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Isolated Unilateral Adduction Paresis of the Right Eye Due to a Contusion in the Subnucleus of Oculomotor Nerve

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Authors' contributions

This work was carried out in collaboration between all authors. Authors IG, AH designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors IG, AH, MDB, GE and NT managed the literature search. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

In this report we present a 45 year old man with horizontal diplopia following minor head trauma. Neurological examination was normal except for unilateral adduction paresis of the right eye. Brain magnetic resonance imaging (MRI) revealed a contusion area 7 mm in diameter at the inferior-posterior portion of the mesencephalon. We thought that this contusion affected the sub-nucleus of oculomotor nerve and caused isolated adduction paresis of the right eye. This relatively rare entity is discussed in the light of the available literature.

Keywords: Adduction paresis; contusion injury; subnucleus; oculumotor nerve.

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1. INTRODUCTION

Cerebrovascular accidents, infiltration, tumor, and severe head injury may lead to oculumotor nerve palsy. Isolated oculomotor nerve palsy is a rare complication of minor head injury, with an incidence of 0%-15% [1-4]. Posttraumatic oculomotor nerve palsy may occur due to direct or indirect mechanisms. Direct injury may result from severe trauma to the nerve, rootlet avulsion distal fascicular damage or a comprise of its blood supply. Avulsion and damage to the surrounding structures is the most important underlying mechanism [5]. Indirect injury can cause compression, displacement or deformity; this results from intracranial aneurysm or other intracranial space-occupying lesions [4]. The third nerve fascicule may be damaged due to posterior petroclinoid ligament stretching [6]. There is paucity of reports on isolated unilateral adduction paresis due to a contusion in the mesencephalon after minor head injury. Therefore, we present a 45-year old man with isolated adduction paresis of the right eye following an MRI-diagnosed contusion injury in the region of the oculomotor subnucleus.

2. CASE

A 45-year old man presented with diplopia after falling from a tree. His past medical history was unremarkable. On physical examination, there was only soft tissue edema on the right temporal region about 4x5 cm in diameter. Neurological examination was normal except for adduction paresis of the right eye (Fig. 1). The pupils were isocoric and had normal direct and consensual light reflexes. Eyelid movements in both eyes were within normal limits. Ptosis was absent. Accommodation was also normal. Fundoscopic examination didn't reveal any pathology. There was no jerk nystagmus in the left eye on attempted left gaze. Initial brain CT was normal. There was no fracture in the bony structure of the bilateral orbit (Fig. 2). Craniocerebral and orbital MRIs (Fig. 3) did not reveal any abnormality except a 7 mm diameter contusion at the posterior-inferior region of the mesencephalon (Figs. 4a, 4b). Patient was hospitalized for one night without any medication. Subsequently, he was followed up weekly in the outpatient clinic for 1 month. His adduction paresis showed progressive improvement. At the fourth week of follow up, eye movements were normal (Fig. 5). Follow-up brain MRI which was requested one month after injury didn't reveal any pathology (Figs. 6a, 6b).

3. DISCUSSION

The nuclear complex of the oculomotor nerve lies in the midbrain at the level of the superior colliculus, ventral to Sylvian aqueduct, straddling the vertical midline. The oculomotor complex includes the anterior median, caudal central, central oculomotor, dorsal, intermediate, medial, parcovellular, and oculomotor nuclei. Each target muscle has its own subnucleus. Most of the rostral and dorsal nuclei give parasympathetic innervations to the sphincter papillae and ciliary muscles. The levator subnucleus is an impaired nucleus and that supplies both levator muscles. Its lesions lead to bilateral ptosis. The superior rectus subnuclei are paired and innervate the contralateral superior rectus mucles. The medial rectus, inferior rectus, and inferior oblique subnuclei are paired and supply the ipsilateral respective muscles [7].

Fig. 1. The patient's eye movements on admission indicate medial gaze paresis of the right eye

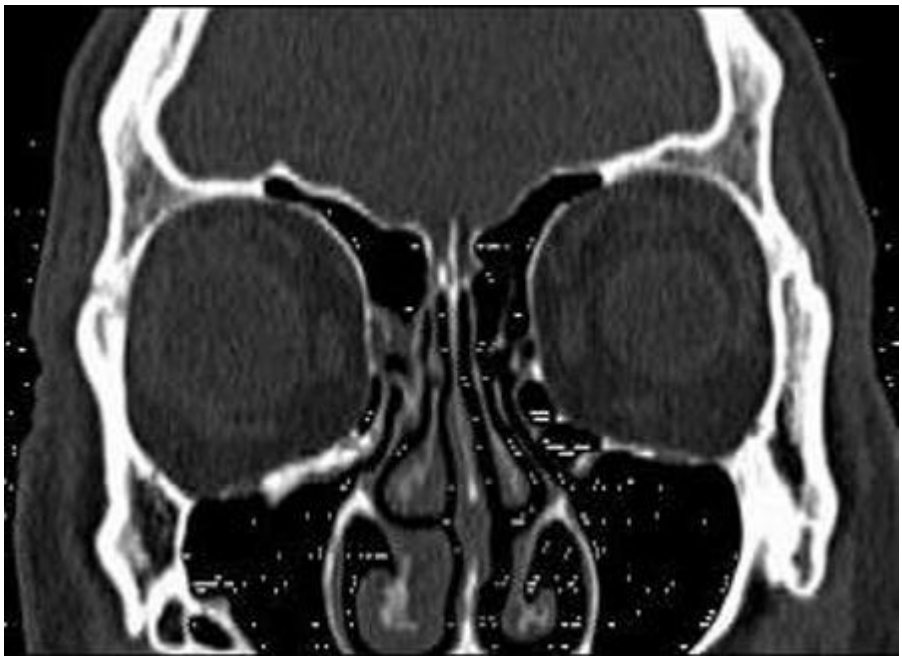


Fig. 2. Computed tomography (CT) of the patient in the coronal plane showing the intact bony structure of the orbit

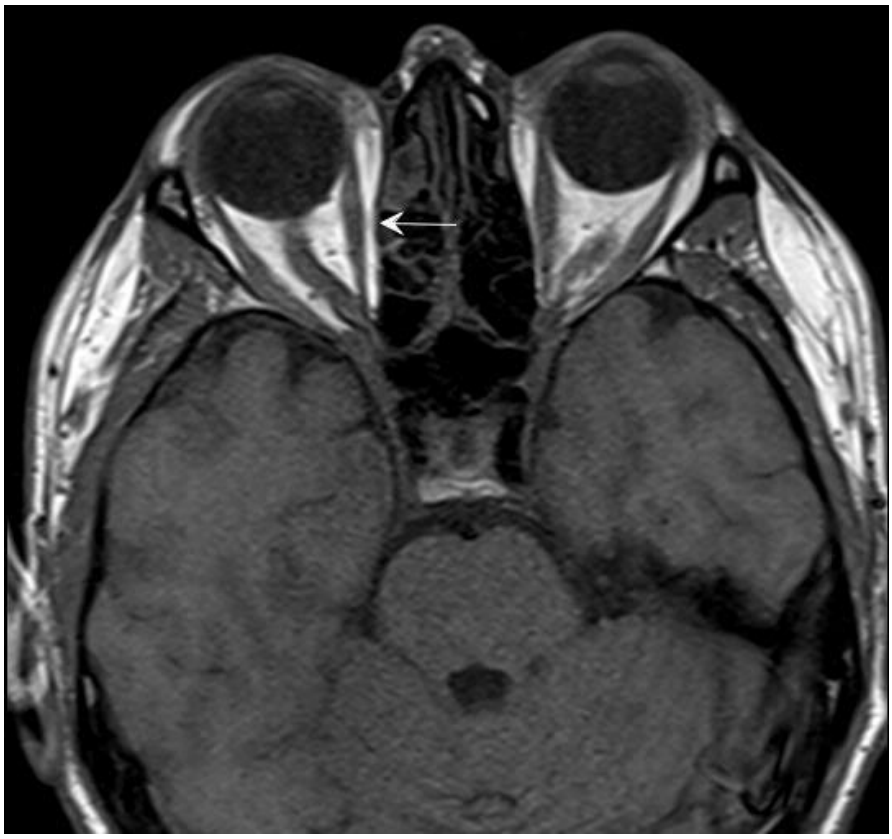
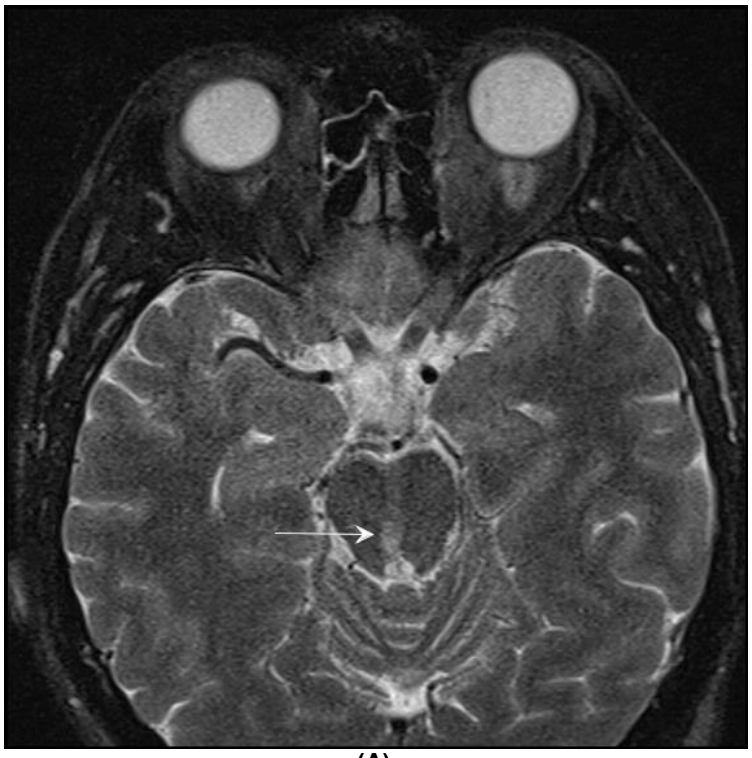
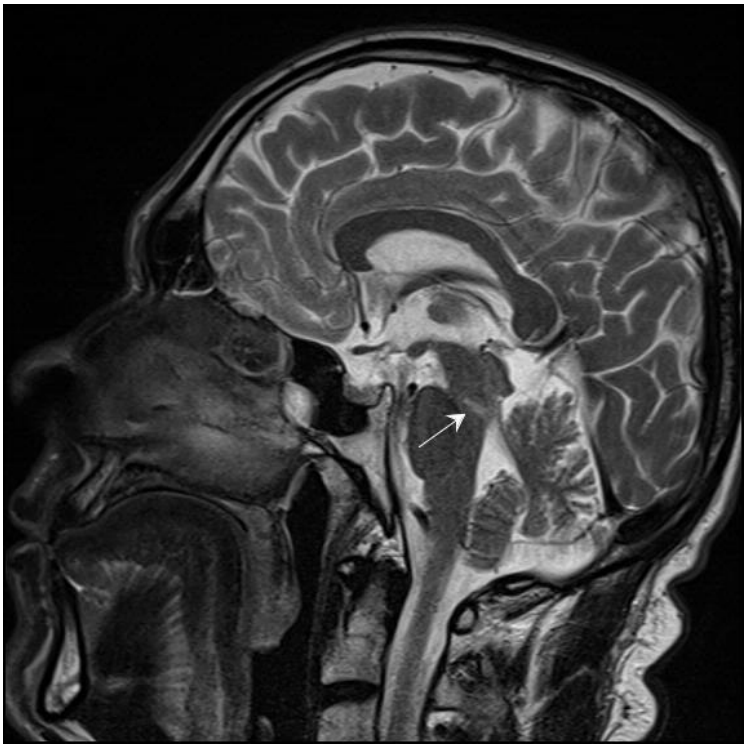


Fig. 3. T2-weighted axial MRI image shows intact muscle structure of the right eye



(A)



(B)

Fig. 4. T2-weighted axial (A) and sagittal (B) MRI images show a hyperintense contusion anterior to the Sylvian aqueduct in the posterior portion of the mesencephalon (white arrows)

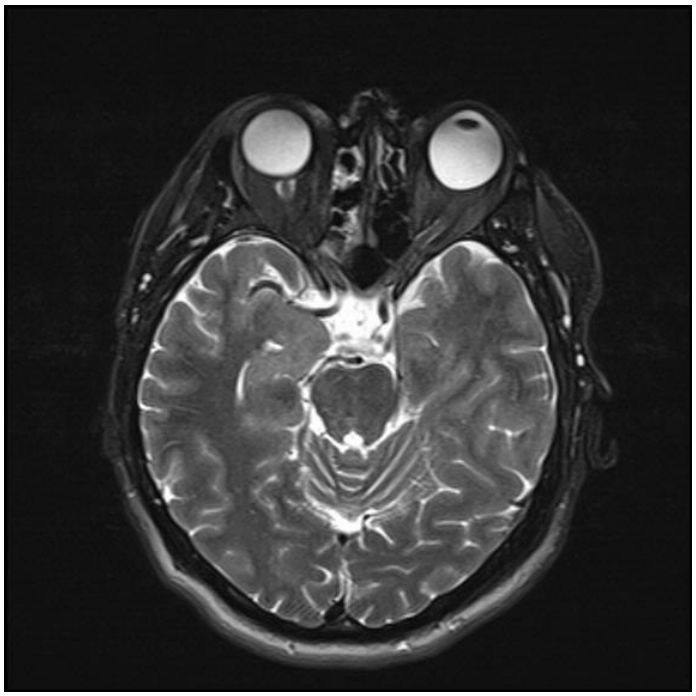
Fig. 5. The patient's eye movements 1 month after the initial examination

The medial longitudinal fasciculus (MLF), which is organized as a pair of white matter fiber tracts, extend through the brainstem and contains fibers that interact with the ocular motor control circuits involved in the coordination of horizontal, vertical, and torsional eye movements. The MLF is the final common pathway for all classes of conjugate eye movements, including saccades (rapid refixation), smooth pursut, and vestibule-ocular reflexes. The six ocular motor nuclei are interconnected via the MLF, which transmits vital information to coordinate and synchronize the movements of the eyes to a visual target [8]. Internuclear ophthalmoplegia is a specific gaze abnormality that results from a lesion in the MLF. This abnormality is characterized by impaired horizontal eye movement, with weak adduction of the affected eye and abduction nystagmus of the contralateral eye. Internuclear ophthalmoplegia is a specific gaze abnormality that results from a lesion in the MLF. This abnormality is characterized by impaired horizontal eye movement, with weak adduction of the affected eye and abduction nystagmus of the contralateral eye. Internuclear ophthalmoplegia was the most important entity in the differential diagnosis of our patient. However, the absence of abduction nystagmus of the contralateral eye made us to eliminate this diagnosis.

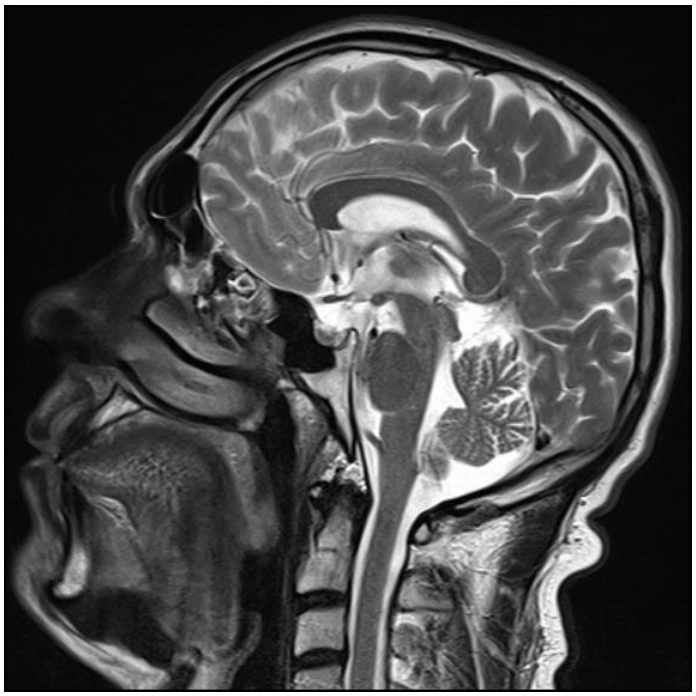
The oclumotor nerve innervates some of the extrinsic eye muscles (medial rectus, superior rectus, inferior rectus, inferior oblique, and levator palpebrae mucles) and the sphincter papillae muscle the ciliary muscle. Lesions affecting the oculomotor nerve can disrupt the function of these muscles. Lesions in the orbit, superior orbital fissure, cavernous sinus, subarachnoid space, or mesencephalon (nucleus and fascicle parts) can affect the oculomotor nerve [9,10].

Isolated paralysis of muscles innervated by the oculomotor nerve nearly always results from pathology of the orbit, thyroid disease, diabetes mellitus, vascular disease, multiple sclerosis, or migraine [11]. Pure unilateral subnuclear lesions are very rare [1,2]. In our patient, orbital MRI did not reveal any intraorbital lesion. In addition, there was no accompanying chronic disease, such as diabetes mellitus or thyroid disease in his medical history.

In unilateral oculomotor nerve destruction, ipsilateral paralysis of the medial rectus, superior rectus, inferior rectus, inferior oblique, and levator palpebrae is observed. This clinical picture usually results from total nuclear involvement or any compression or damage of the oculomotor nerve along its course [12]. In our patient, however, only unilateral medial gaze paresis was evident; consequently, we did not consider the presence of total nuclear damage or damage to the oculomotr nerve along its course.



(A)



(B)

Fig. 6. Follow up brain T2-weighted MRI in the axial (A) and sagittal (B) planes showing complete resolution of the contusion

Apart from these, subnuclear lesions in the midbrain can very rarely lead to isolated paralysis of muscles that are innervated by the oculomotor nerve, with the exception of the superior rectus muscle, levator palpebrae, and papilla constrictor muscles. Paralysis of the

inferior rectus muscle has been reported for this reason [12,13,14]. Similarly, in our patient, we considered damage to a subnucleus of the oculomotor nerve based on the clinical and radiological findings. The contusion seen on MRI, in our patient, in the inferoposterior portion of the mesencephalon corresponds to this region.

4. CONCLUSION

A minor head injury can present with various neuro-ophthalmological signs and symptoms and the underlying lesion in such cases might not be detected by routine brain computed tomography. MRI might be more effective for identifying such lesions.

CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this case report and accompanying images.

ETHICAL APPROVAL

Not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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