



## Case Report

# Penetrating intraorbital wooden foreign bodies involving the right frontal lobe of the brain: A rare case report

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## ABSTRACT

**Background:** Penetrating orbital trauma from a wooden foreign object is rare and challenging to identify, as it cannot be detected with a computed tomography (CT) scan. This report highlights the clinical presentation, diagnosis, and management of such a case.

**Case Description:** A 19-year-old female experienced penetrating orbital trauma from a wooden object following a traffic accident. She intermittently visited the hospital with eye swelling and headache, without visible penetrating wounds on the palpebra. The swelling persisted for weeks, accompanied by increasing signs of ocular and cerebral infection. The suspicion of a non-metallic foreign body penetrating the brain was confirmed 3 months after the initial visit, delayed by the hidden entry wound between the eyelid and eyeball and orbital edema mimicking non-penetrating trauma. A multidisciplinary team managed the case. Procedures included debridement, retro-orbital exploration, retro-orbital abscess evacuation, and frontal basal trephination exploration, successfully removing the wooden object that had penetrated the medial orbit, frontal bone, and brain, along with cerebral abscess evacuation. Postoperative CT scans showed complete removal of the foreign object and successful abscess evacuation. The patient showed improvement in ocular symptoms, resolution of headaches, and no wound leakage. She was discharged on the 14<sup>th</sup> day after completing antibiotic treatment and having the dressing removed.

**Conclusion:** This case is notable for its rarity, high risk of misdiagnosis, and potentially fatal consequences if not promptly managed. We emphasize the importance of patient involvement in routine consultations, careful anamnesis, clinical examination, and a multidisciplinary approach for optimal outcomes.

**Keywords:** Brain, Computed tomography, Orbita, Penetrating, Wooden foreign body

## INTRODUCTION

Penetrating orbital trauma with breakable objects like wood often results in hidden foreign bodies.<sup>[5]</sup> Intraorbital foreign bodies (IOFBs) are foreign objects located within the orbital cavity, accounting for 16.7% of all orbital trauma cases, and are common in young individuals with high-velocity trauma around the eye.<sup>[1,2]</sup> Compared to metal and glass, wooden IOFBs are more difficult to identify using computed tomography (CT) scan or magnetic resonance imaging (MRI), resulting in a high risk of misdiagnosis or delayed diagnosis for several months post-injury.<sup>[4,6,8]</sup> These objects can penetrate the intracranial cavity, increasing morbidity and mortality if not managed properly.<sup>[6,7]</sup>

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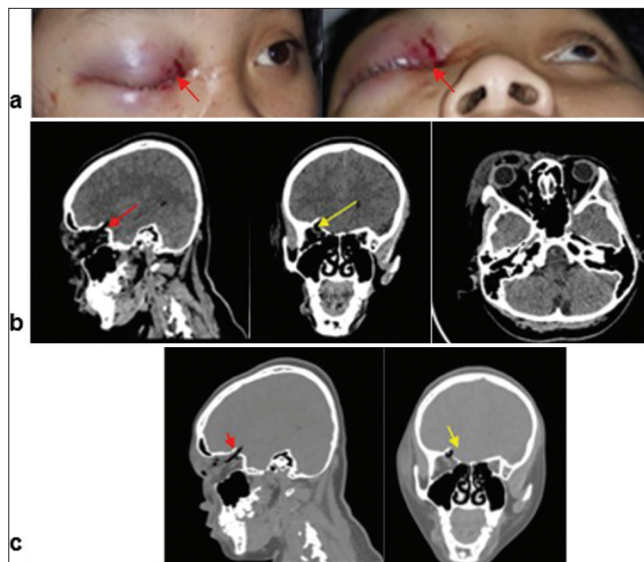
IOFB injuries are emergencies requiring immediate diagnosis and management, often necessitating surgical removal.<sup>[2,6]</sup> However, extracting wooden IOFBs is technically difficult and prone to high failure rates.<sup>[1,5]</sup> We present a rare case of a 19-year-old female who sustained an IOFB injury in the right frontal lobe from a motorcycle accident. The diagnosis was delayed by 3 months due to the difficulty in identifying the wooden IOFB on CT scans and a subtle skin wound (between the palpebra and bulbus oculi). The IOFB was successfully removed through surgical procedures, providing valuable insights for managing similar cases in the future.

## CASE DESCRIPTION

A 19-year-old female presented to the emergency department with complaints of a headache and swelling of the right eyelid. Initially, the patient had been involved in a single motorcycle accident, falling into a bush with many tree branches. The patient did not remember any branches striking her eye, but her right eye was swollen. A primary survey indicated that the patient was stable, with good respiratory, circulatory, and neurological functions and a Glasgow Coma Scale (GCS) score of 15. There were abrasion marks around the right orbital area and limited movement of the right eyeball [Figure 1a]. The patient had a history of fainting, could not remember the incident of falling from the motorcycle, and felt nauseous but did not experience any vomiting.

Overview of brain window and bone window on a head CT scan revealed no intracranial hemorrhage but showed fracture fragments in the superior right orbit extending into the right frontal lobe, along with pneumocephalus [Figures 1b and c]. There was also soft-tissue swelling in the right frontotemporal region and the right periorbital area, pneumoperiorbita, and a linear fracture of the inferior orbital rim. On the 6<sup>th</sup> day after admission, the patient underwent facial bone reconstruction with a miniplate placed on the right inferior orbital rim due to impaired eye movement.

Three months later, the patient visited the hospital with persistent ocular symptoms, early signs of increased intracranial pressure (ICP), and local infection [Figure 2a]. The early signs of ICP observed included persistent headache, nausea, and papilledema detected during ophthalmic examination. The patient had a history of visits to ophthalmology and plastic surgery clinics for postoperative evaluation following facial reconstruction. Physical examination revealed that the general condition was within normal limits, with a GCS score of 15. Recent contrast-enhanced CT scans showed a tubular-shaped lesion in the extraconal space of the right superior orbital cavity extending into the intraparenchymal region of the right frontal lobe

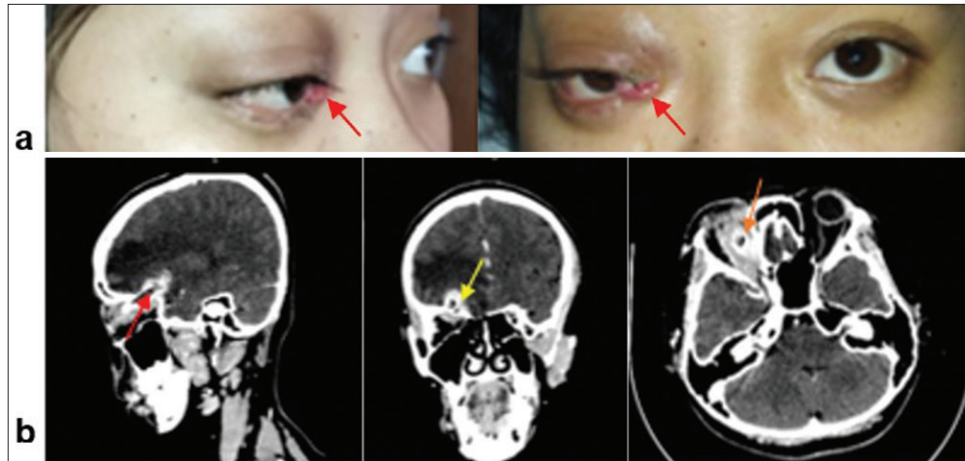


**Figure 1:** Clinical appearance and imaging of the patient at the time of injury. (a) The red arrows indicate the clinical appearance of the patient's eye at the initial visit; (b) Non-contrast CT scan of the brain window at the time of injury. The image shows a fracture of the superior orbital wall and pneumocephalus. There is no evidence of a foreign body at this time. Red and yellow arrows indicate the fracture of the superior orbital wall and pneumocephalus; (c) CT scan with a bone window. Red and yellow arrows indicate the fracture of the superior orbital wall and pneumocephalus.

[Figure 2b]. This condition was associated with extensive vasogenic edema, suspected to be due to infection of the new lesion. The patient also exhibited right orbital proptosis of approximately  $\pm 5$  mm compared to the contralateral side and right frontal sinusitis caused by an abscess retrobulbar of the right orbit [Figure 2a]. Further, evaluation using contrast-enhanced CT with a focus on the skull base indicated the presence of an abscess in the retro-orbital area and a basal frontal brain abscess [Figure 2b]. This was suspected to be due to a non-metallic foreign body, which was challenging to detect with CT scans or MRI.

At the initial evaluation, the low-density linear region in the CT scan from the orbit to the right frontal base was initially suspected to be pneumocephalus due to the patient's orbital fracture and trauma history. However, the shape and the clinical progression raised suspicion of a potential foreign object, even though wooden IOFBs are difficult to detect on imaging. The possibility of a wooden foreign body was not considered in the initial diagnosis due to the lack of visible skin wounds or traumatic entry points in the orbit.

The patient underwent surgery performed by a multidisciplinary team consisting of neurosurgeons, plastic surgeons, and ophthalmologists. The procedure included debridement, retro-orbital exploration, exploratory



**Figure 2:** Clinical appearance and imaging of the patient three months after injury. (a) The red arrows indicate the clinical appearance of the patient's eye prior to the removal of the wooden foreign body (three months after injury); (b) Contrast-enhanced CT scan three months post-injury. The image shows an abscess extending from the retroorbital region to the right basal frontal area through a defect in the superior orbital wall. A suspicion of a foreign body is noted. Red arrow: suspected foreign body; yellow arrow: basal frontal abscess; orange arrow: retroorbital abscess.

trepanation with a subfrontal approach, and abscess evacuation [Figure 3a and b]. During the surgery, a 4 cm wooden foreign body [Figure 3c] was found, which had entered through the medial orbit, perforated the frontal bone, and penetrated the brain, causing brain and ocular abscess infections. The dura tear at the frontal base was repaired using a fat graft to prevent further cerebrospinal fluid leakage. In case of infection, we avoid using artificial grafts.

After debridement, foreign body removal, and a 2-week treatment with antibiotics, including ceftriaxone and metronidazole, we evaluated the patient's ocular [Figure 4a] and headache symptoms, ocular swelling, and contrast-enhanced MRI to assess infection improvement. Postoperative MRI + contrast indicated that there are no signs of tubular lesions in the extraconal space of the right orbit [Figure 4b]. Postoperative clinical evaluation showed improvement in ocular symptoms, no headache, and no signs of wound leakage. The patient was discharged on the 14<sup>th</sup> day after completing antibiotic treatment and removal of the dressings. A home visit was conducted for the patient in the 3<sup>rd</sup> month, revealing that visual function had nearly returned to normal, and no signs of infection were observed on clinical evaluation [Figure 4c].

## DISCUSSION

The presence of a wooden foreign body in the orbit, extending into the intraparenchymal region of the right frontal lobe, is a rare occurrence that can lead to severe injuries to both the orbit and the brain. Thorough anamnesis and clinical examination of the injury are crucial for establishing an

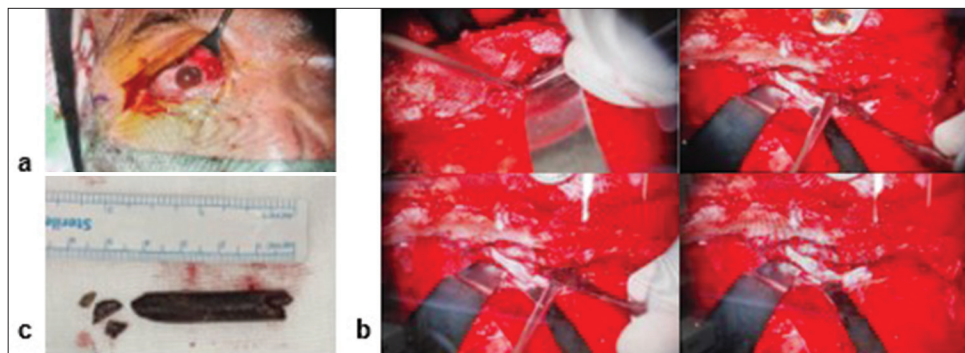
accurate diagnosis and determining appropriate surgical intervention, thereby reducing the rate of reoperation and optimizing patient outcomes.<sup>[6]</sup>

When injury occurs, foreign bodies can either pass through or be embedded in the space between the eyeball and the orbital bone wall.<sup>[1]</sup> This is due to the anatomical structure of the orbit, which is a rectangular pyramid, facilitating the entry of foreign bodies through the superior, inferior, lateral, or medial sides.<sup>[6]</sup> The case we encountered is an unusual example where a 4 cm wooden object entered between the palpebra and the medial wall of the orbit, perforated the frontal bone, and penetrated the brain, leading to abscess infections in both the brain and the eye.

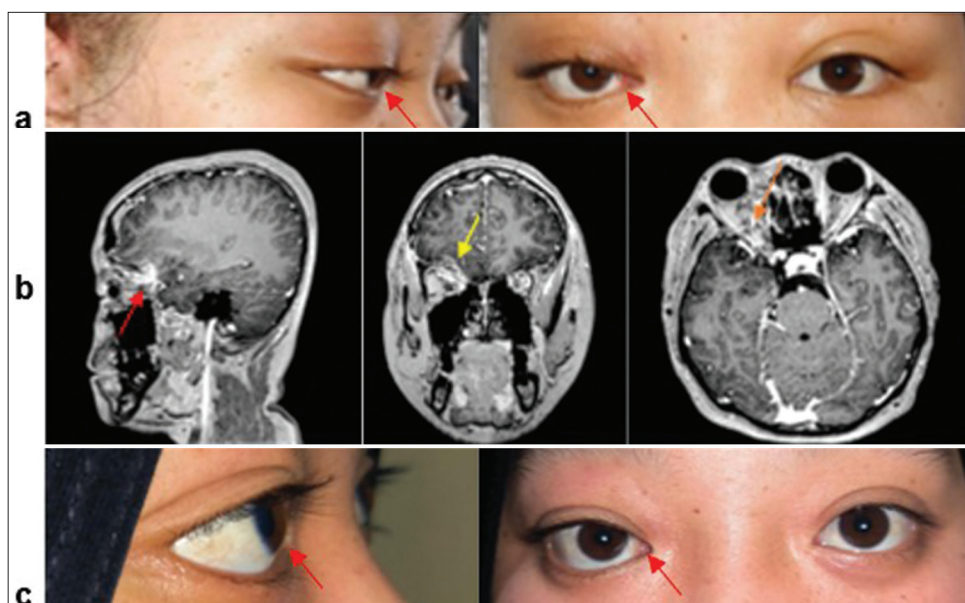
Common clinical manifestations resulting from foreign body penetration include orbital cellulitis, orbital hematoma, proptosis, ptosis, ocular motility disorders, superior orbital fissure syndrome, and orbital apex syndrome.<sup>[1]</sup> In our case, the foreign body caused a fracture in the superior wall of the right orbital cavity, leading to entrapment of the superior rectus muscle and protrusion of fracture fragments into the right frontal lobe. As a result, the movement of the right eyeball is impaired.

In addition to causing orbital damage, a wooden object penetrating the brain without prompt removal can lead to acute inflammatory reactions. The risk of infection with retained wooden foreign bodies can be as high as 64% due to the porous consistency and organic nature of wood, which provides a favorable medium for bacterial growth.<sup>[3]</sup> In our patient, pus culture results were positive for *Klebsiella oxytoca* and *Enterobacter cloacae*. Both





**Figure 3:** Intraoperative images. (a) Exploration of the entry wound of the foreign body inside the palpebral and right eyeball; (b) exploration of the foreign body and abscess evacuation through surgery using a bicoronal subfrontal approach; and (c) view of the wooden foreign body and its fragments, measuring 4–5 cm in length and  $\pm 1$  cm in width.



**Figure 4:** Clinical appearance and imaging of the patient after surgery. (a) The red arrows indicate the clinical appearance of the patient's eye following the removal of the wooden foreign body; (b) MRI two weeks post-surgery and antibiotic treatment. Red arrow: no mass observed; yellow arrow: no basal frontal abscess observed; orange arrow: no retroorbital abscess observed; (c) The red arrows indicate the clinical appearance of the patient's eye three months after the removal of the wooden.

bacteria are part of the *Enterobacteriaceae* family and can cause infections in humans, particularly from wounds or trauma, and are susceptible to the antibiotics ceftriaxone and metronidazole.

In our case, the CT scan played a crucial role in establishing the diagnosis and planning the surgery. CT imaging helps assess the extent of the lesion, localize foreign bodies and bone fragments, detect hematomas, and determine the penetration path.<sup>[6]</sup> However, identifying wooden foreign bodies in the human body presents a significant challenge for surgeons due to their difficult visibility on CT scans. This often results in delayed or missed diagnoses.<sup>[4]</sup> In the acute

phase, wood appears as a low-density material similar to air, making it challenging to identify on initial examination, especially for small wood fragments. In the subacute phase, wood shows intermediate density, similar to orbital fat. In the chronic phase, wood exhibits high density, making it highly visible on CT scans.<sup>[6,8]</sup>

In this case, the initial suspicion of pneumocephalus led to a delayed diagnosis of the wooden foreign body. Wooden foreign bodies are difficult to detect due to their similar density to air in the acute phase, and their appearance can easily be missed on CT scans. Moreover, the lack of visible entry points further complicated the diagnosis. Identifying

wooden foreign bodies requires careful evaluation of clinical symptoms, persistence of symptoms, and consideration of the possibility, even in cases with subtle imaging findings.

In this case, the patient experienced a delayed diagnosis of a penetrating wooden foreign body in the brain for up to 3 months. Suspicion of a foreign body arose following persistent ocular symptoms of proptosis, early signs of ICP, and local infection. CT- and contrast-enhanced MRI focused on the skull base revealed an abscess in the retro-orbital space and a frontal basal brain abscess. These abscesses were suspected to be caused by a non-metallic foreign body that was difficult to detect with CT or MRI. The difficulty in establishing a diagnosis at the initial visit was due to the hidden entry point of the wooden foreign body between the bulbus oculi and conjunctiva (without skin wounds). This condition was accompanied by orbital edema resembling non-penetrating ocular trauma. Active patient engagement through regular consultations was crucial in detecting this case early.

Diagnosis of a wooden foreign body must be promptly followed by appropriate management.<sup>[3]</sup> Wooden foreign bodies are fragile, necessitating careful exploration and thorough removal of necrotic tissue to prevent foreign body residue.<sup>[1,8]</sup> We performed surgery, including debridement, retro-orbital exploration, frontal basal exploratory trepanation, and abscess evacuation. Postoperative MRI showed that there are no signs of tubular lesions in the extraconal space of the right orbit [Figure 4b]. Postoperatively, the patient was treated with ceftriaxone and metronidazole for 2 weeks, antibiotics effective against *K. oxytoca* and *E. cloacae*. These antibiotics have proven effective in treating infections in the eye and brain after surgery.

Three months postoperation, the patient had normal visual function with minimal rightward eye movement deficit. There were no signs of infection, enabling the patient to return to normal activities and work [Figure 4c].

## CONCLUSION

In this report, we present a case and management of penetrating orbital trauma caused by a wooden foreign body that resulted in damage to both the eye and the brain. We encountered significant challenges in establishing the diagnosis, leading to a 3-month delay in diagnosing the penetrating foreign body injury to the brain. In our case, the wooden foreign body was difficult to identify due to the hidden location of the entry wound and orbital edema that resembled non-penetrating ocular trauma. This situation required a careful and thorough anamnesis and clinical examination of the injury. We successfully managed this case through surgical intervention by a multidisciplinary team

comprising neurosurgery, plastic surgery, and ophthalmology specialists. Our findings emphasize the crucial role of patient involvement in regular consultations, careful anamnesis and clinical examination, and the involvement of a multidisciplinary team in establishing the diagnosis and determining appropriate surgical interventions.

## Ethical approval

The Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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