

PENETRATING ORBITAL TRAUMA – CASE REPORT

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Abstract

Penetrating orbital trauma (POT) includes injuries that affect the structures in the orbit caused by the penetration of an object at a certain speed. Due to the close communication of the orbit with the surrounding cranial structures, a multidisciplinary approach is necessary in the evaluation of these patients.

We present a case of a 42-year-old patient with a penetrating injury in the right orbit caused by a plastic foreign body that occurred during a traffic accident. After evaluation of vital parameters and imaging studies at the Emergency Surgical Center, an ophthalmological examination was performed. Pupil reaction to light was preserved, bulbus, extraocular muscles and optic nerve were intact, without penetration of the object into other cranial compartments. A surgical intervention was performed - extraction of the foreign body, achieved surrounding hemostasis and treatment of the entrance wound. Postoperatively, the patient was treated with local and systemic antibiotic and corticosteroid therapy as well as pain relief therapy. The best-corrected visual acuity of the follow-up ophthalmological examination was 6/6, with preserved bulbar motility, no eyelid ptosis and normal fundoscopic findings.

Keywords: orbital trauma, wound, penetrating injury, foreign body

Introduction

Penetrating orbital trauma (POT) includes injuries that affect the structures in the orbit caused by the penetration of an object at a certain speed. POT accounts for 30-50% of all orbital trauma^[1]. They are more often found in males between 20-40 years of age. Most of the cases are unilateral, caused by traffic accidents, falls, physical attacks or at workplaces with an increased risk of mechanical trauma^[1,2]. The penetrating foreign body can be of organic or inorganic origin. Foreign bodies of organic origin (e.g. wood or bone) should be removed as soon as possible due to the high risk of infection. In contrast, inorganic foreign bodies (e.g. metal, plastic or glass) are at a lower risk of infection, and their removal should take into account their size, sharpness, potential penetration into another cranial compartment, and hemostasis^[3]. Small inorganic bodies can remain undetected intraorbitally and they do not cause inflammation, unlike organic ones that are always accompanied by a strong inflammatory reaction.

The most common place of penetration of foreign bodies is in the upper nasal, followed by the upper-temporal sector of the orbit^[4].

Due to the close communication of the orbit with the surrounding cranial structures, a multidisciplinary approach is necessary in the evaluation of these patients. The most common clinical manifestations are: laceration and edema of the eyelids, proptosis, limited mobility of the eye, suffusion, chemosis, corneal erosion, bulbar rupture or optic nerve injury^[5,6]. The diagnosis is based on the clinical examination complemented by radiological investigations, usually computed tomography.

The main prognostic factor in such cases is the severity of the injury, as well as the nature, size and shape of the foreign body. In general, blunt-edged objects that penetrate at high velocity cause greater entry wound and surrounding structural damage compared to sharps. Treatment consists of surgical extraction of the foreign body, supplemented with local and systemic antibiotic therapy. In the evaluation of such patients, tetanus prophylaxis is also necessary due to the depth of the injury and the contamination of the foreign body^[3].

This paper presents a case of a 42-year-old patient who acquired a penetrating orbital injury with a plastic foreign body that occurred during a traffic accident.

Case report

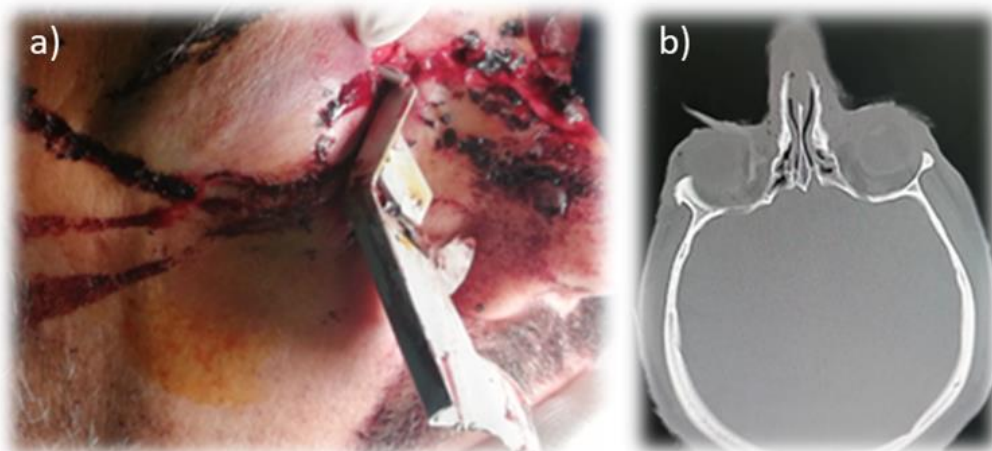


Fig. 1. a) Initial presentation of the patient, b) CT of the head, in the region of the medial part of the right orbital penetrating foreign body

A 42-year-old patient was admitted to the Emergency Surgical Center, University Clinical Center "Mother Teresa" in Skopje, due to an injury that occurred in a traffic accident polytrauma. There was also a penetrating injury of the right orbit with a plastic foreign body present, with an irregular shape and a length of 15 cm. After the vital parameters were evaluated, and computer tomography (CT) was done, an ophthalmological examination was performed (Figure 1). The foreign body penetrated the upper nasal sector of the orbit, transpalpebrally. Moderate chemosis and suffusion of the conjunctiva were observed in the anterior segment of the eye. The cornea and anterior part of the sclera were intact. Pupil reaction to light was preserved. The eye, extraocular muscles, and optic nerve appeared intact on clinical examination and CT features; without penetration of the object into other cranial compartments. The patient was sedated and proceeded to surgical extraction of the foreign body whose penetration reached near the apex of the orbit. After it was removed and control of the surrounding bleeding was achieved, processing and suturing of the entrance wound was performed (Figure 2).



Fig. 2. a) Penetrating orbital trauma, b) operative flow, c) dimensions and shape of the foreign body

Postoperatively, the patient was treated with local and systemic antibiotic and corticosteroid therapy, pain reduction therapy and tetanus prophylaxis. According to the postoperative ophthalmological examination, the structures of the eye were intact. The best-corrected visual acuity was 6/6, preserved motility of the eye in all directions (Figure 3), no ptosis of the eyelid and normal fundoscopic findings.



Fig. 3. The postoperative ophthalmological examination, one day after the intervention, the mobility of the eye in all directions was preserved.

Discussion

Depending on the affected structures, a patient may present with different manifestations. Thus, injury to the extraocular muscles can lead to limited eye movement, tropia and diplopia. Rupture of blood vessels in the orbit can cause retrobulbar hemorrhage, accompanied by periorbital ecchymosis, eyelid hematoma, and proptosis. As a vulnerable structure, the eye often suffers damage in this type of trauma. Starting from traumatic iridocyclitis and hyphema, up to perforation of the bulb and extrusion of ocular tissues into the environment. Incomplete or complete laceration of the cornea and sclera may also be an accompanying finding in POT. The damage to the optic nerve in such cases can occur directly or indirectly. It presents with reduced vision, dyschromatopsia and visual field defects^[5,7]. They usually occur when the foreign body penetrates into the orbital apex and the superior orbital fissure, which results in damage to the neurovascular structures there. Depending on the involved structures, the foreign body in this area

can be presented as: upper orbital fissure syndrome, orbital apex syndrome (vision loss, ptosis and complete ophthalmoplegia), cavernous sinus syndrome, etc.^[6]. Penetration into surrounding intracranial compartments is a possible scenario in such patients.

The management of POT depends on the severity of the injury, the size and type of the foreign body, and the involvement of significant structures such as the brain and eyeball. A multidisciplinary approach is necessary in the evaluation and treatment of those patients. As with any patient with trauma, the principles of advanced trauma support should also be observed [7,8]. A complete physical and neurological examination is necessary to assess the patient's general health and rule out intracranial injury. Further, an ophthalmological evaluation and radiographic imaging techniques are applied. Computer tomography is the first radiographic method in emergency centers, and it is especially helpful in detecting foreign bodies of a metallic nature. Woody foreign bodies are difficult to evaluate with CT, so MRI can help in such cases. In cases where bleeding or vascular injury is suspected, CT angiography or MRI angiography can help clarify the dilemma^[9,10].

Removal of the foreign body should be performed after a complete evaluation of a patient's health status and in a controlled environment and operating room, in order to prevent possible bleeding that could lead to an adverse outcome. Wound debridement is necessary to prevent post-extraction wound infection. Therefore, broad-spectrum systemic antibiotic therapy is also recommended^[11]. The use of corticosteroid therapy can help reduce posttraumatic and postoperative edema, but without a significant impact on improving visual function in patients with traumatic optic neuropathy^[10,12]. Treatment of orbital fractures, if present, depends primarily on the condition and degree of trauma to the eyeball. In cases where the bulbus is intact and where a good recovery of the visual function is expected, it is recommended to repair the orbital fracture as soon as possible.

As a consequence of POT and postoperatively, a large number of intraorbital and extraorbital complications can occur. The following intraorbital complications should be mentioned: retrobulbar hematoma, cellulitis or orbital abscess, bulbus rupture with subsequent retinal ablation, traumatism of the optic nerve, etc. In terms of extraorbital complications, the following are particularly significant: leakage of cerebrospinal fluid due to pathological communication, traumatic aneurysm, cavernous fistula, cerebral abscess or meningitis^[4,5,13]. The risk of developing an abscess or meningitis is higher in foreign bodies of an organic nature. Therefore, early and appropriate removal of foreign bodies in the first 24-48 hours is mandatory in order to reduce the risk of complications and increase the chances of a better outcome.

In our case, the patient was cared for and treated surgically in the first 6 hours after the injury. Postoperative course passed without complications, with gradual healing of the wound and withdrawal of suffusion from the conjunctiva and ecchymosis in the periocular region.

Conclusion

Prognosis in patients with POT mainly depends on the severity of the injury and possible damage to intraocular and intracranial structures. However, timely diagnosis, multidisciplinary approach and appropriate treatment have a great impact on the overall outcome in patients, especially on the prevention of a large number of complications that can occur in this type of trauma.

Conflict of interest statement. The authors declare no conflict of interest.

References

1. Gonullu ME, Filinte GT, Cardak NG, Kucuk S, Akoz T. The Surgical Strategy for the Intraorbital Foreign Bodies. *J Craniofac Surg* 2016; 27(7): 1785-1788. doi: 10.1097/SCS.0000000000002950.
2. Shelsta HN, Bilyk JR, Rubin PA, Penne RB, Carrasco JR. Wooden intraorbital foreign body injuries: clinical characteristics and outcomes of 23 patients. *Ophthalmic Plast Reconstr Surg* 2010; 26(4): 238-244. doi: 10.1097/IOP.0b013e3181bd7509.
3. Amaral MBF, Costa SM, de Araújo VO, Medeiros F, Silveira RL. Penetrating Orbital Trauma by Large Foreign Body: Case Series Study with Treatment Guidelines and Literature Review. *J Maxillofac Oral Surg* 2023; 22(1): 39-45. doi: 10.1007/s12663-020-01392-1.
4. Hoffman JR, Neuhaus RW, Baylis HI. Penetrating orbital trauma. *Am J Emerg Med* 1983; 1(1): 22-27. doi: 10.1016/0735-6757(83)90033-5.
5. Zhang Y, Zhang M, Jiang C, Qiu HY. Intraocular foreign bodies in china: clinical characteristics, prognostic factors, and visual outcomes in 1,421 eyes. *Am J Ophthalmol* 2011; 152(1): 66-73.e1. doi: 10.1016/j.ajo.2011.01.014.
6. Elseyoufi M, Abdel-Ghany H. Penetrating orbital trauma by a large metallic foreign body: A case report, *Oral and Maxillofacial Surgery Cases*, 2023; 9(2): 2214-5419. <https://doi.org/10.1016/j.omsc.2023.100307>.
7. Dehghanpour Barouj M, Tabrizi R, Behnia P, Alizadeh Tabrizi MA, Kheirkhahi M. Penetrating Orbital Injury; a Case Report and Treatment Algorithm. *Arch Acad Emerg Med* 2020; 8(1): e33. PMID: 32259125.
8. Turbin RE, Maxwell DN, Langer PD, Frohman LP, Hubbi B, Wolansky L, et al. Patterns of transorbital intracranial injury: a review and comparison of occult and non-occult cases. *Surv Ophthalmol* 2006; 51(5): 449-460. doi: 10.1016/j.survophthal.2006.06.008.
9. Mzimhiri JM, Li J, Bajawi MA, Lan S, Chen F, Liu J. Orbitocranial Low-Velocity Penetrating Injury: A Personal Experience, Case Series, Review of the literature, and Proposed Management Plan. *World Neurosurg* 2016; 87: 26-34. doi: 10.1016/j.wneu.2015.12.063.
10. Schreckinger M, Orringer D, Thompson BG, La Marca F, Sagher O. Transorbital penetrating injury: case series, review of the literature, and proposed management algorithm. *J Neurosurg* 2011; 114(1): 53-61. doi: 10.3171/2010.8.JNS10301.
11. Taş S, Top H. Intraorbital wooden foreign body: clinical analysis of 32 cases, a 10-year experience. *Ulus Travma Acil Cerrahi Derg* 2014; 20(1): 51-55. doi: 10.5505/tjtes.2014.93876.
12. Magarakis M, Munding GS, Kelamis JA, Dorafshar AH, Bojovic B, Rodriguez ED. Ocular injury, visual impairment, and blindness associated with facial fractures: a systematic literature review. *Plast Reconstr Surg* 2012; 129(1): 227-233. doi: 10.1097/PRS.0b013e3182362a6d.
13. Fernández-Ferro M, Fernández-Fernández M, Fernández-Sanromán J, Costas-López A, López-Betancourt A. Management of a Penetrating Orbital Trauma from an Unusual Foreign Body with Associated Eye Injury. *Ann Maxillofac Surg* 2019; 9(1): 214-217. doi: 10.4103/ams.ams_25_19.