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Intraorbital foreign body – diagnostic and therapeutic challenges

Wewnątrzoczodołowe ciało obce – trudności w diagnozowaniu i leczeniu

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Summary: Here we report the case of a wooden intraorbital foreign body penetrated into the infratemporal fossa in a 17-year-old patient and associated diagnostic difficulties. The superiority of computed tomography over the remaining imaging examinations was proved. It was demonstrated that a patient after orbital trauma should be immediately referred to a multidisciplinary centre where radiologists liaise with oral and maxillofacial surgeons and ophthalmologists.

Key words: wounds, injuries, wood, diagnostic imaging.

Streszczenie: W artykule przedstawiono przypadek 17-letniego pacjenta, który doznał urazu oka drewnianym ciałem obcym penetrującym do oczodołu i dołu podskroniowego, oraz opisano trudności z jego zdiagnozowaniem. W trakcie przeprowadzania badań diagnostycznych udowodniono, że w przypadku diagnozowania urazów spowodowanych drewnianymi ciałami obcymi przewagę nad innymi metodami obrazowymi ma tomografia komputerowa. Dowiedziono ponadto, że pacjentów, którzy doznali urazu oczodołu, należy niezwłocznie powierzyć opiece medycznej w ośrodku specjalistycznym, ponieważ w takiej placówce medycznej można liczyć na pomoc wielu specjalistów – radiologa, chirurga szczękowo-twarzowego oraz okulisty.

Słowa kluczowe: rany i zranienia, drewno, diagnostyka obrazowa.

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Introduction

Intraorbital foreign bodies constitute a frequent interdisciplinary problem for a number of medical specialties, including ophthalmology, oral and maxillofacial surgery, otolaryngology, radiology, neurology and neurosurgery (1–3). The difficulties often stem from the fact that patients do not disclose the actual circumstances of the injury and provide false information instead. Some patients, especially those under the influence of alcohol, may be not fully conscious and cannot remember the circumstances of the injury. Furthermore, they are often unaware of complications, such as vision loss, likely to occur due to the presence of an intraorbital foreign body (4). Additionally, diagnostic imaging poses another challenge, as it is often difficult to visualise certain foreign body types, such as glass, wood and other organic matter, the density of which resembles the one of orbital soft tissues. Detecting fragments of wood is even more difficult if air is present between soft tissue layers (2, 3).

Case presentation

Having had a couple of beers, a 17-year-old male was pushed by his friend and fell in bushes, not losing consciousness. He had a history of congenital nystagmus and was otherwise healthy. He returned home from the accident site but reported with his mother to the University Department of Ophthalmology due to pain in his right eye, accompanied by an injury to the infraorbital region and palpebral oedema 10 hours later (Fig. 1).

Fig. 1. Infraorbital region injury and palpebral oedema.
Ryc. 1. Uraz okolicy podoczodołowej, współistniejący obrzęk powiek.

Physical examination and computed tomography (CT) confirmed ocular trauma, revealing a fracture of the right inferior orbital wall. After another couple of hours following the injury, the patient was referred to the University Department of Cranio-Maxillo-Facial and Oral Surgery for an emergency consultation, with a note that the corneal and scleral injury will be treated surgically. The examination revealed massive palpebral oedema in the right eye with a superficial skin injury within the right infraorbital region, which was debrided and sutured. Both eyes were properly situated within the orbits and had full mobility; the patient did not report diplopia. Since ocular injury debridement was a priority, the patient was sent back to the Department of Ophthalmology. Few hours later, the eye surgeon notified us that through a transconjunctival approach he exposed one end of a wooden stick, stuck into the orbital floor,

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which penetrated into the maxillary sinus. There was no damage to the eye. The protruding piece of a foreign body was secured in place with haemostatic sponge. Our request for performing magnetic resonance imaging in order to locate and assess the size of the foreign body remained unanswered and the patient was subsequently referred to our medical facility. The performed MRI revealed a linear, tubular foreign body which might have corresponded to a dry stick (the lignified part of low signal was visible peripherally as well the core of higher signal). However, very strong artifacts caused by massive trauma-induced soft tissue emphysema along and around the foreign body, made it impossible to measure its thickness and length (Fig. 2). Furthermore, contradictory CT and MRI findings (no typical signs of ocular injury, no damage to the maxillary sinus on the side of the injury, and the absence of evident signs of bones fracture as well as very poor quality previous CT which was not sufficient for clinical interpretation) required repeating the CT scan in order to determine the extent of damage.

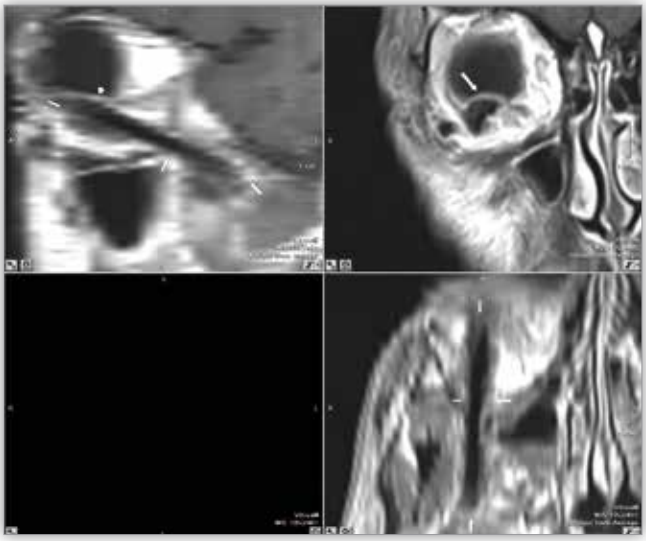

Fig. 2. MRI the deformation of the eyeball bruised by a foreign body.
Ryc. 2. Rezonans magnetyczny obrazujący wpływ ciała obcego na deformację gałki ocznej.

The spiral and multi-slice computed tomography (64-slice CT), with 0.5 mm slice thickness and 1.0 mm reconstruction interval, soft tissue filter and bone filter as well as an MPR analysis was performed and a radiology consultant confirmed the presence of a foreign body in the right orbit corresponding to a piece of a wooden stick about 5.0 cm long and 4.0 mm wide. It was stuck in the inferior orbital fissure and penetrated into the infratemporal fossa without damaging orbital walls, yet pushing the eye forwards and lifting it up. The concomitant massive oedema of orbital adipose tissue pushed the eye out of the orbit. The oedema of the inferior rectus muscle, which was medially displaced, was visible. Previously described air emphysema involved the eyelids, the orbit and the infratemporal fossa (Fig. 3).

There were clinically insignificant, non-displaced fractures of the infraorbital canal. The patient underwent the emergency surgery and the 5.7 cm long stick was removed, along with several smaller detached fragments of bark (Fig. 4). The perioperative and postoperative management included antibiotic

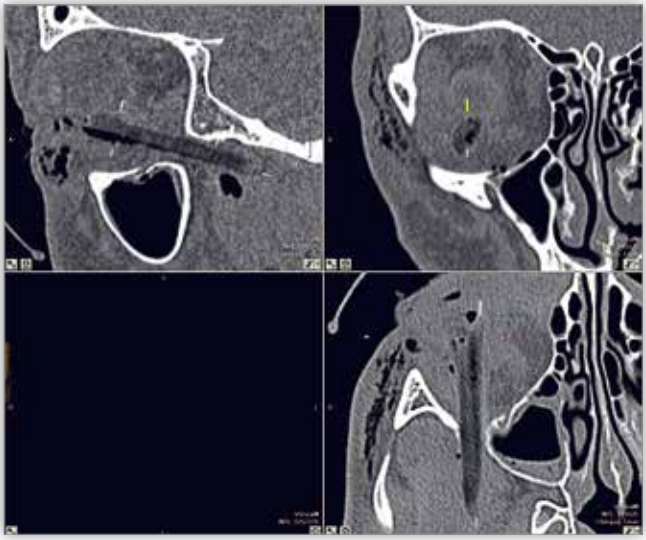

Fig. 3. Preoperative CT enabled accurate assessment and measurement of the foreign body.
Ryc. 3. Tomografia komputerowa – badanie wykonane przed zabiegiem umożliwiało dokładne zmierzenie ciała obcego oraz jego ocenę.

and antifungal therapy, as wooden foreign bodies have a potential for fungal infection, along with corticosteroids and tetanus toxoid. The recovery period was uneventful. Ophthalmology consultation performed one day after the surgery revealed only palpebral oedema and central corneal erosion in the right eye. On day 4. postoperatively, a follow-up CT scan was performed confirming the absence of foreign bodies and showing the infiltration of orbital fat and the bellies of the inferior rectus muscle, the inferior oblique muscle and the lateral rectus muscle. Single, tiny air bubbles were present in the operated area (Fig. 5). The patient was discharged home on day 5. postoperatively and had an episode of gastrointestinal viral infection two weeks later. During a follow-up appointment, there were no ocular complications.

Fig. 4. A 5.7 cm-long wooden stick removed from the eye along with several small, detached fragments of bark.
Ryc. 4. Drewniany patyk o długości 5,7 cm z mniejszymi fragmentami kory, który został usunięty podczas zabiegu.

Fig. 5. Postoperative follow up CT.
Ryc. 5. Tomografia komputerowa – obraz kontrolnego badania wykonanego po zabiegu.

Discussion

Orbital foreign bodies are a commonplace worldwide. They constitute about 1/6 of all orbital injuries and may be of either organic and inorganic origin. Organic foreign bodies include fragments of plant or animal origin. The inorganic ones encompass metals, glass, coal, stones, fragments of carborundum discs and plastic. Metal foreign bodies and glass are the most frequent (5, 6). A decision to remove a foreign body depends on its chemical composition, size, shape and location (1, 7). Retrobulbar location or proximity to the optic nerve is an adverse prognostic factor; removal of such foreign bodies is considered high-risk due to a number of possible complications including vision loss. Asymptomatic inorganic foreign bodies do not require removal. Therefore, some authors recommend watchful waiting approach in such cases (2, 8–10). Organic foreign bodies, though, quickly decompose, which may lead to dangerous complications, such as orbital abscess or phlegmon and intracranial complications. For that reason, they must be removed promptly. Due to its organic origin and porosity, wood is a reservoir for bacteria and fungi (3). Thus, quick infections caused especially by anaerobes arise, due to a deep and narrow inlet canal (6).

Furthermore, wood may move, injuring ocular and orbital structures. In the literature, there are reports of wood fragment penetration into brain tissue (7). Robaei et al. described the penetration of a wood fragment through the orbital roof into the frontal lobe of the brain. Additionally, an undiagnosed fragment of wood remained stuck in the orbit for 3 years despite a CT can. In the CT image, it mimicked orbital abscess and orbital preseptal cellulitis within the medial wall of the ethmoid bone (3). These diagnostic difficulties stem from the changes in wood structure and the fact that wood contains air-filled micropores. If a piece of wood is left in the orbit, the air is replaced with the interstitial fluid with time, and wood density expressed in Hounsfield units increases. Therefore, a CT image of wood directly after injury may resemble air bubbles; in the subacute state, it resembles orbital fat, and in the chronic state, it is similar to muscle tissue. Finally, the exploration of the orbit may not lead to wood foreign body detection as it may be surrounded by orbital fat.

Sheeja et al. described spontaneous extrusion of an undiagnosed wood fragment from the orbit of a 19-year-old patient after 5 years from the injury. Inorganic bodies are difficult to image, in particular in MRI, as it may be impossible to distinguish their shape and size (4). A CT proves to be more useful, as shown in our case, where large artifacts in the MRI, mostly due to the presence of gas in soft tissues, precluded accurate assessment. However, the technique used for foreign body detection and diagnosing ocular/ orbital injuries, hardly absorbing radiation, cannot be low-slice and axial. It is necessary to employ a multi-slice technique which, owing to very thin slices, is capable of detecting almost every detail with the use of soft tissue and bone filtration. An MPR analysis is absolutely necessary.

The literature suggests corticosteroid therapy as necessary to reduce soft tissue oedema, which is important as oedema may camouflage a foreign body in diagnostic imaging. Furthermore, through their anti-inflammatory effect, corticosteroids inhibit tissue reaction, thereby reducing the risk of complications. Similarly, antibiotic therapy is crucial, as it prevents central nervous system infections (3, 10). In the case of organic foreign bodies, antifungal treatment should be administered, as well (6). All these were administered intravenously to our patient.

Even if history and physical examination do not suggest a foreign body, its presence and potential intracranial penetration should always be excluded (6). In particular, even if there is a slightest injury to the tissues surrounding the orbit, the conjunctiva or other ocular structures, the CT scan should be performed (7). In our case, the initial CT did not reveal the presence of a foreign body. It only suggested the orbital floor fracture. In an attempt to explore the orbit, an ophthalmologist revealed the presence of a wood fragment. The authors hereby emphasize the need to monitor patients with foreign bodies left in the orbit (3, 7, 8, 10).

Conclusions

Every intraorbital foreign body in the form of a wood fragment should be removed on an emergency basis and every orbital injury should give suspicions of foreign body penetration. Imaging diagnosis should be based, in the first instance, on multislice computed tomography with an MPR analysis performed by an experienced radiology consultant. The management should be coordinated by the centre which specialises in such diagnosis and treatment, which ensures short interval between the injury and proper treatment.

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