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Case Report

Penetrating Orbital Sphenoid Sinus Trauma with a Wooden Stick: A Challenging Case Report

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Keywords
Wooden foreign object · Computed tomography · Transorbital intra-sphenoidal penetration · Facial trauma · Traumatic optic neuropathy

Abstract
Transorbital and intra-sphenoidal traumas are relatively uncommon, can be challenging to manage, and are associated with a high risk of complications and potentially fatal outcome. Transorbital and intra-sphenoidal trauma pose a medical challenge due to close relationship to delicate and critical anatomical structures, such as the globe, optic nerve, the ophthalmic internal carotid arteries, and central nervous system. Rapid admission to a level 1 trauma center with a high surgical expertise level is essential to ensure the best possible treatment and outcome. We present a case of a 75-year-old man who had a severe orbital trauma, where a wooden foreign object penetrated the orbit into the sphenoid sinus without penetrating its posterior wall. This case is important because of the rare trauma presentation with a wooden foreign object, which can easily be missed on computed tomography. The case also illustrates the importance of close collaboration between ophthalmologists and rhinologists when challenged with severe orbital sphenoid sinus trauma.

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Introduction

Orbital traumas are associated with a significant risk of fatal neurovascular lesions, infections, decreased mobility of the eye, and blindness. Treatment of this kind of injury should be performed without unnecessary delay, and multidisciplinary management is essential to minimize complications. In this case report, we present a rare extensive orbital trauma with a wooden foreign object lodged in the sphenoid sinus close to the internal carotid artery (ICA).

Case Presentation

A 75-year-old man with a past medical history of hypertension but no past ocular history tripped on the sidewalk and hit his head on a branch. The patient was referred to the local emergency department, where the initial examination revealed an approximately 2-cm-long laceration in the lateral part of the left upper cheek with a wooden foreign object (Fig. 1a). Examination of the left globe was complicated due to periorbital swelling, hyperglobus, mechanical blepharoptosis, and difficulties in manually lifting the upper eyelid. There was a left-sided relative afferent pupillary defect, exotropia, exophthalmos, and no light perception (NLP). The motility of the eye was with significant limitation of all ductions, which most likely was due to compression of the globe and extraocular muscles by an orbital foreign body. Slit lamp examination revealed conjunctival injection, clear cornea, and normal depth of the anterior chamber without hyphema. Dilated funduscopy was without evidence of penetrating trauma or other posterior segment manifestations of injury to the globe. The intraocular pressure of the left eye measured with iCare was 23 mm Hg. The intraocular pressure of the right eye was not measured.

A computed tomography (CT) scan of the facial bones revealed a cylindrical foreign body measuring 7 cm in length and 6 mm in diameter (Fig. 2a, b). It penetrated the left orbit inferolateral below the inferior rectus muscle. It was situated craniomedially through the posterior medial orbital wall into the sphenoid sinus, without penetrating the posterior wall (Fig. 2a, b). The minimal distance from the foreign body to the ICA was 6 mm. The globe and optic nerve were intact, but the patient had relative left-sided exophthalmos due to the displacement of the inferior and medial rectus muscles. There were fractures in the floor of the orbit, medially and caudally of the foreign object, penetration of the lamina papyracea, and air trapped in the soft tissue along the path of the wound.

The patient was transferred to the Department of Ophthalmology at our University Hospital and treated with intravenous antibiotics (vancomycin and ceftazidime). The following morning, the patient was transferred to our Department of Otorhinolaryngology, Head and Neck Surgery, and Audiology for joint venture surgery.

The removal of the object was performed by CT image-guided endoscopic surgery. Under visualization of and manipulation in the sphenoid sinus, a 7-cm-long stick was extracted through the wound in the lower eyelid (Fig. 1b). Significant amounts of debris and splinters were removed through the nose. The skin laceration was adapted and stitched together.

The patient showed no sign of infection, and the antibiotic treatment was adjusted to intravenous cefuroxime as monotherapy after consulting with the Department of Microbiology. The patient was discharged after 3 days with oral antibiotics, amoxicillin/clavulanic acid.

Six months after the trauma, the patient had the last follow-up in the ophthalmology outpatient clinic. The visual acuity in the left eye had increased to 0.4, and there was still a relative afferent pupillary defect and affected color vision. Slit lamp examination and dilated

funduscopy was unremarkable besides a pale atrophic optic disc. Spectral-domain optical coherence tomography of the peripapillary retinal nerve fiber layer (pRNFL) demonstrated marked thinning of the pRNFL (Fig. 3a, b). The motility of the left eye was normal except for reduced elevation to about 10°. There was no diplopia in spite of 20° of exotropia. The patient was diagnosed with traumatic optic neuropathy.

Discussion

Traumas involving penetration of the orbital region are sparsely researched. Case reports describe a higher incidence among children and the elderly, some cases resulting in death [1, 2]. General recommendations advise that patients suffering from these kinds of injuries are treated at a facility with a highly specialized trauma team with access to relevant imaging and surgical expertise [3–5].

Rapid diagnostics and surgery, if needed, are essential in minimizing the risk of damage to the optic nerve from compression or impingement. In this case report, the patient had surgery the day after the injury with severely impaired vision. Surprisingly, the visual acuity increased from NLP to 0.4. Such an increase in visual acuity is not always the case, but a marked recovery in visual acuity in patients with traumatic optic neuropathy and NLP has been described before [6]. One might speculate that the sequelae would have been less had the patient been operated immediately.

In cases of suspected foreign bodies not visible on CT, magnetic resonance imaging (MRI) is recommended [7–9]. However, MRI is not readily available in many emergency departments. Any vascular injury should be ruled out by CT angiography, which should be performed on all patients with related injuries. Ultrasound is a cheap, fast, and often available modality that can help identify foreign objects in the initial assessment and be used preoperatively. It should be noted that the quality of the procedure greatly relies on the examiner skills. Moreover, ultrasound of the orbit and globe is rarely performed in the emergency setting, and the risk of worsening the injury by manipulation with the probe must be taken into consideration.

Initially, in this case, a CT scan at the local emergency department was performed to estimate the penetration of the wooden foreign object. This imaging technique is widespread and often used in trauma settings. A CT angiography would have been preferred preoperatively because of the close association of the foreign object and the ICA. The patient could have suffered a catastrophic vascular injury had the wooden object penetrated the ICA. Even though a CT angiography would have been preferred, the CT scan gave the information needed to perform image-guided endoscopic surgery with visualization of the ICA.

CT scan is the preferred modality to visualize bone fractures. It can, to some degree, be used to determine pathology in soft tissue based on differences in the radiodensity measured in units on the Hounsfield scale. This case report, however, presents a well-known challenge in radiology. The Hounsfield value of wood is similar to air, thus risking wooden fragments to be misinterpreted as trapped air on a CT [7, 9–11]. A misinterpretation may cause delayed treatment with loss of function or fatal outcome.

In addition, potential secondary complications to transorbital lesions must be addressed. More specific, the probable risk of severe infections with bacteria and fungi from left organic material spreading to the cerebrum or the undamaged eye has previously been described [12, 13].

In summary, penetrating trauma to the orbital region is relatively uncommon and is associated with a high risk of complications. A multidisciplinary team with otorhinolaryn-

gologists and ophthalmologists should evaluate the orbital traumas immediately. A CT scan is the first-course imaging to identify a retained foreign object and at-risk structures. CT angiography should be performed in traumas with possible vascular injury. In cases of suspected foreign bodies not visible on CT, MRI is recommended.

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Statement of Ethics

Written informed consent was obtained from the patient, including consent to publish pictures.

Conflict of Interest Statement

The authors have no conflicts of interest to disclose.

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Author Contributions

Christian von Buchwald and Jesper Skovlund Jørgensen performed surgery on the patient. Mads Thorsberger and Marie-Louise Uhre Hansen presented the idea of the case report. All authors contributed to the final manuscript.

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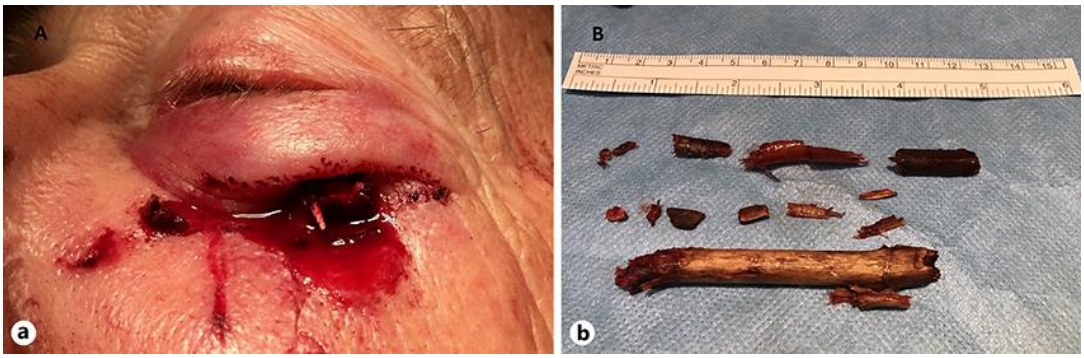

Fig. 1. **a** Upper cheek laceration with a lodged wooden object. **b** The 7-cm wooden foreign object was removed through the wound in the upper cheek laceration. Debris and splinters were removed endoscopically through the nose.

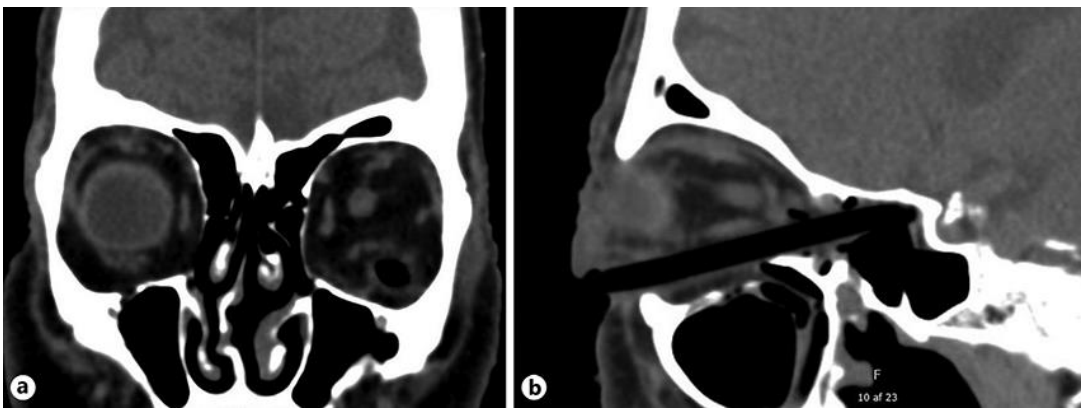

Fig. 2. CT scans. A wooden foreign body penetrates the orbital region going into the sphenoid sinus. **a** Coronal view. **b** Sagittal view.

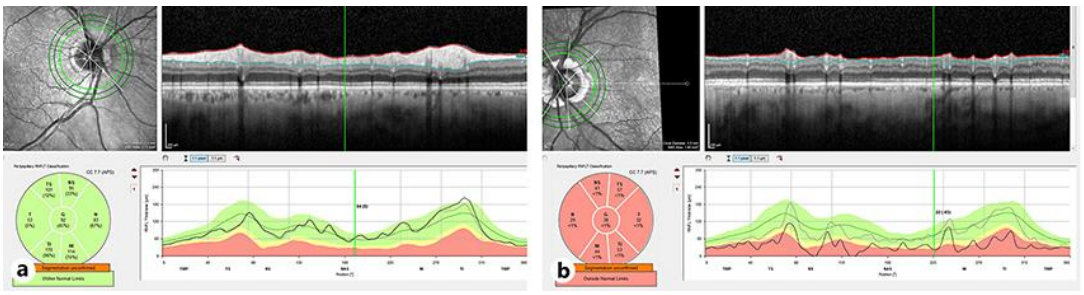

Fig. 3. Spectral-domain optical coherence tomography of the peripapillary retinal nerve fiber layer. **a** The right eye. **b** The left eye.