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Case Report

Retained wood penetrating the inferior orbital fissure removed after several months from injury: A case report and a comprehensive literature review

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ABSTRACT

Background: Intraorbital wooden foreign bodies (IOWFBs) constitute a relatively rare ocular trauma. Clinically, it can be difficult to diagnose them due to their wide variety of clinical manifestations. In addition, radiologic diagnosis of IOWFBs is always uncertain and challenging since their low density and low intensity on initial images are identical to air and fat. Therefore, IOWFBs are commonly missed and may not be confirmed for days or months after the initial injury. This article endeavors to contribute to the existing literature on IOWFBs by adding a case of an unusual occurrence of retained wood penetrating the inferior orbital fissure (IOF). To date, there have been no documented instances of a similar occurrence in this particular anatomical location.

Case Description: A 58-year-old female with a history of trauma sustained by a slipping accident 10 months before her referral to our hospital. She underwent multiple surgeries and was referred to us due to persistent right eye pain, periorbital swelling, recurrent eye discharge, and inferior orbital paresthesia. The imaging revealed a retained foreign body located in the right orbital floor inferior to the inferior rectus muscle extending to the sub-temporal fossa through the IOF. The residue was successfully removed without complications.

Conclusion: A history of trauma followed by persistent symptoms should raise the suspicion of a retained foreign body, regardless of the severity of trauma or the time between trauma and clinical presentation. Appropriate and timely imaging, followed by surgical removal, remains the cornerstone of treatment with a favorable prognosis.

Keywords: Computed tomography, Inferior orbital fissure, Intraorbital foreign bodies, Intraorbital wooden foreign bodies, Magnetic resonance imaging

INTRODUCTION

Intraorbital foreign bodies (IOFBs) are foreign bodies located in the orbital cavity behind the orbital septum and eyeball. They can potentially cause damage to the vision and surrounding structures.[35] Moreover, they usually occur after high-velocity trauma to the orbit, such as a gunshot or an industrial accident. On the other hand, a history of relatively minor trauma should not rule them out as a differential diagnosis.[7,36]

The incidence of IOFBs constitutes 16.7% of all orbital injuries.[36] Computed tomography (CT) scan is the first choice to find and locate the IOFBs.[35] Most IOFBs are metallic and can be easily detected and diagnosed on CT scans because they usually exhibit high-density signals. Even those with a length of merely 2 mm can be easily detected.[18,36] However, the diagnosis of IOFBs in other materials, such as wood, can vary significantly.[36]

Intraorbital wooden foreign bodies (IOWFBs) are relatively rare compared to metallic or glass foreign bodies.[36] In CT scans, they present low density or are even invisible, and their appearance can vary with time. This poses challenges to their timely, accurate diagnosis and leads to misdiagnosis or missed diagnosis in many cases.[7,36] A literature review by You *et al*. included 51 patients with IOWFBs, 12 of whom presented 2 months or more after their initial injuries.[36] Failure to recognize IOWFBs can result in catastrophic consequences, including but not limited to severe orbital tissue necrosis, exophthalmos, extraocular muscle damage, visual disturbances, orbital cellulitis, abscess formation, and orbital fistula.[35,36] In addition, IOWFBs are fragile and difficult to remove, which, further, complicates their management completely.[7] The diagnosis and management of retained IOWFBs have rarely been reported in the literature. In this study, we aimed to report the diagnosis and management of this uncommon trauma and present a literature review of similar cases.

CASE PRESENTATION

History and physical examination

A 58-year-old woman known to have diabetes mellitus type II, hypothyroidism, and depression. Ten months earlier, she had fallen on her face after slipping on a small rock in the desert; after that, a wooden stick entered her right orbit. She visited several hospitals and subsequently underwent 2 operations, 2 months apart. The initial surgery was the removal of the small extraorbital part, and the second surgery was an exploration of her right orbit, as she persistently complained of right eye pain, periorbital swelling, recurrent cutaneous fistula, and inferior orbital paresthesia. Nevertheless, she did not experience any issues with her vision. Afterward, she was referred to our hospital for evaluation of a possible retained foreign body within her right orbit.

On physical examination, the right eye was painful, with mild periorbital swelling and lower lid-cheek proliferation with a fistulous tract. There was no active discharge. The unaided visual acuity of both eyes was 20/30, the pupils were equal, round, and responsive to light, and extraocular movement (EOM) was full without restriction.

Investigations

Laboratory studies revealed no findings of inflammation. The orbital CT and magnetic resonance imaging (MRI) scan obtained revealed a liner foreign body in the right orbital floor directly inferior to the inferior rectus muscle, causing displacement of the inferior rectus muscle superiorly. The foreign body was also observed extending into the subtemporal fossa through the inferior orbital fissure (IOF). Moreover, there was a scar tissue formation along the anterior intraorbital segment of the foreign body. No evidence of globe injury was noted [Figure 1].

Management

Right zygomatic osteoplasty was performed under general anesthesia in a supine position. A curvilinear skin incision was made, starting at the level of the zygomatic root and curving toward the midline. An interfascial dissection of the temporalis muscle was carried out. The zygomatic bone was exposed, and the zygomatic osteotomy was completed using a reciprocating saw. The IOF was exposed, and the foreign body came into view [Figure 2]. The foreign body was carefully dissected and gently pulled out of the IOF. Hemostasis was achieved. The zygoma was fixed with plates and screws, and the closure was done in layers [Video 1]. Postoperative recovery was uneventful, and the patient was discharged 4 days after surgery. Her eye examination remained stable, with no changes. The wood specimen was sent intraoperatively, tested positive for *Staphylococcus epidermidis*, and was reviewed by an infectious disease specialist. Thus, the patient was generally healthy, and her eye examination revealed only mild swelling with no apparent signs of inflammation, and no signs of infection were found through biochemical testing. Antibiotics were not recommended, and the patient was discharged with a 2-week follow-up.

DISCUSSION

This was a case report of a retained IOWFB that was successfully removed surgically. In addition, a literature review was conducted, and it included 37 similar cases.

Sex and age

Of the 37 patients that were included in the literature review, IOWFB injuries were most common in males, making up 27 out of the 37 cases. The age group most impacted was the teenage and young adult demographic. In comparison, only ten out of 37 cases occurred in females, particularly middle-aged females [Table 1].

Site and causes of injuries

The site of the penetrating insult to the eyes was variable. However, according to the literature, the eyelid was the most common penetrating site of injury. Regarding the most

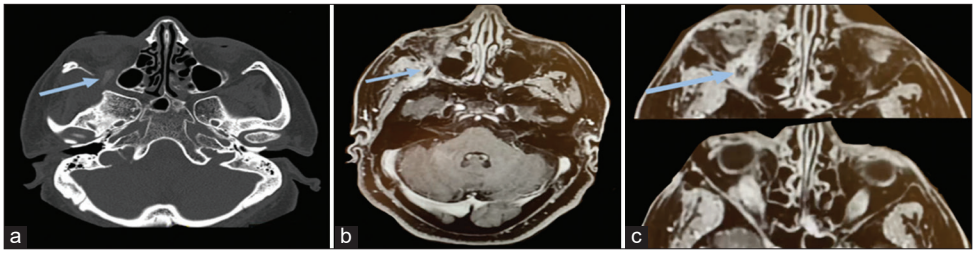


Figure 1: (a) Axial computed tomography scan showing liner hyperdense foreign body (blue arrow) in the right orbital floor and right periorbital soft-tissue swelling was noted consistent with the site of injury. (b and c) Axial view of a contrasted magnetic reasoning imaging T1-weighted image redemonstrating a hypointense linear foreign body (blue arrow) in the right orbital floor inferior to the inferior rectus muscle. It appears to be protruding into the sub-temporal fossa through the inferior orbital fissure.

Figure 2: (a) A preoperative image showing right lower lid hyperpigmented proliferation with a fistulous tract. (b) A photograph showing the intraorbital wooden foreign body measuring 3.5 cm removed from the inferior orbital fissure. (c) Intraoperative view during the removal of the intraorbital wooden foreign body.

common etiology, falls were the commonest, with stabs being a close second [Table 1].

Clinical features

There are a plethora of symptoms a patient can present with, including conjunctival chemosis and congestion, periorbital swelling and redness, ptosis, proptosis, and so forth.[5] However, according to the literature, the most prominent clinical feature patients presented with was EOM restriction. Roughly half of the patients described in the literature presented with EOM restrictions. Visual impairment was a close second in terms of commonality of occurrence in 12 out of 37 patients. The development of an abscess due to the IOFB was considered a rare occurrence. Only two out of 37 patients developed an abscess. Epistaxis was also a seldom-seen symptom, with only one patient presenting with it [Table 1].

Diagnosis

Imaging studies are very helpful in the diagnosis of IOFBs since the patients present with very unspecific clinical manifestations. CT is the gold standard for the diagnosis of IOWFBs. However, even though it is considered the gold standard, it was not very accurate in detecting those wooden foreign bodies and can be missed in the initial CTs, which is consistent with the results of other studies like You *et al*. The appearance and characteristics of IOWFB in the CT can vary depending on the time of the presentation relative to the time of injury. Studies showed in acute stages, wood, which appears as a low-density, similar to air increases the difficulty of accurate detection and diagnosis. As time progresses, wood adopts a moderate density similar to orbital fat in subacute stages and a high-density appearance in chronic stages, which eases the diagnosis.[36] This change of density on the CT relative to the time of injury can explain the delayed presentation and diagnosis of patients with IOWFB.

Furthermore, MRI was found to be slightly more specific in IOWFB diagnosis, especially in detecting small pieces of wood, compared to CT scans. The wood appeared to have lower intensity relative to intraorbital fat on all MRI scans, particularly in T1-weighted images. The T1-weighted images demonstrate a better distinction between wood and the surrounding fatty tissue, where fatty tissue appears brighter compared to other sequences, which makes the diagnosis and detection of this foreign object easier. More than half of the patients who underwent MRI were successfully diagnosed with IOWFB, which emphasizes the importance of undergoing MRI when there is great clinical suspicion, even if the CT failed in the diagnosis.[36] Other imaging modalities like ultrasound can be used for the diagnosis, but it is not often used due to limitations in the visibility of the wooden foreign bodies.[26] Since X-ray

Table 1: Synopsis of the included cases from the literature review.

Author/year	Sex/age in years	Cause/time since the injury	Site of orbital entry in the injury	Clinical presentation/ duration of the symptoms	Previous surgeries	Radiological modalities	Used Modality that successfully identified the foreign body	Surgical management/ patient outcome	Follow- up period/ recurrence
Kim *et al.*/2018	M/56	Fall/2 months	Superomedial	Subconjunctival hemorrhage, chemosis, and restricted EOM/NM	0	CT	CT	Yes/improved	1 year/No
Tayebi Meybodi *et al.*/2020	F/7	Fall/After a few weeks	Orbital roof	Headache/NM	NM	CT and MRI	MRI	Yes/Improved	NM/NM
Gupta *et al.*/2014	M/25	Fall/14 days	Retro-bulbar fat and muscle cone	Swelling, fever, and restricted EOM/14 days	NM	CT and MRI	CT and MRI	Yes/Improved	3 months/ No
Pandit *et al.*/2022	M/33	Fall/8 months	Medial	Swelling and excessive tearing/2 weeks	NM	X-ray and CT	CT	Yes/Improved	7 days/No
Van der Wal and Boukes/2000	M/14	Fight/2 months	Lateral	Painless soft mass/2 months	NM	CT	CT	NM/Improved	NM/NM
Bhuyan and Ghuge/2020	M/20	MVA/10-12 days	Superior	Proptosis, chemosis, restricted EOM, and absent perception of light with non-reactive pupil/ NM	NM	X-ray, CT, and MRI	None	NM/Did not improve	15 days/No
Banerjee *et al.*/2003	M/23	Stab/6 months	Superomedial	Throbbing pain, swelling, discharge/2 months	NM	X-ray and CT scan	NM	NM/NM	NM/No
Yang/2006	M/6	NM/45 days	Above the superior rectus muscle	Proptosis, pain, and decreased vision/2 weeks	0	X-ray and CT	CT	No/NM	NM/NM
John *et al.*/2008	M/19	Fall/18 months	Infraorbital	Proptosis and restricted EOM/NM	NM	CT	None	NM/Improved	1 year/No
Yadav *et al.*/2015	M/17	MVA/2 years	Supraorbital	Ptosis, restricted EOM and decreased vision/A few months	0	X-ray and CT	CT	Yes/Improved	1 month/ No
Fernández-Montalvo/2018	M/28	MVA/2 years	NM	Eye redness, increased intraocular pressure, and restricted EOM/NM	0	CT and MRI	None	Yes/Improved	1 year/No

(*Contd...*)

Table 1: (*Continued*).

Author/year	Sex/age in years	Cause/time since the injury	Site of orbital entry in the injury	Clinical presentation/ duration of the symptoms	Previous surgeries	Radiological modalities	Used Modality that successfully identified the foreign body	Surgical management/ patient outcome	Follow- up period/ recurrence
Liu/2010	F/35	Fall/15 weeks	Medial	Restricted EOM, decreased vision, and conjunctival granuloma/15 weeks	1	US and CT	None	Yes/Improved	2 years/No
	M/29	Stab/20 weeks	Lateral	Restricted EOM, decreased vision, and thick discharge/Several days	1	CT	CT	Yes/Did not improve	NM/No
	F/14	MVA/10 days	Medial	Edema, eye redness, ptosis, and cystic lesion/2 days	1	CT	None	Yes/Improved	8 months/ No
Liaboe *et al.*/2020	M/6	Stab/10 months	Medial	Ptosis, vision loss, restricted EOM, and sluggish pupil/3 months	0	CT and MRI	CT and MRI	Yes/Improved	7 weeks/No
Bayramoğlu *et al.*/2018	M/35	Blunt force trauma/10 days	Supraorbital	Pain/NM	NM	CT	CT	Yes/Improved	6 months/ No
Singh *et al.*/2018	M/48	Blunt force trauma/18 months	Center of the upper lid	Discharge, itchiness, and excoriation of the skin/18 months	NM	CT and MRI	MRI	Yes/Improved	6 months/ No
Rastogi *et al.*/2021	F/35	NM/3 years	NM	Pain and restricted EOM/1 year	1	CT and MRI	MRI	Yes/Improved	NM/NM
Akgüner *et al.*/1998	M/43	Self-inflicted/6 months	Medial canthal region	Ptosis, purulent discharge, and restricted EOM/NM	NM	MRI	MRI	Yes/NM	NM/No
Yoshii *et al.*/2004	F/70	Stab/2 months	NM	Pain, decreased vision, conjunctival hyperemia, retinal tear, and restricted EOM/1 month	NM	X-ray, US, CT, and MRI	MRI	Yes/Improved	4 weeks/No
Oki *et al.*/2022	F/43	Fall/4 months	Lateral	Proptosis, swelling, ocular motility disorder, iritis, conjunctivitis, and restricted EOM/NM	0	CT and MRI	None	NM/Improved	2 months/ No

(*Contd...*)

Table 1: (*Continued*).

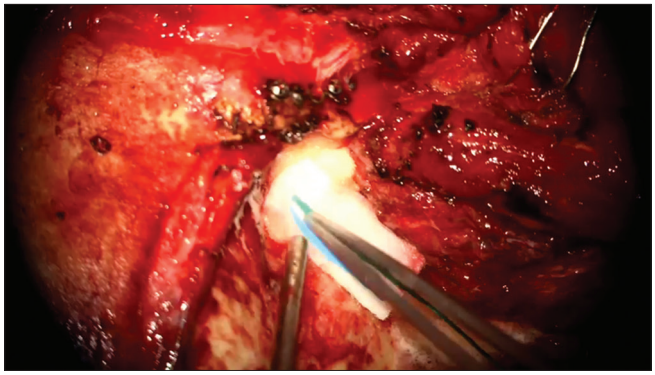
Author/year	Sex/age in years	Cause/time since the injury	Site of orbital entry in the injury	Clinical presentation/ duration of the symptoms	Previous surgeries	Radiological modalities	Used Modality that successfully identified the foreign body	Surgical management/ patient outcome	Follow- up period/ recurrence
Owji *et al.*/2011	M/2	Fall/2 years	Upper eyelid	Decreased vision, swelling, proptosis, restricted EOM, and swelling/months	0	CT	CT	Yes/Improved	NM/No
Wu *et al.*/2022	M/52	Fall/4 months	Upper eyelid and extended into the left orbit.	Pus discharge/6 years	1	CT and MRI	CT	Yes/NM	NM/NM
Singh *et al.*/2018	M/48	Blunt force trauma/18 months	Upper eyelid	Pus discharge/18 months	0	CT and MRI	None	Yes/Improved	6 months/ No
Khanam *et al.*/2021	F/35	Blunt force trauma/3 years	Inferolateral	Swelling, restricted EOM, hypotropia, and chemosis/15 days	0	NM	NM	Yes/Improved	NM/NM
	F/36	Blunt force trauma/8 months	Inferomedial	Swelling and ocular abscess/NM	0	US	NM	Yes/NM	NM/NM
Oseki *et al.*/2023	M/74	Fall/6 months	Lower eyelid	Decreased vision, chemosis, subconjunctival hemorrhage, swelling, increased ocular pressure/NM	1	CT	None	NM/Improved	1 year/No
You *et al.*/2021	M/33	Fall/2 weeks	Lower eyelid	Decreased vision. Discharge, subconjunctival hemorrhage, exophthalmos, and restricted EOM/NM	NM	CT and MRI	None	Yes/NM	NM/NM
	F/3	Stab/2 years	Upper eyelid	Abscess/NM	0	CT and US	CT and US	NM/Improved	3 months/ No
Lee and Lee/2002	M/41	NM/1 month	NM	Esotropia and decreased vision/NM	1	CT	CT	NM/Did not improve	NM/NM
Sahu *et al.*/2022	M/70	NM/6 months	Medial rectus and posterior aspect of the superior rectus muscle	Pain, discharge, restricted EOM, ptosis, and decreased vision/6 months	0	CT and MRI	None	Yes/NM	NM/NM

(*Contd...*)

Table 1: (*Continued*).

Author/year	Sex/age in years	Cause/time since the injury	Site of orbital entry in the injury	Clinical presentation/ duration of the symptoms	Previous surgeries	Radiological modalities	Used Modality that successfully identified the foreign body	Surgical management/ patient outcome	Follow- up period/ recurrence
Kadir/2020	M/15	Fall/1 month	Inferolateral	Swelling, orbital cellulitis, pain, proptosis, and ptosis/1 month	1	CT and MRI	MRI	Yes/Improved	NM/NM
	M/2	Stab/7 weeks	Upper eyelid	Swelling, erythema, proptosis, displacement of the globe, seizures, and hemiplegia/7 months	0	CT	CT	Yes/Improved	NM/NM
	M/2	Fight/6 weeks	Upper eyelid	Erythema, swelling, and induration around a healing wound/NM	0	CT	CT	Yes/Improved	NM/No
Hedge/2015	M/50	Fall/8 months	Medial eyelid	Itchiness and discharge/8 months	0	MRI	MRI	Yes/Improved	NM/NM
Wadhwa/2017	M/42	Fall/3 months	Medial rectus	Epistaxis/3 months	0	CT	None	Yes/Improved	2 months/ No
Weinacht/1997	F/12	Fight/2 years	Medial canthal area	Hematoma, conjunctival laceration, corneal erosion, exotropia restricted EOM, decreased vision, and headache/NM	0	CT and MRI	MRI	Yes/Did not improve	2 years/No

M: Male, F: Female, NM: Not mentioned, EOM: Extra-ocular movement, US: Ultrasound, CT: Computed tomography, MRI: Magnetic reasoning imaging.



Video 1: A short intraoperative video during the removal of the IOWFBs.

cannot detect wood, it is seldom used in the diagnosis[36] [Table 1].

Missed diagnosis of IOWFBs by all initial images was reported in 21 patients out of 51 patients, accounting for 52.9%, in the You *et al*. study. This underscores that IOWFBs cannot be totally excluded despite negative imaging results. Long-term follow-up and re-imaging are recommended.

Management and follow-up

Each case of IOFB presents and behaves differently depending on the mechanism of trauma, time elapsed since the injury, type of foreign object, and other variables. Therefore, a tailored treatment approach should be implemented for each case. In general, in suspected foreign body cases, a comprehensive evaluation based on clinical information obtained from a detailed history, physical examination, and appropriate imaging is essential. Furthermore, anti-tetanus prophylaxis and broad-spectrum antibiotics should be administered for all cases of retained IOFB.[17] On the other hand, IOWFB specifically is known for its polymicrobial nature of the related infection regardless of the site of entry. As reported by a previous study, rods, cocci, and anaerobes are predominant in organic material cultures, including *Staphylococcus aureus*, *S. epidermidis*, *Enterobacter agglomerans*, and *Clostridium perfringens*. Although fungal infections do not play a major role in IOWFB, empirical anti-fungal therapy is still recommended to administer.[10]

Surgical intervention should be considered and weighed against the iatrogenic risk, especially for wooden foreign bodies, which have a higher risk of infection and inflammation if left untreated. In this review, 28 cases out of 37 underwent surgery as a definitive treatment. Of these, 26 patients reported an improvement post-surgery, four required more time to recover, and the outcomes for the remaining patients were not documented [Table 1].

IOWFBs are notorious for fragmenting during surgeries; therefore, MRI should be performed postoperatively to look for residual or decomposed foreign bodies.[17] Furthermore, suspicion of retained wooden foreign bodies should also be considered after surgery if there is a recurrence of symptoms, especially if a discharging sinus is present.[11] Long-term follow-up is also crucial to monitor the healing process, look for potential complications, including infections, and assess the overall prognosis.

The prognosis of IOWFB can vary based on factors such as the location of the foreign body, the extent of tissue damage, and the promptness of the management.[36] However, most of the cases presented in this review had a good prognosis, and none of them reported a recurrence of symptoms [Table 1].

Limitations

The present study included a single case report and a literature review, which may affect the reliability of evidence of the data. However, this study may have the potential to add valuable insights to the existing literature on the management and prognosis of retained intraorbital wooden bodies. Further studies are warranted to provide a better understanding of similar cases.

CONCLUSION

In clinical settings, incidents of trauma with wooden IOFBs are commonly seen. While diagnosing and managing these cases can be complex, satisfactory outcomes can be reached by obtaining a detailed history and performing a thorough evaluation of the clinical signs along with utilizing appropriate imaging techniques. Moreover, prompt exploration and surgical removal combined with the use of anti-infection prophylaxis can be sight-saving followed by long-term monitoring to prevent potential complications.

Ethical approval

The research/study approved by the Institutional Review Board at ethical committee of King Fahad Medical City, number FWA00018774, dated April 10, 2024.

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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