Case Report

Delayed and isolated oculomotor nerve palsy following minor head trauma

Yu Nakagawa, Masahiro Toda, Shunsuke Shibao, Kazunari Yoshida

Department of Neurosurgery, School of Medicine, Keio University, Tokyo, Japan

E-mail: Yu Nakagawa - fi020202naka2510027yu@gmail.com; *Masahiro Toda - todam@z2.keio.jp; Shunsuke Shibao - shibarc@yahoo.co.jp; Kazunari Yoshida - kazrmky@keio.jp
*Corresponding author

Received: 02 August 16   Accepted: 05 December 16   Published: 06 February 17

Abstract

Background: The purpose of this study was to consider the mechanism of isolated oculomotor nerve palsy after minor head trauma.

Case Description: We report a rare case of delayed and isolated oculomotor nerve palsy following minor head trauma. A 19-year-old boy complained of double vision 1 day after a minor head trauma. Neuro-ophthalmic examination showed isolated left oculomotor nerve palsy. Computed tomography and magnetic resonance imaging examination revealed no abnormal findings and steroid therapy was administered for a week. Three months after the injury, the ptosis and extraocular movements had fully resolved, although the pupillary light reflex was still abnormal.

Conclusions: Delayed and isolated oculomotor nerve palsy may be caused by an injury at the point where the oculomotor nerve runs over the posterior petroclinoid ligament. Because edema of the damaged oculomotor nerve might result in constriction at the point where the nerve pierces the dura of the cavernous sinus, symptoms of oculomotor nerve palsy appeared late after trauma. Steroid treatment reducing edema could be effective for delayed and isolated oculomotor nerve palsy following minor head trauma.

Key Words: Minor head trauma, oculomotor nerve injury, steroid

INTRODUCTION

The severity of head trauma is significantly higher in patients with traumatic brain injury (TBI) and cranial nerve injury than in those with intact cranial nerve function, with a greater number of radiological abnormalities on computed tomography (CT) scans and poor neurological outcome. The trauma required to damage the oculomotor nerve is extensive and is usually associated with loss of consciousness, basilar skull fracture, or subarachnoid hemorrhage. Minor head trauma, without loss of consciousness or abnormal findings on radiological imaging, is unlikely to cause cranial nerve palsy. Therefore, isolated oculomotor nerve palsy in minor head trauma without an initial loss of consciousness or radiological abnormalities on CT scans is extremely rare. Therefore, an isolated oculomotor nerve palsy that occurs after minor head trauma should raise concerns about an underlying lesion that could be compressing, stretching, or infiltrating the oculomotor nerve, predisposing it to dysfunction following an otherwise inconsequential...
injury. Previous studies have reported that oculomotor nerve palsy after minor head trauma is the presenting sign of cerebral aneurysmal compression or uncal herniation due to intracranial tumor in some patients. In addition to aneurysms and tumors, other causes of isolated oculomotor nerve palsy include microvascular ischemia, infection, and inflammation. Here, we report a rare case of delayed and isolated oculomotor nerve palsy after minor head trauma, and describe its mechanism and treatment.

CASE REPORT

A 19-year-old boy with an unremarkable medical history suffered a bruise to his occiput during a game of rugby. He did not lose consciousness and continued playing. Next day, he visited the Department of Neurosurgery complaining of headache. The neurological exam and CT was normal [Figure 1]. However, he had noticed drooping of his left eyelid and double vision with onset on the second day; subsequent examination revealed an isolated left oculomotor nerve palsy with a nonreactive pupil [Figures 2-4]. No raccoon eye, Battle’s sign, rhinorrhea, otorrhea, or other abnormalities were noted in the neurological exam. CT, magnetic resonance imaging (MRI), and MR angiography showed no abnormal findings [Figure 1]. Oral betamethasone was prescribed at a dose of 8 mg per day for 1 week. Repeat MRI and MRA 1 week later also showed no abnormal findings. Over the next 3 months, the ptosis and ocular motility resolved fully, however, the left pupil was still larger and less reactive to light than the right [Figures 2 and 3].

DISCUSSION

Oculomotor nerve palsy may be caused by damage to the nerve at any point along its path between the oculomotor nucleus in the midbrain and the extraocular muscles within the orbit. There are reports of injury to the oculomotor nerve at its exit from the brainstem, from the superior orbital fissure, and at the tentorial shelf after herniation. These reported third nerve injuries were all caused by severe head trauma. In the present case, repeated CT and MRI did not reveal any subtle findings, including hemorrhage at the midbrain exit site of the oculomotor nerve or bending of the ipsilateral oculomotor nerve at the posterior petroclinoid ligament, which have been reported to cause isolated third nerve palsy. In addition, absence of other associated signs and symptoms, such as hemiparesis and other cranial nerve palsies, indicated that the damage might not have occurred in the midbrain, cavernous sinus, or superior orbital fissure.

It has been suggested that traumatic oculomotor nerve injury with minor head trauma occurs because of differential movements between the brainstem and supratentorial structures, which can stretch the nerve and cause distal fascicular damage. This mechanism for direct oculomotor nerve injury is strongly related to the anatomy of this nerve. The oculomotor nerve pierces the dura of the cavernous sinus through the oculomotor triangle, consisting of the anterior and posterior clinoid processes and the petrous apex. The medial margin of this triangle is formed by the interclinoid ligament, which extends from the anterior to the posterior clinoid process. The lateral margin is formed by the anterior petroclinoid ligament, which extends from the anterior to the posterior clinoid process to the petrous apex, whereas the posterior margin is formed by the posterior petroclinoid ligament, which extends from the posterior clinoid process to the petrous apex. The oculomotor nerve runs over the tough posterior...
petroclinoid ligament. Direct oculomotor nerve injury with minor head trauma may occur at this point, as the brainstem moves downward at the time of injury, the nerve then becomes swollen, and ischemia could be caused by dural constriction at the point where the nerve pierces the dura of the cavernous sinus.\[10,16\] This could explain why the symptoms appeared a day after head trauma in this case.

Isolated third nerve palsy without any other symptoms such as loss of consciousness or radiological abnormalities is exceptionally rare, this being the 6\textsuperscript{th} case reported in the literature [\textbf{Table 1}].\[2,10,15,17,19\] Regarding the treatment of third nerve palsy with head injury, only two of the 6 reported cases were treated with steroids. Although the site of injury to the third nerve was not clearly demonstrated, the suggested mechanism described above is supported by the effectiveness of steroid treatment for third nerve injury with minor head trauma, similar to the treatment rationale in patients with delayed facial nerve palsy. The facial canal is at its narrowest in the labyrinthine segment; therefore, any swelling of the facial nerve would cause compression, and the meager blood supply would add to the damage. Hence, steroid therapy has been proposed to help alleviate delayed facial palsy.\[6,7,14\]

Prism therapy and strabismus surgery may be helpful in patients with oculomotor nerve palsy. However, indications for these treatments and their effectiveness are limited. Until now, there is no satisfactory surgical treatment for patients with complete oculomotor nerve palsy.

\section*{CONCLUSION}

We report that minor head trauma can cause isolated oculomotor nerve palsy in the absence of loss of consciousness and abnormalities on brain CT, MRI, and MRA. The mechanism underlying oculomotor nerve injury following minor head trauma is still unclear, although injury at the posterior petroclinoid ligament is suggested. Steroid therapy may possibly be effective for functional recovery.

\section*{Financial support and sponsorship}

Nil.

\section*{Conflicts of interest}

There are no conflicts of interest.

\section*{REFERENCES}

1. Balcer LJ, Galetta SL, Bagley LJ, Pakola SJ. Localization of traumatic oculomotor nerve palsy to the midbrain exit site by magnetic resonance imaging. Am J Ophthalmol 1996;122:437-9.
2. Chen CC, Pai YM, Wang RF, Wang TL, Chong CF. Isolated oculomotor nerve palsy from minor head trauma. Br J Sports Med 2005;39:e34.
3. Coello AF, Canals AG, Gonzalez JM, Martin JJA. Cranial nerve injury after minor head trauma. J Neurosurg 2010;113:547-55.
4. Dhaliwal A, West AL, Trobe JD, Musch DC. Third, fourth, and sixth cranial nerve palsies following closed head injury. J Neuroophthalmol 2006;26:4-10.
5. Eyster EF, Hoyt WF, Wilson CB. Oculomotor palsy from minor head trauma. An initial sign of basal intracranial tumor. JAMA 1972;220:1083-6.
6. Grant G, Rostomily RR, Kim DK, Mayberg MR, Farrell D, Avellino A, et al. Delayed facial palsy after resection of vestibular schwannoma. J Neurosurg 2002;97:93-6.
7. Guthikonda B, Pensak ML, Theodosopoulos PV. Delayed facial palsy after the anterior petrosal approach: Case report and review of the literature. Neurosurgery 2010;66:EB45-6.
8. Heinze J. Cranial nerve avulsion and other neural injuries in road accidents. Med J Aust 1969;2:1246-9.
9. Jacobson DM, Warner JJ, Choucair AK, Ptacek LJ. Trochlear nerve palsy following minor head trauma. A sign of structural disorder. J Clin Neuroophthalmol 1988;8:263-8.
10. Kaido T, Tanaka Y, Kanemoto Y, Katsuragi Y, Okura H. Traumatic oculomotor nerve palsy. J Clin Neurosci 2006;13:849-52.
11. Keefe WP, Rucker CW, Kernohan JW. Pathogenesis of paralysis of the third cranial nerve. Arch Ophthalmol 1960;63:585-92.
12. Kuo LT, Huang APH, Yang CC, Tsai SY, Tu YK, Huang SJ. Clinical outcome of mild head injury with isolated oculomotor nerve palsy. J Neurotrauma 2010;27:1959-64.
13. Levy RL, Geist CE, Miller NR. Isolated oculomotor palsy following minor head trauma. Neurology 2005;65:169.
14. Morton RP, Ackerman PD, Pisansky MT, Krezalek M, Leonetti JP, Raffin MJM, et al. Prognostic factors for the incidence and recovery of delayed facial nerve palsy after vestibular schwannoma resection. J Neurosurg 2011;114:375-80.
15. Muthu P, Pritty P. Mild head injury with isolated third nerve palsy. Emerg Med J 2001;18:310-1.
16. Nagaseki Y, Shimizu T, Kakizawa T, Fukamachi A, Nukui H. Primary internal ophthalmoplegia due to head injury. Acta Neurochir 1989;97:117-22.
17. Najafi MR, Mehrbod N. Isolated third nerve palsy from mild closed head trauma. Arch Iran Med 2012;15:583-4.
18. Neetens A, Van Aerde F. Extra-ocular muscle palsy from minor head trauma. Initial sign of intracranial tumour. Bull Soc Belge Ophthalmol 1981;193:161-7.
19. Takeuchi S, Takasato Y, Masaoka H, Hayakawa T, Otani N, Yoshino Y, et al. Isolated traumatic oculomotor nerve palsy caused by minor head trauma. Brain Nerve 2008;60:555-8.
20. Tiffin P, MacEwen CJ, Craig E, Clayton G. Acquired palsy of the oculomotor, trochlear and abducens nerves. Eye 1996;10(Pt 3):377-84.
21. Walter KA, Newman NJ, Lessell S. Oculomotor palsy from minor head trauma: Initial sign of intracranial aneurysm. Neurology 1994;44:148-50.