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Intraorbital Wooden Foreign Body: CT and MR Appearance

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Summary: A case of an intraorbital wooden foreign body mimicking air on standard CT window setting and on MR is presented. Its higher attenuation with higher CT window setting as well as its elongated and well-delineated shape on both CT and MR helped to distinguish it from air.

Index terms: Foreign bodies; Orbit, computed tomography; Orbit, magnetic resonance

Wooden foreign bodies within the orbit may be difficult to diagnose both clinically and by imaging studies. Detection of intraorbital wooden foreign bodies is important, because severe complications secondary to infection can occur. In this study, we describe a case of intraorbital wooden foreign body diagnosed with computed tomography (CT) and magnetic resonance (MR) imaging.

Case Report

A 7-year-old white boy was referred for evaluation of possible retained foreign bodies within his left orbit. Three days earlier, he had fallen face down approximately 7 feet onto a pruned rose bush. A branch from the rose bush had apparently entered his left orbit and then his left maxillary sinus. The patient had pulled the rose bush branch out himself. He had subsequently undergone an exploration of his left orbit at an outside hospital with repair of a left upper eyelid laceration as well as removal of a few wooden chips through the entry wound at the inferior fornix of his left eye. However, after surgery, the patient's clinical status had worsened with increased lethargy, swelling, and redness of the left periorbital area.

On physical examination, the left eye was painful with swelling and erythema of the eyelids. An entry wound was noted at the inferior fornix of the left eye, but no foreign body was identified. Visual acuity was difficult to evaluate because of pain. Pupils were equal, round, and briskly reactive to light. Motility of both eyes was restricted but remained difficult to evaluate because of pain in the left eye.

Unenhanced 3-mm axial CT scans were obtained through the orbits with a 9800 unit (GE Medical Systems, Milwaukee, Wis). Images photographed at a window width of 214 Hounsfield units (HU) and a window level of 19 HU (Fig 1A) revealed a well-defined J-shaped area of extremely low attenuation extending from the retrobulbar fat of the left orbit into the opacified superior aspect of the left maxillary sinus. The density of this area was indistinguishable from air present within the superior aspect of the right maxillary sinus. Hyperdensity within the left retrobulbar fat around the J-shaped area represents hemorrhage and edema. The left orbital floor was fractured (not shown). Images of the orbits photographed at a window width of 1000 HU and a window level of -500 HU (Fig 1B) showed the J-shaped area to be of higher density than air within the superior aspect of the right maxillary sinus. It was well delineated from surrounding tissues, which appear extremely dense at this window setting. MR (Fig 2A-C) performed on a 1.5-T MR imaging unit showed the J-shaped area to be well demarcated and markedly hypointense on all pulse sequences. It was isointense with air on all pulse sequences. Regions of the same density on CT and intensity on MR as the J-shaped area were seen within the left maxillary sinus (not shown). All of these areas within the left orbit and maxillary sinus were compatible with wooden foreign bodies.

The patient underwent a Caldwell-Luc procedure, with removal of wooden foreign bodies from the left orbit and maxillary sinus. Numerous bacteria and fungi were isolated from the wood cultures. The patient was put on antibiotics with marked improvement of his clinical status.

Discussion

Detection of intraorbital wooden foreign bodies may be difficult, especially in cases of apparently minor trauma. The severity of injury in penetrating trauma to the orbit is often underestimated by physical examination. Wood, with its porous consistency and organic nature, provides a good medium for microbial agents (1). Infection resulting from retained intraorbital

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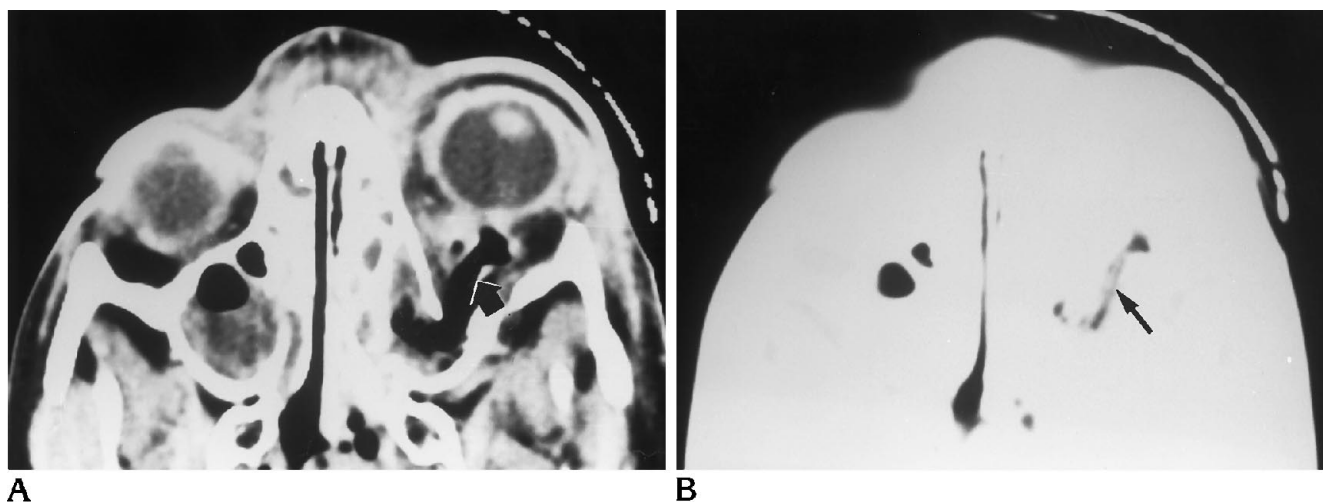


Fig 1. Intraorbital wooden foreign body on CT.

A, Axial image immediately below the midorbits shows a well-delineated J-shaped foreign body (*arrow*) extending from the retrobulbar fat of the left orbit into the opacified superior aspect of the left maxillary sinus. The foreign body has the same density as air at the window width of 214 HU and window level of 19 HU. Hyperdensity within the left retrobulbar fat around the foreign body represents hemorrhage and edema.

B, At the window width of 1000 HU and window level of -500 HU, the foreign body has higher density than air.

wooden foreign bodies may lead to complications such as panophthalmitis, abscess, and fistula.

Imaging studies in the detection of wooden foreign bodies within the orbit have had variable success. Plain film radiography is not useful in detecting intraorbital wooden foreign bodies. Standardized ophthalmic ultrasonography (combine of standardized A-scan and B-scan) has been suggested to be used first (2). However, standardized ophthalmic ultrasonography requires a specific expertise and technology that is not available in many communities and is time consuming. Moreover, ultrasonography may not be able to evaluate the complete orbit and cannot detect intraorbital wood surrounded

by air. With the use of CT, several authors (1, 3-5, 8) were able to detect intraorbital wood. CT also allowed detection of associated problems such as fractures and abscesses. Wide window widths (up to 1000 HU) were proposed to optimize visibility of intraorbital wood (3, 4). MR imaging was thought to be helpful if plain radiography, ultrasonography, and CT were negative in patients with high suspicion for intraorbital wooden foreign bodies (6, 7).

On CT, wood has been described as low attenuating or high attenuating, depending on the degree of air or other substances trapped within its cellulose matrix (1, 3, 4). It can mimic air within the orbit (5-7). Measurement of absorption coefficients was not helpful in distinguish-

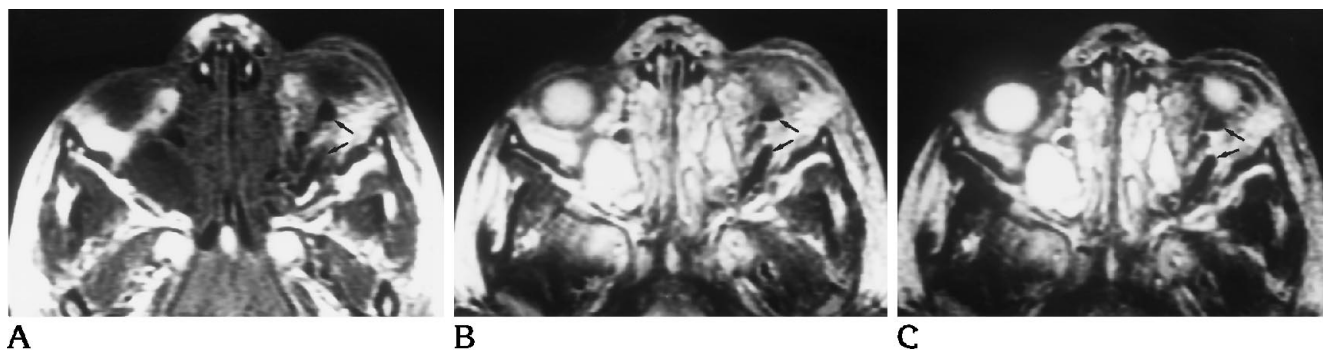


Fig 2. Intraorbital wooden foreign body on MR. T1-weighted (750/19/4) spin-echo (A), proton-density (3700/38/2; echo train length, 8) (B), and T2-weighted (3700/95/2) fast spin-echo (C) axial images shows the foreign body to be well demarcated from the hyperintense intraorbital fat and have the same signal intensity as air on all pulse sequences. These axial images are of slightly different level and angulation than that in Figure 1; therefore, the foreign body is not entirely demonstrated.

ing small pieces of wood from air because of volume averaging (3). On MR imaging, both dry and fresh wood have been described to be hypointense relative to intraorbital fat on all spin-echo pulse sequences (3, 4, 7). T1-weighted images were thought to be more useful than proton density- and T2-weighted images, because they provide better contrast between intraorbital fat and wood. In addition to their density on CT or signal intensity on MR, the elongated and well-demarcated shape of intraorbital wooden foreign bodies also may allow them to be inferred.

In our case, the intraorbital wooden foreign body mimicked air in attenuation on CT images photographed at our institution's standard window width of 200 to 250 HU and window level of 15 to 30 HU for orbits. However, density greater than air could be appreciated at the window width of 1000 HU and window level of -500 HU. Its elongated and well-delineated shape also helped to distinguish the wood from air. On MR imaging, the intraorbital wood in our case had the same signal intensity as air on all pulse sequences. Its shape again helped to differentiate it from air. Proton density- and T2-weighted fast spin-echo images were comparable to T1-weighted spin-echo images. Intraorbital fat has high signal on the proton density- and T2-weighted fast spin-echo images and therefore serves as a good background to delineate hypointense wooden foreign bodies. In addition, fast spin-echo allows shorter scan time than standard conventional spin-echo.

In conclusion, to detect intraorbital wooden foreign bodies with diagnostic imaging, thin axial and coronal CT images at variable window widths are extremely useful and therefore should be performed first. MR imaging in our case did not prove to be more useful than CT. It might be helpful when CT is negative in patients with high suspicion for intraorbital wooden foreign bodies, but this remains to be proved. The accuracy of diagnosis could be increased by the knowledge that wood has variable appearances and can mimic air on CT and MR.

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