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Please cite this article TRANSORBITAL PENETRATING INJURY OF THE SKULL BASE AND CAVERNOS SINUS – DEFINING A MINIMAL INVASIVE TREATMENT

PENETRANTNA TRANSORBITALNA POVREDA BAZE LOBANJE I KAVERNOZNOG SINUSA – PRIKAZ MINIMALNO INVAZIVNOG TRETMANA

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UDC:

DOI: https://doi.org/10.2298/VSP200529106J

When the final article is assigned to volumes/issues of the Journal, the Article in Press version will be removed and the final version appear in the associated published volumes/issues of the Journal. The date the article was made available online first will be carried over.
Title: Transorbital penetrating injury of the cavernous sinus – defining a minimal invasive treatment.

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Abstract

Introduction. A transorbital intracranial injury with a foreign body can be a very complex and controversial therapeutic problem. The orbit's content is susceptible to penetrating trauma, and neurovascular skull base structures are at high risk from injury. There are some traditional cranial surgical approaches, and more recently reported different endoscopic approaches for treating this kind of injury. Case report. We present a case of a 30-year-old male who had an accident at work when a piece of wood hit him in his head and entered through the medial aspect of his left orbit with skull base and cavernous sinus injury. Rapid and complete radiological and clinical assessments were performed, and the patient was treated in a minimally invasive manner. The foreign body was manually extracted with an endoscopic and endovascular team ready to treat adverse events. No postoperative complications were reported, and visual acuity increased at one month follow up. Conclusion. Penetrating wounds of the orbit represent a challenge that requires a multidisciplinary assessment and well-organized management. Combined endoscopic minimally invasive approaches should be considered during the treatment of this kind of injury.

Key words: extracranial optic canal decompression; head trauma; traumatic optic neuropathy; skull base injury.
Apstrakt

Uvod. Transorbitalna intrakranijalna povreda stranim telom predstavlja veoma kompleksan i kontroverzni terapeutski problem. Sadržaj očne duplje je podložan penetrantnim povredama, a postoji i velik rizik od povreda neurovaskularnih struktura baze lobanje. Postoje tradicionalni transkranijalni hirurški pristupi dok se u poslednje vijesti koriste različiti endoskopski pristupi pri tretiranju ovih povreda. Prikaz bolesnika. Prezentovan je slučaj tridesetogodišnjeg muškarca koji je zadobio penetrantnu povredu leve orbite na radnom mestu sa komadom drveta kao stranim telom, i pri tome povredom baze lobanje i kavernoznog sinusa. Nakon kliničkog pregleda načinjena je brza i kompletna radiološka dijagnostika, a povređeni je nakon procene tretiran minimalno invazivnom metodom. Strano telo je manuelno ekstrahovano uz pripreman endoskopski i endovaskularni tim u slučaju potrebe za tretmanom mogućeg pogoršanja stanja i komplikacija. Do komplikacija nije došlo, a oštrina vida povređenog je se poboljšala na kontrolnom pregledu mesec dana po otpustu. Zaključak. Penetrantne povrede očne duplje predstavljaju izazov koji iziskuje multidisciplinarni pristup i dobro organiziran pristup pri lečenju. Trebalo bi uvek razmotriti kombinovan minimalno invazivni endoskopski tretman ovih povreda.

Ključne reči: dekompresija ekstrakranijalnog optičkog kanala; povreda glave; traumatska optička neuropatija; povreda baze lobanje.
Introduction

Transorbital penetrating injuries present a significant threat not only to orbital but also for major skull base vascular structures and cranial nerves. This type of injury represents a small portion of all head injuries; however, they make up to 24% of penetrating head injuries in adults, and 45% in children. The penetrating injury and foreign body of the orbit can be followed by traumatic optic neuropathy presented by partial or complete loss of visual function. The extent of cerebral injury and skull base injury is related mainly to the size, shape, trajectory, and velocity of penetrating object and orbital bone anatomy. Some injuries may be occult with a smaller foreign object and entry wound, and the foreign body itself may be composed of different materials.

Computed tomography (CT) is most frequently used to assess the head injuries, mainly because of the need for rapid diagnosis and potential metal foreign material in this kind of trauma. The local physical, neurological, and ophthalmic examination must be performed before and after any treatment.

The treatment aims to remove the foreign body while preserving the orbital content. Reconstruction of the skull base relationships, if required, is mandatory with as little secondary injury as possible. Recovery and the functional outcome depend on many factors, the time elapsed after the injury being one of the most important. The range of potential delayed intracranial complications from penetrating orbital injuries is rather broad and includes meningitis, encephalitis, pyogenic abscess, cerebrospinal fluid leakage, traumatic pseudoaneurysm, or carotid-cavernous fistula. In this article, we report successful extraction of wooden foreign body from the orbit with skull base and cavernous sinus injury.

Case report

A 30-year-old male was admitted to the Emergency Department after accidental work injury when a piece of wood hit him in his head, in the region of the superior eyelid. It entered into the medial aspect of his left orbit and became wedged with a massive part visible outside (Figure 1.). He was admitted within one hour after the injury, completely conscious, with a Glasgow Coma Scale score of 15/15. Vision, light reflex, as well as all bulbomotor functions in the left eye were lost. No cornea, lens, or posterior segment damage of the eyeball was present. The numbness into the ipsilateral V1 region was
present, and the rest of the cranial nerves were normal. Other than the entry wound, there were no signs of injury or bleeding. A non-contrast enhanced CT scan revealed a hypodense foreign body localized along the axis of the orbit, between the superior rectus, medial rectus muscles, and the optic nerve. The tip of this piece of wood penetrated the skull base and entered into the anterior part of the cavernous sinus (Figure 2.). A CT angiogram showed no carotid injury, but there were some air bubbles into cavernous sinus itself.

The multidisciplinary team proposed manual extraction of the foreign body in general anesthesia, with the tip of it gently detached from the cavernous sinus and pointed away towards the lateral and caudal side during the extraction process. The immediate postoperative course was uneventful, and the patient was placed on high-dose steroids for optic nerve protection as well as prophylactic antibiotics for three weeks. A control CT scan revealed no significant bleeding and secondary injury (Figure 3.). The patient was discharged home three weeks after his surgery. The left pupil remained nonreactive to light, and facial numbness resolved completely. Visual acuity improved, and all bulbomotors regained their function at one month follow up with good local cosmetic result.

Discussion
Penetrating transorbital injury always represents a complex and controversial therapeutic problem that requires a thorough patient condition assessment. Although these injuries often lead to severe consequences, and before mentioned complications can occur if appropriate surgical intervention is not performed. Traumatic optic neuropathy is one of the most important ophthalmic emergencies, and recovery success depends on the rapid treatment of optic nerve injury and decompression within 8 hours. Standard skull and facial radiographs are not sufficient, and CT studies should include dedicated axial, coronal, and sagittal images. Fractures can be absent when the natural skull base foramina are transversed. The role of angiography is not to be underestimated before the treatment because it is essential to assess the extent of the injury and to rule out carotid dissection, traumatic pseudoaneurysm, cavernous sinus thrombosis or carotid-cavernous fistula. Some traditional and rather extensive cranial approaches to posterior orbit have been described in the literature, and in the last decade, the role of endoscopy to treat the anterior cranial fossa and skull base pathology is continuously evolving. Our multidisciplinary
team from neurosurgery, interventional neuroradiology, anesthesiology, maxillofacial surgery, and ophthalmology planned the best and most minimally invasive way to extract the foreign body. There were two main solutions to this problem, and the first one is pterional craniotomy and direct microsurgical control of the cavernous sinus and potential carotid injury during extraction. The second one, manual extraction itself and, if needed, and subsequent endoscopic examination with local tamponade of the wound. Angio suite was prepared for fast access and endovascular carotid control in case of uncontrolled bleeding during an actual treatment. The endoscope inserted through the wound or additional surgical incision offers good exposure of the orbit and all anterior skull base region, with the possibility of angled vision to important neurovascular structures.

**Conclusion**
Surgical removal of penetrating orbital foreign bodies is a classic example of an interdisciplinary therapeutic approach, where the best outcome is usually the result of rapid intervention and assessing the best approach. Combined endoscopic minimally invasive approaches should be considered during the treatment of this kind of injury.
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Figures

Figure 1. CT reconstruction of patient initial appearance with wooden foreign body penetrated into the left orbit (anatomical view).

Figure 2. Preoperative axial CT scan reveals tip of the foreign body (asterisk) in anterior part of cavernous sinus with some air bubbles consequently in it (arrow).
Figure 3. Postoperative axial CT scan demonstrates complete decompression of the orbit and no additional intracranial hemorrhage in region of cavernous sinus.