

Intraorbital wooden foreign body (IOFB): mimicking air on CT

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Abstract We report the case of a 41-year-old man who presented to the ER following a fall in his back garden during which he sustained a left orbital injury. Computed tomography (CT) demonstrated an intraorbital linear lucency surrounded by haziness in the intraconal fat. An intraocular wooden twig was confirmed during subsequent surgery. The possibility of a wooden intraorbital foreign body should be strongly suspected following orbital trauma when there is intraorbital density below that of the surrounding intraorbital fat on CT, as this may mimic organic foreign bodies.

Keywords Intraorbital foreign body · CT · Orbital air

Introduction

Intraorbital foreign bodies (IOFBs) are a common occurrence worldwide and happen at a frequency of once in every six cases of orbital trauma. Metallic foreign bodies are commoner than inorganic nonmetallic foreign bodies, such as glass, plastic, and rubber, as well as organic foreign bodies such as vegetables [1, 2]. Imaging and management should be tailored individually. In this report, we present the case of a 5-cm-long intraorbital wooden foreign body that appeared to simulate intraorbital air on computed tomography (CT).

Case report

A 41-year-old white man presented to the ER with painful left eye movements and diplopia—1 day after falling face-down in his back garden and sustaining left-sided orbital injury. Pertinent physical and laboratory findings include swelling with a laceration of his left lower eyelid, redness, and tenderness, as well as features of left periorbital cellulitis. Although the patient had normal fundoscopic and visual acuity tests and no evidence of corneal laceration, there were restricted left eye movements, most notably on upward gaze.

Pre- and postcontrast (hand-injected 50 ml of Niopam® 300) axial helical CT scans (Siemens SOMATOM Sensation 16) of the orbit were obtained (Figs. 1, 2, 3, 4, 5, and 6) with 0.75-mm-slice collimation. Image data were reconstructed at a slice thickness setting of 3 mm. Axial and coronal reconstructed images were viewed with soft tissue (W: 350, L: 50), bony (W: 2,500, L: 250), and lung (W: 1,500, L: -600) window settings on a 512×512 matrix. The scan demonstrated left-sided periorbital and orbital edema, proptosis, and a low-density linear foreign body resembling air that extended from the left lower eyelid into the intraconal retro-orbital fat infero-medially, 7 mm from the left optic nerve.

The patient was treated with antibiotics and analgesics, and the 5-cm-long dry twig, along with a shriveled leaf (Figs. 10 and 11), was removed under general anesthesia. His left ocular motility and cellulitis have since improved.

CT images of the extracted twig demonstrate the porous center with a density very similar to that of air (Figs. 7, 8, and 9).

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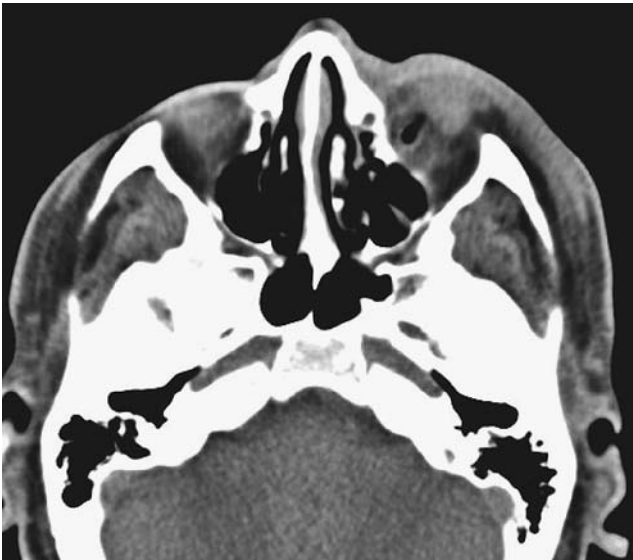


Fig. 1 Axial CT viewed on soft tissue windows showing left-sided proptosis, the low-density linear left IOFB, preseptal swelling and haziness, and corresponding change in the postseptal fat, which is partly due to infection and in part from hemorrhage

Discussion

Orbital injuries occur commonly following maxillofacial trauma [3]. The severity of penetrating orbital injury is often underestimated by physical examination, and diagnosis of IOFB therefore requires high clinical suspicion and an appropriate choice of imaging modalities [4].

Wood and other organic IOFBs still present a diagnostic challenge despite improved resolution of CT scanners. The CT densities of wooden foreign bodies vary according to

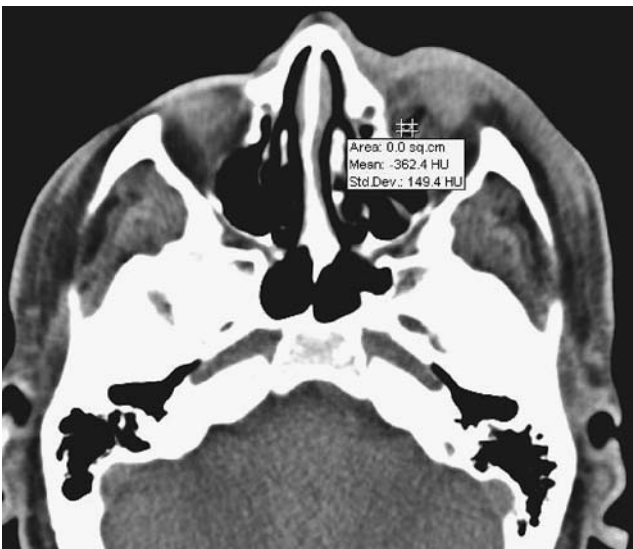


Fig. 2 Axial CT viewed on soft tissue windows showing the low-density linear left IOFB with density of -362 HU



Fig. 3 Axial CT viewed on bony windows showing the low-density linear left IOFB and the absence of an orbital wall fracture

their porosity [5]. They may present with densities similar to that of the intraocular muscles, especially with late presentation [1], but in the acute stages, they tend to resemble bubbles of air. Dry pine has a density of -656 Hounsfield units (HU) compared with fresh pine, which has a density of -24 HU [6]. In the absence of a fracture, intraorbital air should raise the suggestion of an IOFB,

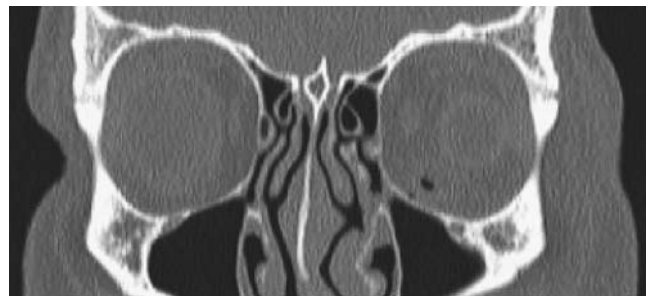


Fig. 4 Coronal CT reformat viewed on bony windows showing the round low-density left IOFB and an intact orbital wall

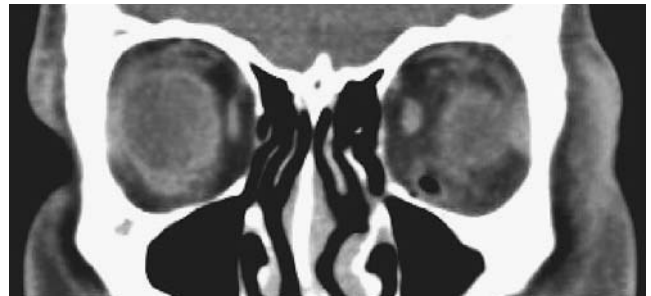


Fig. 5 Precontrast reformatted coronal CT viewed on soft tissue windows showing the round low-density left IOFB inferior to the left inferior rectus muscle and the surrounding haziness

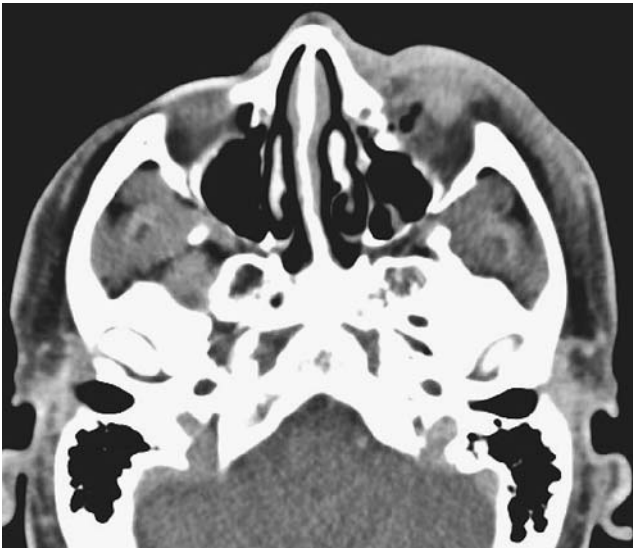


Fig. 6 Postcontrast axial CT viewed on soft tissue windows showing the low-density linear left IOFB and no abscess

particularly if the air has a linear configuration, as in our case [7].

CT is generally considered to be the gold standard for IOFBs [8]. It is safe to use with metallic IOFBs, excludes orbito-cranial extension, and is also able to diagnose orbital wall fractures and orbital sepsis with high accuracy [9, 10]. Abscess formation in the orbit, bone, and brain are other complications that CT may exclude.

Spiral CT has advantages over conventional CT due to higher quality coronal and sagittal images, reduced motion artifact, lower lens dose [11], and reduced beam-hardening artifact from metallic IOFBs [12]. CT is also accurate for

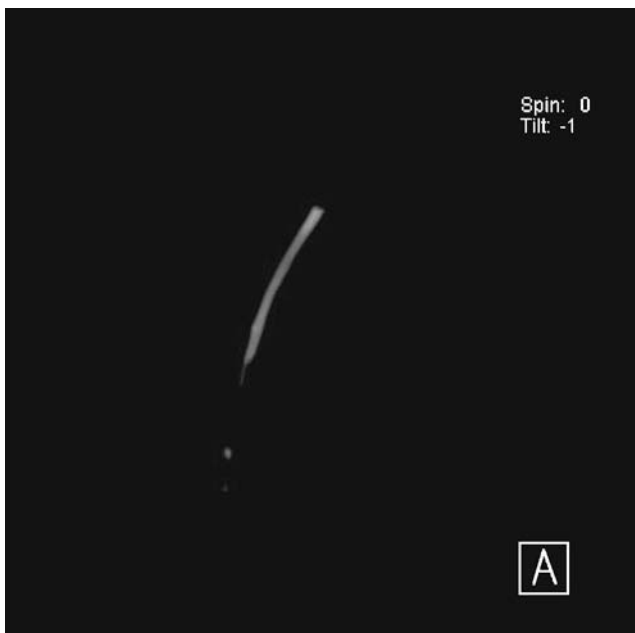


Fig. 7 Maximum intensity projection of the surgically extracted wooden intraorbital foreign body

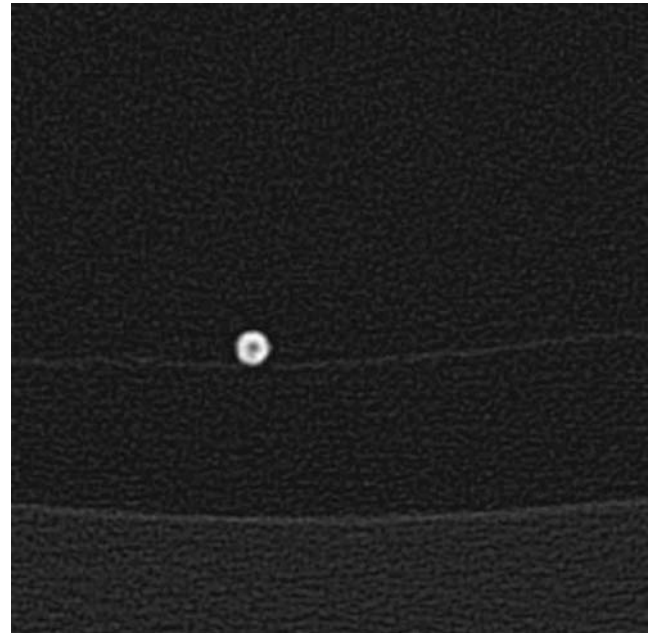


Fig. 8 Magnified axial section through extracted wooden foreign body showing the air-filled, porous, and radiolucent center

the detection and localization of glass, metal, and stone foreign bodies [13], and the nature of the IOFB may be deduced from the Hounsfield numbers [14].

Metallic density is easily distinguished on CT, but size overestimation of metals on soft tissue window settings is a well-recognized occurrence [15]. The CT threshold size for the detection of metallic foreign bodies is 0.07 mm^3 with thin slice CT [16]. A separate study has found steel to be

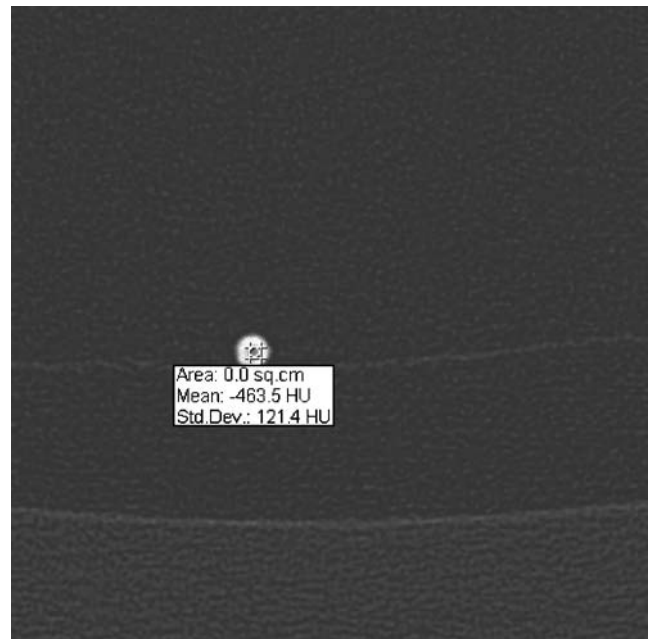


Fig. 9 Same image as in Fig. 8, with *cursor* showing the HU of 462 in the center of the wooden foreign body



Fig. 10 Image of the extracted twig

the easiest IOFB to detect, followed by copper, aluminum, spectacle glass, vehicle window glass, and wood [17].

Chronic cases of wooden IOFB may become more visible with contrast enhancement due to the surrounding inflammatory reaction [1, 18], which may also contribute to the increased density of the wood along with the increased water content of the wood.

Suspected IOFB and associated injuries may also be investigated with plain radiographs, ultrasound, and magnetic resonance imaging (MRI), depending on local expertise, facilities available, and the probable constitution of the IOFB. Plain radiographs are inexpensive but underestimate plastic and wooden IOFBs. Normal structures, such as the ophthalmo-meningeal foramen, may be mistaken for IOFBs on plain radiographs [19]. Ocular ultrasound has a higher sensitivity than plain radiographs for detecting all kinds of IOFBs and is accurate for intraocular foreign bodies [13, 14]. However, it is time consuming, does not visualize the orbit completely [6], and may result in false positives, such as intraorbital air mimicking solid foreign bodies on ultrasound [20]. MRI scans should be performed when there is a high suspicion of IOFBs, especially wooden IOFBs and a negative CT scan. MRI can also distinguish between air and wood and is more helpful in cases of organic IOFBs when CT is negative [21]. MRI is, however, more expensive, less accessible, and requires pre-MRI imaging (plain radiographs and CT) to exclude metallic IOFBs in cases of orbital trauma. Treatment principles for IOFB include pain relief, broad-spectrum antibiotic cover, and surgical extraction [22, 23].



Fig. 11 The extracted twig and leaf

In summary, multimodality imaging can provide the required information regarding the location and type of IOFB and allows preoperative surgical planning. Radiologists should be aware that intraorbital gaseous densities might represent wooden foreign bodies, especially if given the appropriate clinical information. We recommend CT orbits for all suspected intraocular foreign bodies and MRI for negative CT scans, particularly if the suspected IOFB is organic. The use of ultrasound would depend on local expertise and availability.

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