

## NEUROSURGICAL MANAGEMENT UNCOMMON TRANSORBITAL PENETRATING BRAIN INJURY IN CHILDREN

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**Key words:** Transorbital penetration ■ Brain injury ■ Treatment.

**Objective** – To evaluate the optimal neurosurgical treatment of rare paediatric transorbital penetrating brain injuries. **Case report** – A 6 year-old male patient was admitted to the Department of Emergency Medicine of Zenica Cantonal Hospital, Bosnia and Herzegovina, because of an injury to the right eye caused by a knife. The patient was fully conscious, oriented, hemodynamically stable and without any neurological deficit and with a Glasgow Coma Scale score of 15. Computed Tomography showed a knife blade entering the right orbital roof and the medial part of the right frontal lobe, with an underlying tract hematoma. The patient underwent bifrontal craniotomy. The knife was removed carefully. There were no signs of vascular or related injuries on the trajectory. After surgery, the eye was examined by an ophthalmologist. The patient recovered fully and was discharged about ten days after surgery. **Conclusion** – Early surgery with a multidisciplinary approach is indicated in patients with transorbital penetrating brain injury to prevent serious complications. The outcome depends on the type of object, the point of entry, the trajectory, the extent of parenchymal injury, the presence of vascular injury, adequate dural closure and septic complications.

### Introduction

Transorbital penetrating brain damage is very rare, and there are few reports in the literature. (1). These injuries may cause significant damage to the optic nerve, eyeball and neurovascular structures (2). These injuries are associated with a high risk of vascular injury, infection, seizures and cerebrospinal fluid leakage (3). The aim of surgery consists of debridement and removal of the retained foreign fragment. This is important to prevent potentially fatal complications (4).

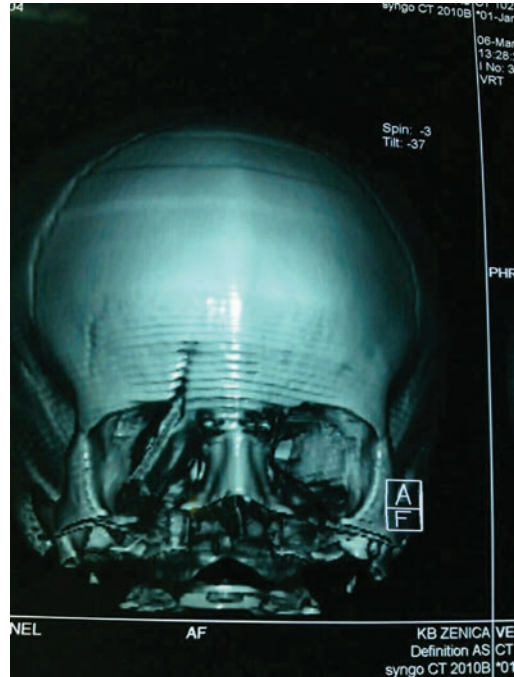
The aim of this report was to evaluate the optimal neurosurgical treatment of rare paediatric transorbital penetrating brain injuries.

### Case report

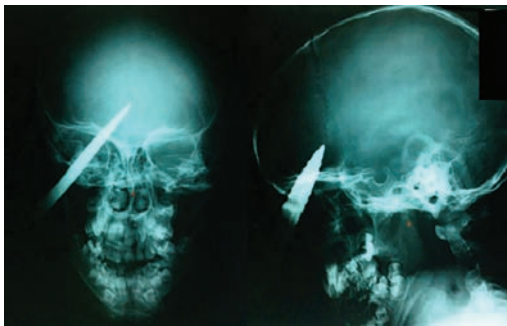
A 6-year-old male patient was admitted to the Department of Emergency Medicine of Zenica Cantonal Hospital, Bosnia and Herzegovina, for an injury to the right eye caused by a knife. His medical history indicated that the patient had been playing with the knife and fell on it. The patient was fully conscious, oriented, hemodynamically stable and without any neurological deficit, and with Glasgow Coma Scale score (GCS). The right eye was not available for ophthalmological examination. Local examination showed the knife handle on the medial epicanthus of the right eye (Fig. 1).



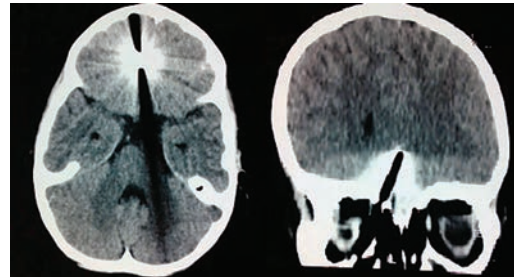
**Fig. 1** Knife on the medial epicanthus of the right eye.



**Fig. 3** CT scan of the knife entering the orbit through the medial part of the right superior eyelid.



**Fig. 2** Skull radiograms of the knife penetrating into the cranium through the medial part of the roof of the right orbit.



**Fig. 4** CT scans of the knife that extended to the interhemispheric fissure.

After diagnostics, the patient was cleared for emergency surgery. The laboratory findings were within reference values (Cell-Dyn Ruby, IL 60064, USA, 2013). Conventional skull radiograms in anteroposterior and lateral views (X-Ray Siemens Opti 150/30/50C-100, Model No. 1161525, SiemensRohre/Tube Model No. 1184696) showed a knife penetrating about 4 to 6 cm into the cranium through the medial part of the roof of the right orbit (Fig. 2).

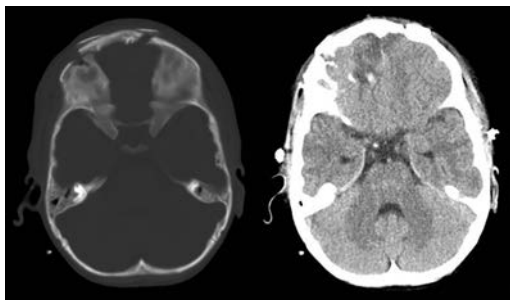
Computed Tomography (CT) (Siemens Somatom Definition AS 1021-012-210 746) showed a knife entering the orbit through the medial part of the right superior eyelid. The globe was displaced laterally (Fig. 3).

The CT also showed that the knife had passed through the right orbital roof into the medial part of the right frontal lobe, with underlying tract hematoma. The knife extended to the interhemispheric fissure (Fig. 4).

The patient was given antibiotics and antiepileptic prophylaxis in the preoperative period.

## Surgery

After initial emergency management, the patient was cleared for surgery. We performed combined surgery with neurosurgeons and ophthalmic surgeons. The patient underwent bifrontal craniotomy. The frontal dura was incised to the midline. The anterior part of the superior sagittal sinus was ligated and cut off at the cerebral falx. After careful preparation of the right frontal lobe the knife blade was shown. The knife blade had passed through the base of the anterior cranial fossa into the right frontal lobe. To release the knife we removed a small part of the orbital roof using



**Fig. 5** CT after surgery showed a small contusion in the frontal lobe without any significant intracranial haemorrhage.



**Fig. 6** The patient after one year, at the follow up examination, fully recovered without any complications.

a high speed drill. The knife was removed carefully. There were no signs of vascular or related injuries along the trajectory. The basal dural defect was reconstructed with a pericranial flap, and the dural opening was closed in a watertight manner. After surgery the patient was transferred to the Intensive Care Unit. He was fully conscious, oriented (GCS 15), without any neurological deficit. The eye was examined by an ophthalmologist. Ophthalmological finding: VOD 0.7; VOS 0.7; Intraocular pressure: normotonic; Cover test: negative; Regular movement of eye socket. The next day a control CT was performed, which showed a small contusion in the frontal lobe, without any significant intracranial haemorrhage (Fig. 5). The patient recovered fully and was discharged about ten days after surgery. The patient had a one-year follow up examination. He had fully recovered without any complications (Fig. 6).

## Discussion

In this paper we present a rare penetrating brain injury (PBI) caused by a knife. In the present case the knife had penetrated through the orbital roof into the frontal lobe, without causing any significant intracranial haemorrhage or eye injury. We did not perform angiography because there was no suspicion of vascular injury. The patient was treated surgically and we did not notice any complications in the postoperative period.

Penetrating brain injury is a rare, but serious clinical condition. PBIs are associated with significant mortality and morbidity (5). PBI accounts for 0.04% of all head trauma (6). Medical reports of PBI date from as early as 1806 (7, 8). These injuries are classified as high and low velocity types. In civilian accidents the most common type of PBI is low velocity (9, 10). In the most common cases these injuries are caused by toys, pencils, stones, wooden sticks, bicycle brake handle, chopsticks, umbrella ends, thumb tacks,

tooth brushes, crochet hooks, etc. Only a few cases of PBI caused by a knife have been described (11). Penetration most commonly occurs through the thin bones of the skull such as the thin orbital roof and temporal bone (12). The best imaging modality for evaluating a TBI injury is a non-contrast cranial or maxillofacial CT scan. If there is suspicion of vascular injury, an angiography should be performed (13). Prophylactic antibiotics, anti-tetanus protection and anti-epileptics are important to prevent complications of PBI (14, 15). The most common serious complication of transorbital PBI include persistent CSF leakage and consecutive meningitis, orbital cellulitis, orbital or cerebral abscesses, encephalitis etc. The late vascular complications include carotid-cavernous fistulas, venous sinus thrombosis and false aneurysm formation (16, 17). The goals of surgery are to remove the penetrating foreign body, to remove necrotic tissue, evacuation of haematomas, meticulous haemostasis and watertight closure of the dura to prevent CSF leakage (18, 19). Only one other case of a PBI in a child caused by a knife, with full recovery and without any loss of vision, has been described in the literature (20).

## Conclusion

PBIs are very rare, but serious injuries, with significant mortality and morbidity. To the best of our knowledge, only one other case of PBI caused by knives in children has been described in the literature. Ours is an example of a rare case of PBI that illustrates its scientific significance and is an example of how to treat patients with PBI. Early surgery with a multidisciplinary approach is indicated in patients with PBI, to prevent serious complications. The outcome depends on the type of object, the site of entry, the trajectory, the extent of parenchymal injury, the extent of vascular injury, if any, adequate dural closure and the absence of septic complications.

**Authors' contributions:** Conception and design: AM and HB; Acquisition, analysis and interpretation of data: AM, HB, and RS; Drafting the article: AM; Revising the article critically for intellectual content: AM, HB and RS; Approved final version of the manuscript: AM and HB.

**Conflict of interest:** The authors declare that they have no conflict of interest.

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