

**Case Report**
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## Transorbital Penetrating Intracranial Trauma with a Pen. A case Report

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### ABSTRACT

Intracranial injury by penetrating foreign bodies through the eye socket is an unusual form of traumatic brain injury. Postoperative complications, such as meningitis, bleeding and brain abscess are some of the most common in these rare cases. In this study, we are reporting a case of a 54-year-old man who stuck a pen in his left eye socket with the aim of committing suicide. The patient arrived via emergency with clinical manifestations of hemiparesis and ophthalmoplegia, CT scan was performed which showed the presence of a foreign body (a writing pen) in the projection of the left orbit, the course of which crosses the apex of the orbit and the basal part of the brain (without displacement of medial structures) penetrating the upper part of the left cerebellar hemisphere. After successful extraction, the patient was in our neuro-intensive care unit for a period of 3 days. The patient was prescribed intravenous administration of broad-spectrum antimicrobials, but 5 days after the injury, developed secondary bacterial meningitis so it was decided to change the antibiotic therapy. After 12 days of admission, the patient presented a noticeable improvement while his relatives asked for discharge at their request and, 3 weeks later the patient is readmitted with symptoms of hydrocephalus. In the control CT, can be seen a marginal lamellar fracture in the apex of the left orbit, accompanied by purulent meningitis and post-traumatic occlusive hydrocephalus.

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### Introduction

Penetrating injuries of the skull base caused by foreign bodies are relatively uncommon, representing only about 0.4% of head injuries [1-7]. There have been few reports in the literature of transorbital penetrating wounds from a non-rocket low-velocity object; these incidents are usually caused by violence, accidents, or suicide attempts, the foreign bodies reported including wood, bamboo, metallic fragments, and toothbrushes.

Injury may be initially asymptomatic, but serious events can occur several days, months, or even years after the injury [2]. There is no diagnostic and therapeutic algorithm for its treatment.

Here we report a case of a 54-year-old man who inserted a pen into the left orbital cavity with the aim of suicide. Clinical manifestations in the form of hemiparesis and ophthalmoplegia with the subsequent development of secondary purulent meningitis and post-infectious occlusive hydrocephalus.

### Case Presentation

#### Materials and Methods

The patient's record and radiological images (Figures 1) were

carefully analyzed before booking the procedure. Patient was admitted to our neurosurgery department in an emergency order, delivered from the courtroom. He did not complain due to the severity of the condition. It is known that 1 hour before admission to the hospital during the court session, he defiantly hit himself with a ballpoint pen in his left eye with the aim of suicide.

On the examination: a foreign body (a writing pen with metallic ballpoint) is located medially in the area of the left orbit, immersed in the cranial cavity by about 10-12 cm, the left eyeball is compressed, left pupil dilated, no external bleeding is visualized (Fig. 1A).

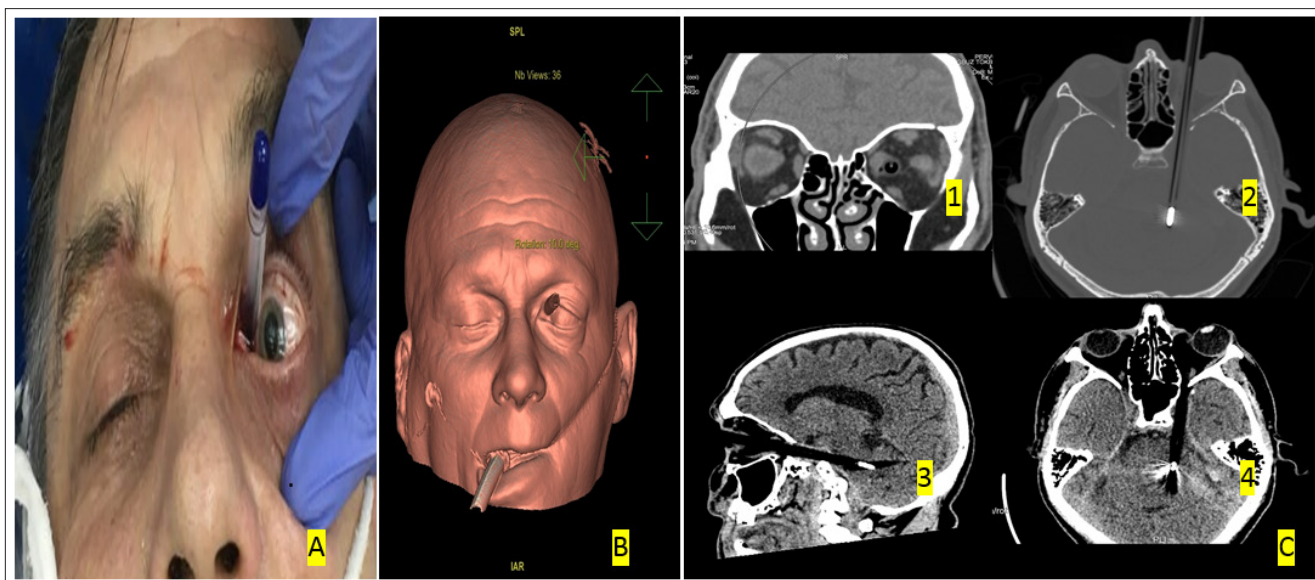
Neurological status: At the time of admission, the patient arrived at the emergency room in critical condition: Glasgow coma scale, 8 points; right hemiplegia; Pupillary reaction to light absent in left side; Movement of the eyeballs, fixing the gaze to the left side; positive Babinski sign on the right foot; Epileptic seizures none; Pelvic organ function control impaired. Meningeal symptoms: neck muscle stiffness.

A survey was conducted. The CT scan of the head (Fig. 1C) shows the presence of the foreign body in the projection of the left orbit and immersed into the cranial cavity by about 10-12 cm, the course of which goes through the apex of the orbit, the basal part

of the brain with penetration into the upper parts of the cerebellum on the left. The left eyeball is pushed back, however there are no structural changes. Retrobulbar fibers preserve their integrity. The optic nerve is strongly compressed upwards. The muscles of the eyeball do not present changes. In the projection of the basal parts of the temporal region on the left, some blood is determined with an approximate volume of up to 1.0 ml. The median structures are not displaced. In the CT bone imaging window, the marginal lamellar fracture of the apex of the left orbit is determined, diastasis up to 0.3 cm.

Based on the examination data, a clinical diagnosis was made: Penetrating wound of the skull. Severe brain injury with damage to the basal parts of the brain and cerebellum on the left. Foreign body in cranial cavity. Puncture wound of the left orbit with lesion optic nerve. Left lower eyelid hematoma. Ophthalmoplegia left eye.

In the emergency room on a gurney, previous asepsis and antisepsis with preparation of a sterile field in place and in presence of a multidisciplinary team composed by neurosurgery, ophthalmology, and anesthesiology, the foreign body was carefully removed from the orbit, no cranial trepanation was required. The control tomography did not show any foreign bodies or intracranial hemorrhages (Fig. 2).

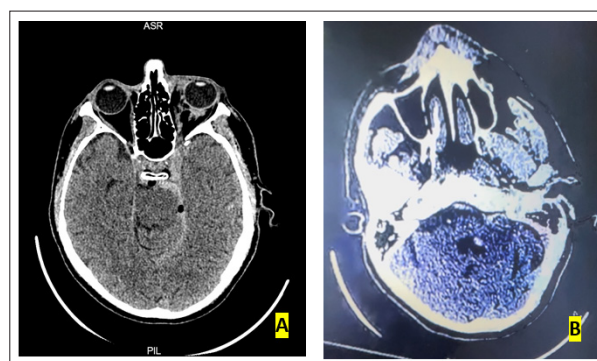


**Figures 1:** Preoperative stage from left to right: (A) Patient at emergency admission, a pen can be visualized into left orbital cavity, left mydriasis present. (B) 3D CT scan of our patient. (C) Non-contrasted CT scan: 1- Coronal slide shows the foreign body penetrating through the nasal side of the left orbit, ocular muscles can be appreciated; 2- Axial projection in bone window, shows the integrity of the left superior orbital fissure. 3- Sagittal and 4-axial slide showing the foreign body (a writing pen with the metallic ballpoint) passing through the superior orbital fissure in the projection of the left orbit, whose course passes through the apex of the orbit and the basal part of the brain, crossing lateral to the brain stem and penetrating the upper part of the left cerebellar hemisphere.

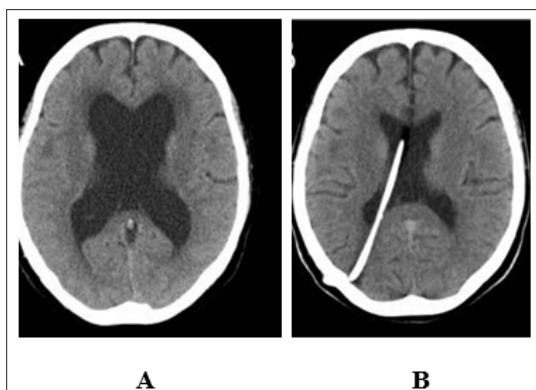
## Results

### Postoperative Care

The patient was in the neuro-intensive care unit for 3 days, was prescribed intravenous administration of broad-spectrum antimicrobials (ceftriaxone), but 5 days after injury, secondary bacterial meningitis was verified and, the antibiotic was changed to Cefepime. There was a positive dynamic against the background of treatment. After 12 days, the patient left the neurosurgery department by request of discharge of his relatives. The patient was re-admitted 3 weeks after discharge with the development of symptoms of hydrocephalus (dementia, impaired approach and pelvic disorders), CT was performed showing hydrocephalus of the lateral ventricles (Fig.3 A). An emergency operation was performed: external ventricular drainage and after that, a planned ventricular-peritoneal bypass surgery was performed (Fig.3 B). At the time of discharge from the hospital, the general condition is satisfactory.



**Figure 2:** Post-operative CT scan control. Axial images showing: (A) the fractured apex of the left orbit and (B) shows that there is no bleeding after the extraction of the foreign body.



**Figure 3:** Preoperative and postoperative CT axial slides on second intervention due hydrocephalus, from left to right; (A) shows hydrocephalus of the lateral ventricles, (B) shows the right placement of the ventricular-peritoneal catheter.

### Discussion

Transorbital penetrating wounds are uncommon; these incidents are usually caused by violence, accidents, or suicide attempts. Self-inflicted penetrating brain damage with a ballpoint pen has been discussed in only a few reports. Due to the low frequency of occurrence of damage to the cranial cavity by foreign bodies through the eye socket among adults with various mechanisms of injury (suicidal attempts or non-compliance with safety regulations at work), individual cases are described in most literature sources. Here we present a unique situation when an adult during the trial took out a ballpoint pen and inserted it into his left eye, a CT scan of the brain revealed the penetration of a foreign body through the left visual canal with damage to the basal parts of the brain and the left cerebellar hemisphere.

CT scans of the brain and face are the main methods used in neuroimaging examination of patients with penetrating intracranial injuries [3]. MRI, since it can be potentially dangerous in cases of retention of ferromagnetic objects due to the possible movement of the object in response to magnetic moment, therefore we do not recommend using it for penetrating brain injuries.

These injuries can lead to serious disability and even death if not treated in time [4]. Therefore, emergency treatment of penetrating transorbital trauma includes rapid neuroimaging examination and knowledge of common repetitive injury patterns.

The authors recommend microsurgical removal of the object in case of transorbital intracranial penetrating trauma with a preserved intracranial object, followed by immediate intervention eyes intervention [5]. Patients with penetrating intracranial injuries and orbital fractures without displacement, without bone fragments and without signs of vascular damage may undergo removal of an externally accessible foreign body without cranial trepanation. However, this process should not be taken as a standard recommendation for the treatment of such situations. Removal of a penetrating foreign body outside the operating room in rare cases can lead to life-threatening bleeding.

The most dangerous among all complications are infectious, the timing of their development, according to different authors, varies from 2 days to 7 years. It is recommended to prescribe broad-spectrum antimicrobials in all cases of penetrating brain damage for at least 7-14 days [6-8, 9]. Our patient has bacterial meningitis and, due to treatment failure, internal occlusive hydrocephalus.

### Conclusion

Intracranial foreign bodies are observed sporadically, and the relevant publications are mainly represented by single observations or small series. In addition, there are no recommendations concerning to diagnostic-therapeutic tactics, possible complications and outcomes in this type of injury.

Radiological diagnostic methods-craniography and computed tomography (CT) are recommended in the diagnosis and emergency care of penetrating wounds of the skull and brain.

In these cases, surgical tactics will depend on the localization and entry point; the location of the foreign body, its size, shape, the presence of abscesses and other possible complications, the approach can be transorbital or transcranial. With minor damage to the eye socket, the foreign body can be removed transorbitally. The most dangerous among all complications are infectious: meningitis, abscesses and post-infectious occlusive hydrocephalus.

### Declarations

Ethics approval and consent to participate: None-required

**Patient Consent Declaration:** Patient's consent not required as patients' identity is not disclosed or compromised.

**Availability of data and materials:** Yes

**Competing interests:** Nothing to declare

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