Unusual orbitocranial penetrating injury by a grinding wheel: case report

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Orbitocranial penetrating injuries are uncommon and usually life threatening, which constitute about 0.4% of all head injuries, 24% of penetrating head trauma in adults, and 45% in children. They may occur accidentally or due to an assault and may have serious consequences and can be potentially fatal. Immediate plastic and reconstructive surgery, ophthalmology and radiology consultations are essential for the proper diagnosis and treatment. We reported an adult patient with a transorbital cerebral injury by an unusual material—grinding wheel. To our knowledge, this is the first reported case of transorbital penetrating injury by a grinding wheel in the literature.

CASE REPORT

A 43-year-old man was admitted to emergency room after being severely injured by a grinding wheel piece due to the wheel’s breakage accidentally. At admission, the patient was disoriented and agitated with a Glasgow Coma Scale score of 12. Blood pressure and heart rate were normal in his physical examination. Initial examination showed a foreign body filling the whole left orbital cavity with a concomitant right peri orbital swelling (Fig. 1). In ophthalmologic examination, the left eye globe was damaged severely. Cornea, lens, iris and pupilla were not observed clearly. Only damaged patchy sclera, choroid areas were seen. There was no light perception or projection. Conventional radiographs, computed tomography (CT) and three dimensional (3D) skull images demonstrated a hyperdense foreign body filling the orbit and extending through the frontal base into the frontal parenchyma, and contusions within the frontal lobe with a significant midline shift (Figs. 2-7). After the administration of tetanus toxoid and intravenous empiric antibiotic, the patient underwent an emergent surgical intervention under general anesthesia for extraction of the foreign body under direct vision. Following skin incision, a right frontal craniotomy was performed just above the supraorbital rim. The piece of the grinding wheel was seen penetrating intracranially through the orbital roof with the tip ending intraparenchymally within the frontal lobe. The supraorbital rim was also broken and displaced through the frontal base. The piece of the grinding wheel was extracted totally (Fig. 8) after removing the orbital rim and the frontal parenchymal contusion was evacuated. Because the left eye globe was severely injured, any repairing procedure could not be performed. After the evisceration of the globe, no sphere was placed because the orbital walls and orbital architecture were seriously damaged. Rigid fixation and reconstruction was performed with mini straight plates of 1 mm thickness to the displaced supraorbital rim by a piece of calvarial autograft, and non-defective fracture of infraorbital rim was also secured with micro straight plates of 0.6 mm thickness (Trimed, Uomed Medikal Ltd., Ankara, Turkey). Conjunctiva was repaired with 7/0 monofilament glycomer (Biocin, Tyco, USA). Following the tars repair, the eyelid was primarily sutured. The patient’s postoperative course was uneventful with a Glasgow Coma Scale score of 15.
DISCUSSION

The anatomical structure of the orbit with its thin walls and inverted pyramidal shape may be a potential gateway to the brain with some foreign bodies.\(^6\) The possible pathways for penetrating the cranium through the orbit are listed as follows: orbital roof, superior orbital fissure and the space between the optic canal and the lateral wall of the orbit.\(^2,7\) In this case, the way of the penetrating object was the orbital roof. Because of the shape and size of the object, orbit and eye globe were severely damaged.

Traumatic transorbital penetrating cerebral injuries may occur by a variety of materials.\(^2,4,5,7,12\) Most of these penetrating materials are simple to identify in cases of external trauma.\(^12\) But in some cases, it may be difficult to diagnose the trauma type and the type of the foreign body which has no obvious external signs. Skull radiography and CT scanning are mandatory in all patients with orbitocranial penetrating injury to distinguish the penetrating material properly. In addition, magnetic resonance imaging (MRI) and ultrasonography seem to be important imaging modalities in diagnosis of some foreign bodies such as wooden materials, which could not be seen in skull radiography and CT scanning.\(^6,11\) In our patient, external signs of the injury were very obvious, so skull radiogram and CT scans were satisfactory to evaluate both bony and parenchymal structures.

The potential complications due to transorbital cerebral injury may be related to the size, shape, structure and entry angle of the penetrating object as well as the severity and mechanism of injury. Intracranial hemorrhage, major vessel injury, visual disturbances, globe injuries, focal neurological deficits, cranial nerve injuries, cerebral contusion and edema, hydrocephalus, seizures, central nervous system infections, cerebrospinal fluid (CSF) fistulas, arteriovenous fistulas and intracranial aneurysms may develop as early or late complications.\(^12,13\) In our patient, left orbit and eye globe were severely damaged. The bony structures were repaired with plates and the globe was eviscerated. In the early postoperative period, he did not develop any neurological deficits or complications related to injury or surgery.

The aim of the surgical intervention in transorbital penetrating injuries is to remove the foreign material
totally because any retained fragments may lead to dangerous infectious complications.10 The object was totally extracted in this case and the control CT scan did not show any residual fragments of the grinding wheel. We did not use MRI as an imaging modality because the structure of the penetrating material was radio-opaque, however, it can be easily seen on CT scan.

Improperly using grinding wheels can be dangerous and grinding wheels should be mounted as rigidly as possible. The wheel guard is designed to prevent serious injury to the operator in the event of wheel failure and should not be modified in any way. Improper mounting, imbalance, improper storage or age, mismatched speed ratings, exposure to freezing, humidity and extreme temperatures may cause grinding wheel failures such as wheel breakage.14 Although our patient did not remember the mechanism of injury, it seemed to be due to wheels blow-up while he was working without wheel guard and face shield. Although most of the transorbital cerebral injuries occur accidentally, especially in children and elderly patients who fall on sharp objects carried in their hands previously, some occupational accidents may also occur as we described in this report. In conclusion, some occupational accidents leading to orbitocranial penetrating injuries can be easily prevented by improving the safety precautions and instructions of working equipment.

REFERENCES


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