

CASE REPORT

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Transorbital penetrating head injury by a wooden chopstick in the cavernous sinus: a case report and literature review

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ABSTRACT

Penetrating head injury is a relatively rare condition associated with high morbidity and mortality. Although the immediate treatment of penetrating head injury is needed, surgical strategies are varied based on the trajectory of the penetrating objects in the cranium. We present a case of 24-year-old man who sustained a transorbital penetrating injury caused by a wooden chopstick. Neuroimages revealed a linear lesion extending from the left intraorbital segment to the cavernous sinus passing through the superior orbital fissure. The foreign body was successfully removed via the transcranial approach without complications. A careful management based on the perioperative images and correct diagnosis is necessary to avoid unfavorable complications. Four cases of transorbital penetrating injuries have been previously reported, in which the foreign body penetrated through the superior orbital fissure and lodged in the cavernous sinus. The frontotemporal craniotomy with extradural approach can be a useful option to remove foreign bodies around the cavernous sinus regions.

Keywords: superior orbital fissure, cavernous sinus, wooden foreign body

Abbreviations:

PHI: penetrating head injury

SOF: superior orbital fissure

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INTRODUCTION

Penetrating head injury (PHI) is a relatively rare condition accounting for 0.4% of all head trauma.¹ Particularly, transorbital penetrating injuries represent 24% of PHIs in adults and 45% of PHIs in children.² Although early surgical treatment for the transorbital penetrating injury is critical due to the high rates of cerebral complications, surgical approaches are varied based on the location of the fragment in the cranium, to expose and remove foreign bodies safely.³ Four cases of transorbital penetrating injuries have been previously reported where the foreign body had

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penetrated through superior orbital fissure (SOF) and lodged in cavernous sinus.^{1,4-6} Herein, we present a case of transorbital penetrating injury that was successfully treated via frontotemporal craniotomy along with a literature review.

CASE REPORT

Case description

A 24-year-old man was struck at his left eye with a wooden chopstick and was transferred to our emergency department three hours after the assault with complain of headache, vomiting and bleeding from the wound. A linear wound about 5 mm in length was observed at the medial aspect of the left lower eyelid (Fig. 1A) during physical examination. The shaft of the chopstick had broken and was not visible outside. His eyelid was swollen and he could not open his left eye. Ocular examination showed the pupil of his left eye was fixed and dilated 4 mm without reaction to light. Although the injured eye had limited movements in all directions, visual acuity was preserved at least counting fingers and the anterior ocular segment, optic media, and eyeground were not damaged by intraocular examination. No other serious neurological deficit was noted.

Computed tomography revealed a linear hypodense lesion extending from the left intraorbital segment to the left cavernous sinus passing through the SOF, which suggested the foreign body. Although a medial orbital wall fracture and intraorbital hemorrhage were evident, there was no subarachnoid hemorrhage or brain contusion (Fig. 1B). Magnetic resonance imaging showed the foreign body as a linear signal void subject in T1 and T2 weighted images. The tip of the foreign body ended immediately near the internal carotid artery, but there was no evidence of the carotid artery injury (Fig. 1C, D).

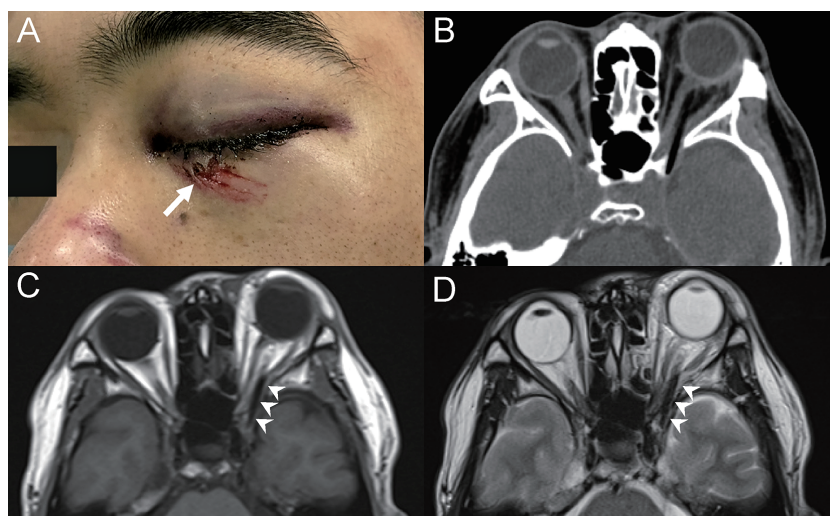


Fig. 1 Clinical photograph and preoperative neuroimages

Fig. 1A: Photograph of the patient shows a minor wound (arrow) at the middle aspect of the left lower eyelid which indicating the entrance to the orbit.

Fig. 1B: Computed tomography show a linear hypodense lesion extending from the left intraorbital segment to the left cavernous sinus passing through the SOF (superior orbital fissure).

Fig. 1C–1D: T1 and T2 weighted magnetic resonance imaging reveal a wooden foreign body as a linear low intensity subject (arrowheads).

Operation

The removal surgery for a wooden foreign body penetrating the cavernous sinus was performed. Under the general anesthesia, a left frontotemporal craniotomy was performed. With the retraction of the frontal lobe, the sphenoid ridge was drilled off epidurally under microscope (Fig. 2A). After the meningo-orbital band was detected, further bone removal of lateral part of the SOF was carried out. Adhesion between the dura and the periorbita was dissected, then a tip of the chopstick was discovered (Fig. 2B). The chopstick was pulled and removed along its trajectory through the cavernous sinus with gentle dissection of the connective tissue around it (Fig. 2C, D). Hemostatic agents were carefully used to achieve hemostasis in the cavernous sinus. After hemostasis was confirmed in the epidural space, the wound was closed in the usual manner without drainage.

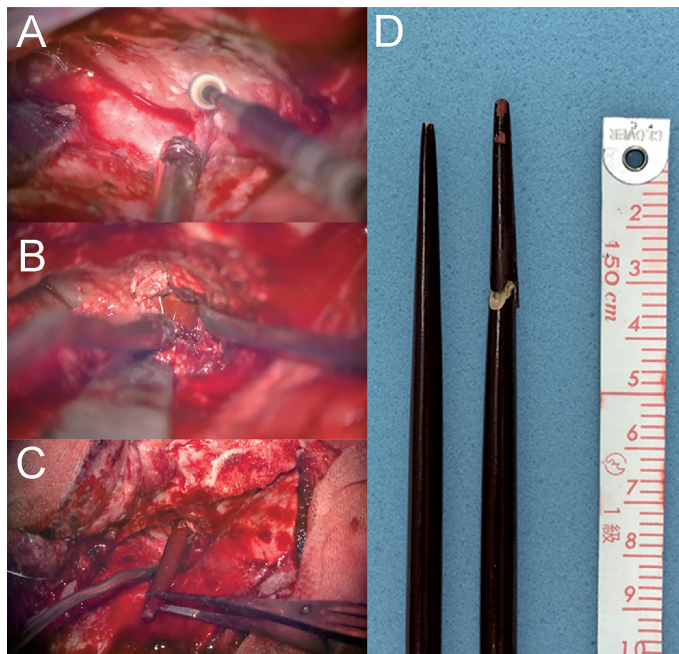


Fig. 2 Intraoperative photographs

- Fig. 2A:** The sphenoid ridge was drilled off epidurally with the retraction of the frontal lobe.
- Fig. 2B:** A tip of the chopstick was identified passing through the SOF (superior orbital fissure).
- Fig. 2C:** The chopstick was pulled and removed along its trajectory through the cavernous sinus.
- Fig. 2D:** A fragment of the wooden chopstick and a fully intact chopstick are shown.

Postoperative course

The patient continued antibiotics. Although the left trochlear nerve palsy had persisted, the dilation of his pupil and visual acuity improved to 1.0. He was discharged on postoperative day 15. Postoperative neuroimages showed no significant abnormal findings (Fig. 3A, B). He was followed up for six months and there were no signs suggesting an infection.

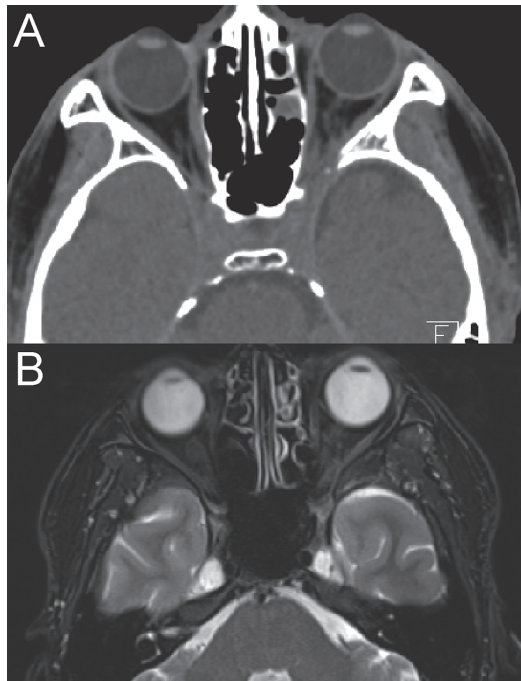


Fig. 3 Postoperative neuroimages

Fig. 3A–3B: Postoperative computed tomography and T2 weighted magnetic resonance imaging show no evidence of the residual foreign body.

DISCUSSION

We report a rare case of transorbital penetrating injury by a wooden chopstick. While determining the presence of fragments in the wound can be challenging, foreign bodies remaining in the cranium can cause serious complications including intracranial hematoma, subarachnoid hemorrhage, brain stem injury and vascular damage.³ Moreover, in case of wooden foreign bodies, the porous organic materials provide a good culture for bacteria and meningitis or brain abscess can easily occur.^{2,7} Herein, immediate treatment of the patient with PHI is needed due to high morbidity and mortality caused by these complications.⁸

The potential risk of brain injury depends on the trajectory of the penetrating objects. In transorbital penetrating injury, there are three major trajectories through which foreign bodies penetrate intracranial region: the superior orbital fissure, optic canal and the orbital roof. As the orbit is uniquely structured like a horizontal pyramid with an apex, penetrating objects are usually directed toward the apex passing through the SOF or optic canal. The orbital roof is also a common trajectory due to the fragility of the superior orbital plate of the frontal bone. In case of penetration through the optic canal or the orbital roof, foreign body can cause optic nerve injury or frontal lobe contusion. However, in case of the SOF, wooden objects are usually directed into the brain stem through the cavernous sinus, which may result in the cavernous sinus and internal carotid artery injuries or brain stem and cerebellar injuries.^{1,3} In the present case, fortunately, there was no evidence of intraaxial damage. Although the oculomotor nerve palsy was evident preoperatively, the symptoms of his pupil and eye movement were improved in the postoperative course as the nerve damage was reversible. His visual acuity was also fully

Table 1 Summary of published transorbital penetrating injury by wooden foreign body lodged in cavernous sinus

Authors (year)	Age	Sex	FB type	Wound	Trajectory	Surgical approach	Outcome
Borkar et al¹ (2014)	10	F	Wooden stick	Medial canthus of the right eye	SOF	Frontotemporal craniotomy with transorbital extraction	Enucleation of the right eye
Parajuli et al⁴ (2015)	14	F	Bamboo	Left lower eyelid	SOF	Frontotemporal craniotomy with transorbital extraction	No light perception ophthalmoplegia
Avraham et al⁵ (2020)	71	M	Wooden stick	Left superior eyelid	SOF	Subtemporal craniotomy	No light perception ophthalmoplegia
Hermann et al⁶ (2021)	37	M	Wooden stick	NA	SOF	Frontotemporal craniotomy	No light perception ophthalmoplegia
Present case	24	M	Wooden chopstick	Left lower eyelid	SOF	Frontotemporal craniotomy	The left trochlear nerve palsy

F: female

FB: foreign body

M: male

NA: not available

SOF: superior orbital fissure

recovered. The preoperative intraocular examination indicated that his transient visual obscuration was caused by the multiple elements including the diplopia, the swelling eyelid and the dilated pupil due to the traumatic event rather than optic neuropathy.

The strategies for removing a foreign body retained in the cranium depend on the location of the fragment. In presented case, neuroimages showed the presence of foreign body extending from the left intraorbital segment to the cavernous sinus ended just along the interdural space of the lateral cavernous sinus wall. In previous reports, transorbital penetrating injuries by foreign body lodged in cavernous sinus were extremely rare (Table 1) and transcranial approach was mainly documented.^{1,4-6} Although transorbital approach is a useful option to remove foreign body as orbitotomy is less invasive and can be accomplished without intracranial manipulation, craniotomy is preferred when intracranial injury is suspected.^{1,5} A frontotemporal craniotomy can provide wide exposure of SOF and cavernous sinus as to allow sufficient microsurgical manipulation to repair dural defects or vessel injury. Moreover, we adopted an extradural approach with a frontotemporal craniotomy as a reasonable alternative approach for removal of the foreign body because this approach could provide wide exposure of the cavernous sinus regions without direct intradural manipulation. Especially in case of a penetrating injury by wooden foreign body with high risk of infection, the procedure could completely achieve extradural manipulation and prevent brain infection.

CONCLUSION

Transorbital penetrating injury caused by a wooden chopstick is rare condition and has a potential risk of severe complications. Although the surgical treatment of PHI is not standardized, the frontotemporal craniotomy with extradural approach is a useful option for the removal of foreign bodies around the cavernous sinus regions.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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