Scale of 15/15. Vision and light reflex in the left eye were lost. Examination of facial nerve revealed facial weakness on the left side. The rest of the cranial nerves were normal. There was no other motor or sensory deficit.

A noncontrast CT study showed a linear hypodense structure extending from the medial aspect of the left orbit to the occipital bone, suggesting a foreign body. This foreign body was hyperdense relative to normal parenchyma. From a CT scan with 3-dimensional reconstruction, the foreign body was found to be passing through the optic canal into the cranium. The clear plastic chopstick was withdrawn without difficulty. The patient was discharged home 3 weeks after his surgery. A treatment plan for a transorbital penetrating injury should be determined by a multidisciplinary team, with input from neurosurgeons and ophthalmologists.

Key Words : Penetrating · Foreign body · Orbit · Craniocerebral trauma.

INTRODUCTION

Transorbital penetrating intracranial injury makes up only a small percentage of all head injuries. However, such injury accounts for nearly one-quarter of penetrating head injury cases in adults, and one-half of the cases in children. The diagnosis is straightforward when the absence or presence of the foreign body fragment in the wound is confirmed. Yet, diagnosis based on an incomplete history and trivial trauma is difficult and thus, the penetrating injury may be overlooked. Furthermore, patients may not exhibit immediate neurological deficits. Serious events may occur several days, months, or even years after the injury. We treated a man with orbitocranial penetrating injury caused by a chopstick.

CASE REPORT

While heavily intoxicated, a 38-year-old man fell down from a chair with a chopstick in his hand. He noticed pain, swelling, and numbness around his left eye. On physical examination, a linear wound was noted at the medial aspect of the left eyelid. On contrast computed tomography (CT) study showed a linear hypodense structure extending from the medial aspect of the left orbit to the occipital bone, suggesting a foreign body. This foreign body was hyperdense relative to normal parenchyma. From a CT scan with 3-dimensional reconstruction, the foreign body was found to be passing through the optic canal into the cranium. The clear plastic chopstick was withdrawn without difficulty. The patient was discharged home 3 weeks after his surgery. A treatment plan for a transorbital penetrating injury should be determined by a multidisciplinary team, with input from neurosurgeons and ophthalmologists.

Key Words : Penetrating · Foreign body · Orbit · Craniocerebral trauma.
Transorbital penetrating brain injury by a foreign body is relatively rare. The orbit, which has the shape of a horizontal pyramid on a posteromedially directed axis, tends to deflect objects toward the apex, where the superior orbital fissure or the optic canal may provide passage intracranially\(^1\). However, of the two major routes by which foreign bodies penetrate intracranially\(^2\), the most frequent is via the orbital roof, due to the fragility of the superior orbital plate of the frontal bone. Such penetration often leads to frontal lobe contusion. The second most frequent site of penetration is the superior orbital fissure, through which foreign bodies occasionally reach the brain stem through the cavernous sinus, resulting in a serious injury. A third, rarer avenue of penetration is the optic canal, where the object is directed into the suprasellar cistern, close to the optic nerve and ICA\(^3\).

Complete physical examination, including full neurological and ophthalmological examinations, is important in the diagnosis and appropriate treatment of any patient diagnosed with penetrating orbital trauma. All patients, regardless of age, with obvious ocular or palpebral injury should undergo full examination to rule out penetrating intracranial injury\(^4\). Intracranial trauma cannot be excluded by a benign external appearance\(^5\) or by an intact globe\(^6\).

Noncontrast CT scanning is the key imaging modality used when intracranial injury is suspected in an orbital trauma in order to determine the course of the object and the extent of bone and parenchymal injury\(^1,8,12,24\). MR imaging of the brain is useful in cases of wooden foreign body injury, since dry wood has a similar density to air and hydrated wood has a similar density to the soft tissue on a CT scan, making diagnosis potentially difficult\(^6,23\). Cerebral angiography, or other less invasive modalities including CT angiography or MR angiography, is indicated when there is evidence of possible vascular injury, either by the location and trajectory of the foreign body or by evidence of hemotoma on CT scanning\(^7,23\). If there is suspicion for vascular injury, angiography should also be performed to evaluate for traumatic aneurysm, which can develop soon after a perforating injury\(^8\).

Immediate complications include intracerebral hematoma, cerebral contusion, intraventricular hemorrhage, pneumocephalus, brain stem injury, and cerebrovascular injuries\(^9,13,22\). If the foreign body is retained in the orbit and cranium, severe infectious complications may occur later\(^10\). When a patient develops a...
Fig. 4. A : Axial T2-weighted MR image shows a hyperintense linear lesion injury from a chopstick. B : CISS image revealed that left facial nerve was not injured. MR : magnetic resonance, CISS : constructive Interference in Steady State.

cerebral abscess postoperatively, a retained foreign body should be ruled out. Early radical debridement and removal of the retained fragment are mandatory to prevent potentially fatal infectious complications. Depending on the location of the fragment, a transorbital or transcranial approach can be selected. Postoperative intensive antibiotic treatment should be administered to prevent late infectious events.

CONCLUSION

Transorbital penetrating intracranial injuries are uncommon and therefore, the management of such injuries is often complex. However, since neuroimaging examinations, including CT and MR imaging, are widely available and early diagnosis is also possible, early surgical exploration will most likely result in success. A treatment plan for transorbital penetrating injury should be determined by a multidisciplinary team, with input from neurosurgeons, otolaryngologists, and ophthalmologists.

References

1. Carothers A : Orbitofacial wounds and cerebral artery injuries caused by umbrella tips. JAMA 239: 1151-1152, 1978
2. Chibbaro S, Tacconi L : Orbito-cranial injuries caused by penetrating umbrella tips. Acta Neurochir (Wien) 148: 937-941; discussion 941-942, 2006
3. De Villiers JC, Sevel D : Intracranial complications of transorbital stab wounds. Br J Ophthalmol 59: 52-56, 1975
4. Di Roio C, Jourdan C, Mottolese C, Convert J, Artru F : Cranio-cerebral injury resulting from transorbital stick penetration in children. Childs Nerv Syst 16: 503-506; discussion 507, 2000
5. du Trevou MD, van Dellen JR : Penetrating stab wounds to the brain : the timing of angiography in patients presenting with the weapon already removed. Neurosurgery 31: 905-911; discussion 911-912, 1992
6. Dunn II, Kim DH, Rubin PA, Blinder R, Gates J, Golby AJ : Orbitocerebral wooden foreign body : a pre-, intra-, and postoperative chronicle : case report. Neurosurgery 65 : E383-E384; discussion E384, 2009
7. Eidsness R, Coupal DJ, Kelly ME, Hattingh S : Traumatic orbital injury. J Trauma 62 : 1286-1287, 2007
8. Fezza J, Wesley R : The importance of CT scans in planning the removal of orbital-frontal lobe foreign bodies. Ophthal Plast Reconstr Surg 15 : 356-368, 1999
9. Fujimoto S, Onuma T, Amagasa M, Okudaira Y : [Three cases of an intracranial wooden foreign body]. No Shinkei Geka 15 : 751-756, 1987
10. Ginsberg LE, Williams DW 3rd, Mathews VP : CT in penetrating cranio-cervical injury by wooden foreign bodies : reminder of a pitfall. AJNR Am J Neuroradiol 14 : 892-895, 1993
11. Hansen JE, Gudeman SK, Holgate RC, Saunders RA : Penetrating intracranial wooden wounds : clinical limitations of computerized tomography. J Neurosurg 68 : 752-756, 1988
12. Kahler RJ, Tomlinson FH, Eisen DP, Masel JP : Orbitocranial penetration by a fern : case report. Neurosurgery 42 : 1370-1373, 1998
13. Kasamo S, Asakura T, Kusumoto K, Nakayama M, Kadota K, Atsushi M, et al. : [Transorbital penetrating brain injury]. No Shinkei Geka 20 : 433-438, 1992
14. Kazarian EL, Stokes NA, Flynn JF : The orbital puncture wound : intracranial complications of a retained foreign body. J Pediatr Ophthalmol Strabismus 17 : 247-250, 1980
15. Kitakami A, Kirikae M, Kuroda K, Ogaeva A : Transorbital-transpetrosal penetrating cerebellar injury--case report. Neurol Med Chir (Tokyo) 39 : 150-152, 1999
16. Knerlich F, Verheggen R : Neurological picture. Feeding cats might be dangerous : penetrating orbital and brain injury without neurological deficits. J Neurol Neurosurg Psychiatry 76 : 1359, 2005
17. Lunetta P, Obherr A, Sajanilla A : Suicide by intracerebellar ballpoint pen. Am J Forensic Med Pathol 23 : 334-337, 2002
18. Maruya J, Yamamoto K, Wakai M, Kaneko U : Brain abscess following transorbital penetrating injury due to bamboo fragments--case report. Neurol Med Chir (Tokyo) 42 : 143-146, 2002
19. Matsumoto S, Hasuo K, Mizushima A, Mihara F, Fukui M, Shirozu T, et al. : Intracranial penetrating injuries via the optic canal. AJNR Am J Neuroradiol 19 : 1163-1165, 1998
20. Miller CF, Brodkey JS, Colombe BJ : The danger of intracranial wood. Surg Neurol 79 : 95-103, 1977
21. Reddy HS, Chang E : Images in clinical medicine. Penetrating orbital trauma. N Engl J Med 358 : e3, 2008
22. Smely C, Orszagh M : Intracranial transorbital injury by a wooden foreign body : re-evaluation of CT and MRI findings. Br J Neurosurg 13 : 206-211, 1999
23. Turbin RE, Maxwell DN, Langer PD, Frohman LP, Hubbi B, Wolansky L, et al. : Patterns of transorbital intracranial injury : a review and comparison of occult and non-occult cases. Surg Ophthalmol 51 : 449-460, 2006
24. Wald MS, Yelverton JC, Robinson JS Jr : Penetrating orbital trauma with internal carotid injury. South Med J 102 : 116-117, 2009
25. Wesley RE, Anderson SR, Weiss MR, Smith HP : Management of orbito-cranial trauma. Adv Ophthalmic Plast Reconstr Surg 7 : 3-26, 1987
26. Zentner J, Hassler W, Petersen D : A wooden foreign body penetrating the superior orbital fissure. Neurochirurgia (Stuttg) 34 : 188-190, 1991