pISSN 1226-9751 / eISSN 2288-3800 http://dx.doi.org/10.13104/jksmrm.2014.18.2.167

Case Report

Medial Longitudinal Fasciculus on MRI in a Patient with Internuclear Ophthalmoparesis: A Case Report

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The medial longitudinal fasciculus (MLF) is myelinated composite tract, lying near the midline, ventral to periaqueductal grey matter that plays a key role in coordinating eye movements. A lesion of the MLF results in an ipsilateral adduction deficit and a contralateral abducting nystagmus, referred to as an internuclear ophthalmoparesis. The blended tract with adjacent white matter in pons and midbrain is indistinguishable on brain imaging such as CT and MRI. Until now, to the best of our knowledge, MLF is not delineated on in vivo MRI. We present a case showing the whole connecting courses of MLF lesion on MRI in a patient with inflammatory demyelinating disorder.

Index words : Medial longitudinal fasciculus · Internuclear ophthalmoparesis · Magnetic resonance imaging (MRI)

INTRODUCTION

The medial longitudinal fasciculus (MLF) is heavily myelinated composite tract that connects the nuclei of the third, fourth, sixth and eighth cranial nerves (1). This pathway provides a neural mechanism for simultaneous contraction of the lateral rectus muscle on the one side and the medial rectus muscle on the opposite side, require for conjugate lateral gaze (2, 3). We present a case showing the whole courses of the MLF pathways between abducens and oculomotor nucleus including decussation at the midbrain level on MRI in a patient with inflammatory demyelinating disorder.

• Received; May 15, 2014 • Revised; June 11, 2014
• Accepted; June 16, 2014
This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. NRF-2012R1A1A4A01005117)
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CASE REPORT

A 9-year-old boy presented to the pediatric department with one-month history of ophthalmoplegia and diplopia. The physical and neurologic examination revealed inward deviation and abduction failure of the left eyeball, and weak abduction movement of right eye ball at present. The patient had any prodromal illness and had no other neurologic or laboratory abnormality. T2 weighed image of MRI (slice thickness = 4 mm, FOV = 165 × 220, Matrix =512 × 198, no gap, TR/TE= 3588/99) showed bilateral contiguous high signal intensities in the dorsal pons and midbrain, illustrating ascending fibers from the abducens nucleus to the occulomotor nucleus (Fig. 1) The bilateral fasciculi ran medially and decussated at the lower level of midbrain. The patient had conservative therapy and discharged 3 days later. The symptoms were fully recovered 3 months later.

DISCUSSION

Direct projection to the occluomotor nuclear complex arise from parts of the vestibular nuclei, the interstitial nucleus of Cajal, abducens internuclear neurons, part of the perihypoglossal nuclei, the rostral interstitial nucleus of the MLF, and the pretectal olivary nucleus (4). The MLF is a critically important conduit for many brainstem pathways, and constitutes the final common pathway for all major classes of conjugate eye movements including saccades, smooth pursuit, and vestibule-ocular reflexes, including semicircular and otolith mediated ocular motor reflexes. The paired fasciculus plays a key role in coordinating eye movements (5). Pairs of cranial nerve III, IV, VI are interconnected via the MLF, which transmits vital information for the purpose of achieving synchronization and conjugacy of eye movements to a visual target. Within this system are both the excitatory as well as reciprocal inhibitory projections that serve to precisely regulate the interplay between agonist and antagonist muscles of the eyes (3).

Injury to the MLF leads to abnormalities in eye movements that can be measured with high precision by oculography, making it an ideal eloquent pathway to study imaging/function correlates (2). Internuclear ophthalmoparesis (INO) is characterized by impaired horizontal eye movement with weak adduction of the affected eye and abduction nystagmus of the contralateral eye (6). INO is one of the most localizing brainstem syndromes, resulting from a lesion in the MLF in the dorsomedial brainstem tegmentum of either the pons or the midbrain. INO is a distinct clinical sign and seen in association with a lesion in the MLF between the third and sixth cranial nerve nuclei. Main cause of INO is stroke and multiple sclerosis, which are followed by other cause compose more than one quarter of the causes. The other causes of INO include tumor, infection, and traumatic injury (7).

Due to its high spatial resolution, magnetic

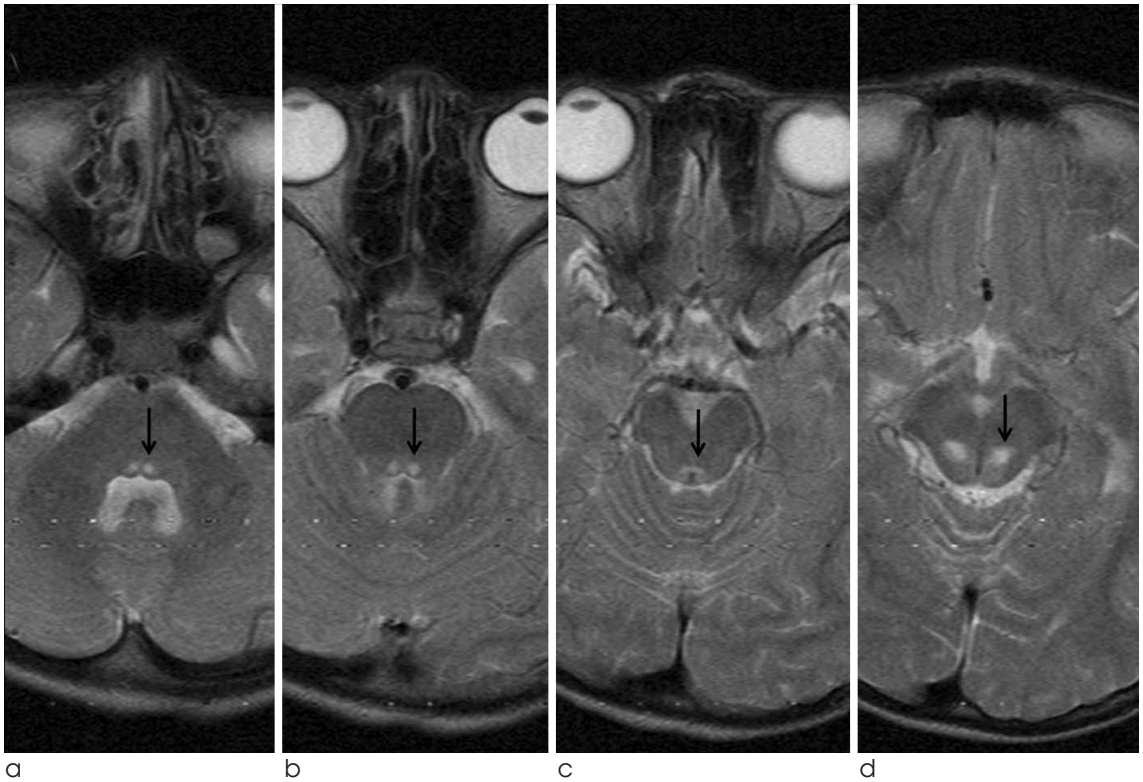


Fig. 1. T2 weighed image of MR imaging showed bilateral contiguous high signal intensities at the posterior aspect of pons and midbrain. High signal intensities of the pons represent ascending fibers from the abducent nucleus (**a**, arrow) to the occulomotor nucleus (**d**, arrow) via medial longitudinal fasciculus (**b** and **c**). The bilateral fasciculi run medially and decussated at the lower level of midbrain (**c**, arrows).

http://dx.doi.org/10.13104/jksmrm.2014.18.2.167

resonance imaging (MRI) has allowed us to depict in vivo, the anatomic organization of the human oculomotor nerve complex, the MLF, and related structures in the brainstem. Frohman et al. (6) showed that all the patients with confirmed INO had evidence of high signal intensity abnormalities in the brainstem tegmentum in the region of MLF, which was best identified with proton density imaging. Despite the frequency and conspicuity of MLF lesions on conventional MRI in MS patients with INO, MLF is not exactly distinguished from other blended white matters tracts in pons and midbrain (8). Recently, advanced MR technique such as diffusion tensor imaging, automated brainstem coregistration and Ultra high field imaging may also provide important information for MLF, but the MLF was not specifically indicated (9, 10). In our patient, he did not have any prodromal illness and had no other neurologic or laboratory abnormality. MRI did not show any other parenchymal abnormality and MRS was normal. All the other causes of other than demyelinating pathology could be excluded. So, we considered the lesion as an isolated inflammatory demyelinating lesion of the brainstem. T2 weighted MRI showed the whole courses of the MLF pathways between abducens and oculomotor nucleus including decussation at the midbrain level.

We present a patient with isolated unilateral INO probably due to an isolated inflammatory demyelinating lesion of the brainstem. The MR finding of the illustration of the connection between 3rd and 6th nucleus by MLF can be educational. Until now, to the best of our knowledge, the connection between abducens and occulomotor nucleus by MLF has not been completely delineated on MRI.

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대한자기공명의과학회지 18:167-170(2014)

신경핵사이 눈근육마비환자에서 자기공명영상에서의 내측세로다발: 증례 보고

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내측세로다발은 조화로운 눈운동의 핵심적인 역할을 하는 유수 합성로이며 수도관주위회색질의 배쪽의 중간선 근처에 놓여있다. 내측세로다발의 병변은 신경핵사이 눈근육마비로 불리는 동측의 내전 결손과 반대측 외전 안진을 야기한다. 중뇌와 교뇌에서 인접한 백질과 섞여있는 신경로는 전산화단층촬영술과 자기공명영상과 같은 뇌영상에서 구별하기 어렵다. 지금까지 우리가 알기로는 내측세로다발은 실제 자기공명영상에서 구체적으로 묘사되지 않았다. 우리는 염증성 탈수초성 질환에서 자기공명영상에 내측세로다발의 전체 연결 과정을 보이는 증례를 보고한다.

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http://dx.doi.org/10.13104/jksmrm.2014.18.2.167