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Case Report

# Post-traumatic Unilateral Avulsion of the Abducens Nerve with Damage to Cranial Nerves VII and VIII: Case Report

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Traumatic injuries of the abducens nerve as a consequence of facial and/or head trauma occur with or without associated cervical or skull base fracture. This is the first report on unilateral avulsion of the abducens nerve in a 29-year-old man with severe right facial trauma. In addition, he exhibited mild left facial palsy, and moderate left hearing disturbance. Magnetic resonance imaging (MRI) using fast imaging employing steady-state acquisition (FIESTA) revealed avulsion of left sixth cranial nerve. We recommend thin-slice MR examination in patients with abducens palsy after severe facial and/or head trauma.

**Keywords:** abducens nerve palsy, head trauma, FIESTA

## Introduction

Abducens nerve is vulnerable because of its long tortuous course.[1)] Traumatic injuries of abducens nerve as a consequence of severe facial and/or head trauma have been observed in the presence or absence of associated cervical or skull base fracture. While the reported incidence of unilateral abducens palsy from head trauma is 1–2.7%,[2)] unilateral avulsion of the abducens nerve has not been documented. Advances in magnetic resonance imaging (MRI) have made it possible to detect the abducens nerve. We report a patient with left abducens palsy after severe right facial trauma. Thin-slice magnetic resonance (MR) sequence revealed avulsion of the unilateral abducens nerve.

## Case Report

This 29-year-old healthy man was hit by a falling tree and sustained severe right facial trauma. At presentation, Glasgow coma scale was 11 (E3V3M5). Computed tomography (CT) revealed multiple fractures of jawbone, thyroid cartilage, right maxillary and zygomatic bone, and frontal skull base. There was no petrous bone fracture. He presented with left peripheral facial palsy (House–Brackmann Grade II) and left lateral gaze palsy, and his left eye showed inward rotation in forward gaze. Hess test showed complete left abducens nerve palsy (Fig. 1). He also noticed left-sided hearing disturbance; audiometry revealed moderate (WHO grade 2) left hearing impairment. Magnetic resonance imaging (MRI, Signa Excite, GE Medical Systems, Milwaukee, WI) with fast imaging employing steady-state acquisition (FIESTA; TR 4.9 ms, TE 2.4 ms, Flip angle 45°, FOV 18 × 18 cm, matrix size 256 × 256, slice thickness 0.8 mm, intersection gap –0.4 mm, NEX 1, 140 slices, acquisition time 3:46 min) revealed avulsion of the left VI cranial nerve from brainstem (Fig. 2A, B, C, and D). The schema of bilateral abducens nerves course is shown in Fig. 3. Other cranial nerves, including left VII and VIII nerves, were morphologically intact. FLAIR and $T_2$*-weighted images showed no brain contusion. His symptoms were unchanged 5 months after the injury.

## Discussion

Etiology of abducens nerve palsy include vascular causes, neoplasm, idiopathic, congenital aplasia, or trauma.[1,3)] Reported spontaneous recovery rate from acute traumatic abducens nerve palsy ranges from 12 to 54%.[4)] Holmes et al.[5)] performed a prospective multicenter study of acute traumatic abducens nerve palsy and found that the overall spontaneous recovery rate at 6 months post-injury was 73% and that the recovery rate from unilateral was higher than from bilateral palsy (84% vs. 38%). Median time to documented recovery was 90 days[6)] in patients with unilateral- and 92 days in patients with bilateral palsy. Holmes et al.[6)] also reported that non-recovery at 6 months post-onset was associated with complete palsy (adjusted risk ratio 9.11) and with bilateral palsy or paresis (adjusted risk ratio, 2.53). As they did not perform thin-slice MRI, some of their patients may have had undiscovered avulsion of abducens nerve.

The suspected mechanism of injury to the nerve is contusion/stretching along its course and downward and/or upward displacement of brain.[7)] Abducens nerve palsy is mostly associated with severe head/facial injuries and/or cervical spine fracture. The nerve is thought to be more prone to injury at two sites—dural entry point (during upward displacement) and petrous apex (during downward displacement). A few have reported palsy even after minor head trauma indicating the possibility of stretching/contusion injury.[8)] Our patient did not present with brain contusion and abducens nerve avulsion may have occurred by downward displacement of cisternal segment at Dorello's canal.

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In their 1.5T MRI studies, Alkan et al.[9] identified the complete cisternal course of 540 in 570 abducens nerves (94.7%). Our 3T MRI scans using FIESTA revealed unilateral discontinuity of abducens nerve along its pre-pontine course and at the mid-pons level. Morphology of other cranial nerves was intact. To our knowledge, there has been only one earlier imaging study reporting bilateral abducens nerve avulsion after head trauma.[7] FIESTA is a heavily $T_2$-weighted MR sequence capable of acquiring very thin slices. As it allows reformatting in all three planes, FIESTA is optimal for analyzing the morphologic features of structures next to cerebrospinal fluid-containing spaces like the basal cisterns. Use of FIESTA on high-Tesla MRI instruments may help better understand the etiology of abducens nerve palsy.[3]

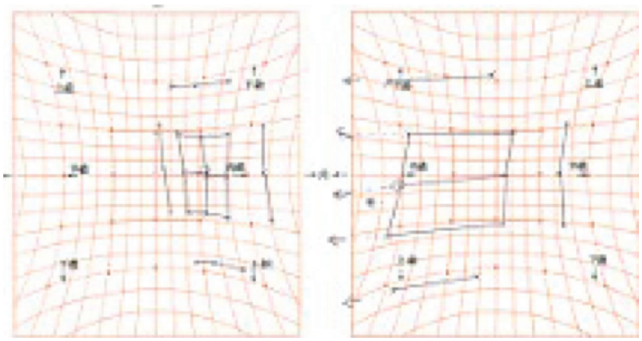


**Fig. 1** Hess chart demonstrating left abducens nerve palsy.

We presume that our patient's VII and VIII nerve paresis was due to axonotomesis by stretching at the pontomedullary junction. Traumatic abducens nerve palsy associated with other cranial nerve palsy including facial and hypoglossal nerves has been reported.[10,11] Although the incidence is unclear, we recommend careful examination of other cranial nerves, including VII and VIII, in patients with traumatic abducens nerve palsy.

## Conclusion

We report a head trauma patient who presented with unilateral avulsion of the abducens nerve, mild ipsilateral peripheral facial nerve palsy, and moderate ipsilateral hearing disturbance. MRI with FIESTA revealed avulsion of

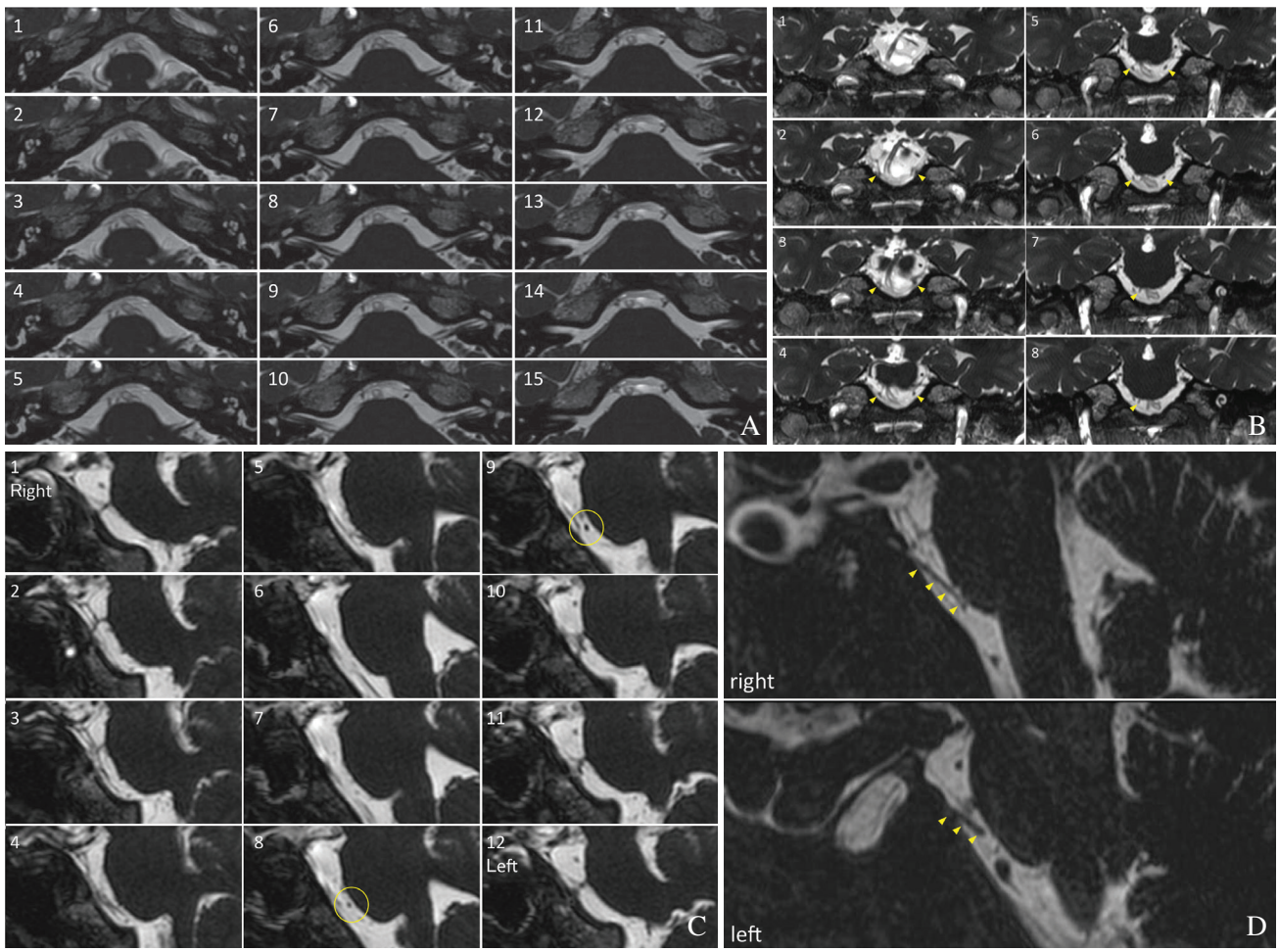
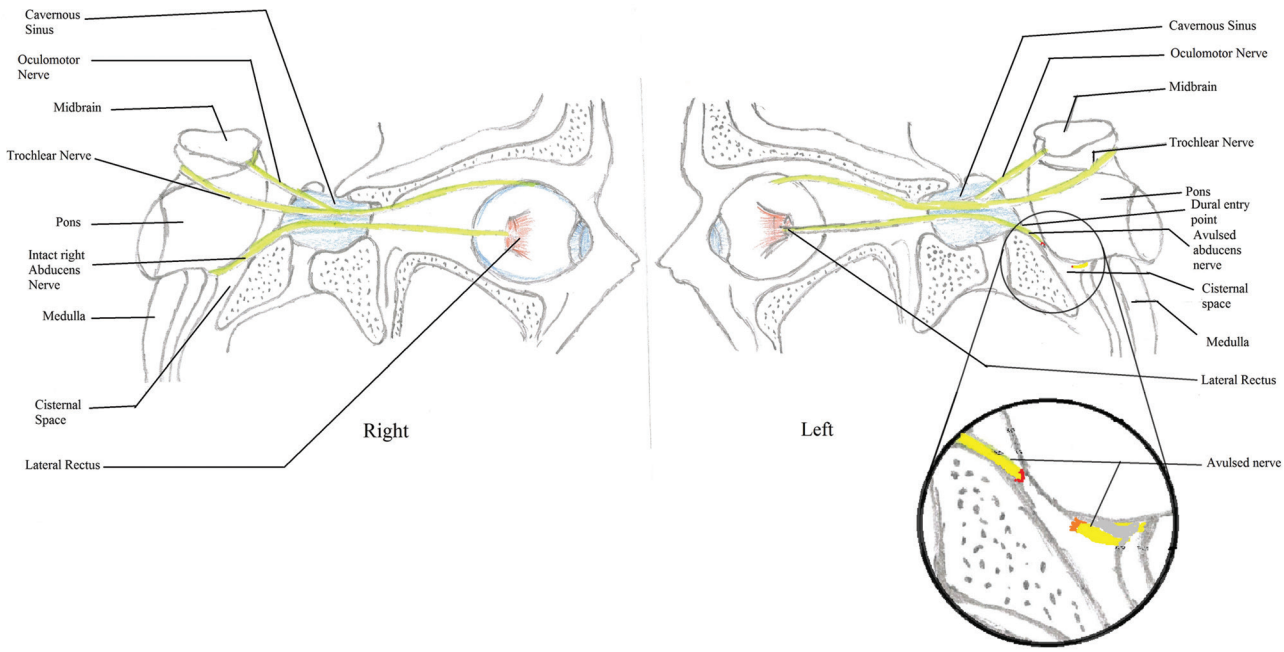



**Fig. 2** (A) Axial, (B) coronal, and (C) sagittal fast imaging employing steady-state acquisition (FIESTA) images reveal discontinuity at the cisternal segment of the left abducens nerve (complete avulsion). Sagittal oblique view was made along with abducens nerve based on the sagittal FIESTA images (D). Arrowheads point to the bilateral abducens nerves. Rounds point to the edge of avulsed abducens nerve.




Schematic diagram showing abducens nerve a) intact right nerve b) avulsed left nerve in the cisternal space

**Fig. 3** Schema of bilateral abducens nerves.

the left sixth cranial nerve. We recommend that head/facial trauma patients with abducens and/or facial palsy should undergo thin-slice MR study and audiometry.

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## Conflicts of Interest Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this article.

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