oculomotor nerve palsy in the orbit.

This study followed the tenets of the Declaration of Helsinki, and was performed according to the guidelines of Institutional Review Board of Seoul National University Bundang Hospital (B-1808-484-703).

#### Author Contributions

Conceptualization: Ji-Soo Kim, Hui Jong Oh. Data curation: Eunjin Kwon, Jeong-Yoon Choi, Hyo-Jung Kim. Formal analysis: Ju-Young Lee, Ji-Soo Kim. Funding acquisition: Ji-Soo Kim. Investigation: Ju-Young Lee, Eunjin Kwon, Hyo-Jung Kim, Ji-Soo Kim. Supervision: Ji-Soo Kim. Visualization: Hyo-Jung Kim. Writing—original draft: Ju-Young Lee, Ji-Soo Kim. Writing—review & editing: Ji-Soo Kim.

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#### Conflicts of Interest

Drs. Lee, Kwon, HJ Kim, Choi and Oh report no disclosures. Dr. JS Kim serves as an associate editor of *Frontiers in Neuro-otology* and on the editorial boards of the journal of *Clinical Neurology*, *Frontiers in Neuro-oph-*

*thalmology*, *Journal of Neuro-ophthalmology*, *Journal of Vestibular Research*, *Journal of Neurology*, and *Medicine*.

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