Treatment of a Transorbital Penetrating Injury: a Particular Endovascular Approach

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Summary

The management of craniocerebral penetrating injury currently represents a challenge for neurosurgeons and neuroradiologists and requires innovative planning. This report describes the case of a worker admitted to hospital with an intracranial piece of concrete-cutting saw stuck through the right eye. At the time of admission the patient was conscious and this fact influenced the choice of a particular approach. This patient escaped without neurological deficit or complications, except for the inevitable removal of an eye.

Introduction

Head injury is extremely common: about a million patients visit accident and emergency departments each year with head injuries¹. However, transorbital orbitocranial penetrating injuries (TOPI) are relatively rare².

Workplace injuries, along with traffic accidents, assault, and battery, are deemed to be the most common causes of oral and maxillo-facial injuries³. Head injuries may be broadly stratified using the Glasgow Coma Scale (GCS) according to their severity¹. Eighty percent are classified as mild (GCS 13-15), 10% are moderate (GCS 9-12) and the remainder are severe (GCS 3-8)⁴.

We describe the case of a 42-year-old man admitted to hospital with an intracranial piece of concrete-cutting saw (measuring 12 cm × 7 cm) stuck in his face. The patient was conscious at time of admission. The foreign body (FB) was removed after occlusion of the ca-

rotid arteries with balloons and bleeding was then treated by coils.

Case Report

A 42-year-old construction worker was admitted to the emergency department in October 2010. A metallic plate of 12 × 7 cm was found embedded in the orbito-frontal region. He was working near a colleague who was using a circular concrete-cutting saw. Suddenly, the circular saw broke off, and a metallic piece flew outward, hitting the patient.

On admission, the patient was conscious (GCS of 15) and neurological examination did not reveal any motor or sensory deficit. The right eye showed exophthalmos. However, the patient rapidly deteriorated neurologically (GCS 13). Considering the type of intervention, we decided that the patient required intubation and assisted ventilation. The patient at the time was bradycardic but was responsive to atropine administration. Laboratory tests showed an increase in PCO₂ (60.2 mmHg) and pO₂ (161 mmHg) and blood glucose (204 mg / dL). The other parameters were normal.

Computed tomography (CT) scan of the head and face disclosed a FB, which penetrated the right orbital region, directed antero-posteriorly and from right to the left, and penetrated the parenchyma of both frontal lobes. The parenchyma was difficult to assess due to the artifacts of the foreign body. There was a concomitant fracture of the maxillary sinus and of the orbital right walls. (Figures 1 and 2).

The patient underwent cerebral angiography.

Figure 1 X-Ray view with the intracranial foreign body (FB).

Figure 2 CT scan before removal of the FB. Note the presence of the FB and some artifacts.

Figure 3 Angiography before removal of the FB did not show any bleeding.

Figure 4 After removal of the FB and inflating balloon angiography did not show bleeding.

Balloon angiocatheters (Merci Balloon Catheter 8F 5.9 Fr 10×10 mm L=95 cm) were positioned at the origin of both carotid arteries using an anterograde route through the femoral arteries. The preliminary study did not reveal angiographically-demonstrable active bleeding. The frontopolar branch of the right anterior cerebral artery was interrupted and the flow was slowed. Then a microguide was inserted into the right anterior cerebral artery and a bal-

loon (CONCENTRIC kit with occlusive balloon microcatheter and guide hyperglide TM 10" 4×20 mm, ev3) was positioned through the right carotid siphon in the A1 segment of right anterior cerebral artery. The balloons were inflated to occlude cerebral flow completely.

After removal of the FB, angiography showed massive bleeding from the frontopolar branch of the right anterior cerebral artery. The balloons were then inflated to stop the hamor-

Figure 5 After removal of the FB and deflating balloon, the angiography showed bleeding.

Figure 6 Positioning of coils to embolize bleeding vessels.

Figure 7 At the control after removal of the FB, angiography did not show bleeding.

Figure 8 Control CT scan after removal of the foreign body showed the presence of coils and a hematoma.

rhage, for the time necessary to remove the FB. The bleeding branch of the frontopolar artery was identified through tests of deflation and was embolized with two detachable coils (1.5 mm × 2 cm Axium Helix Coil, eV) (Figures 3-5). To prevent the risk of clotting we administered 5000 UI of heparin (PHAREPA 5000 UI/1 ml). The bleeding was resolved, except for a branch of the right ophthalmic artery. In agreement with the neurosurgeon, this bleeding was con-

sidered irrelevant. The embolization was not performed in prediction of an evaluation of the eye condition and its possible rescue.

Later, the patient underwent a decompressive craniotomy as a hematoma occurred.

Finally, the patient underwent a third intervention where the right eye had to be eviscerated and maxillofacial reconstruction was performed. Then the patient was moved to the intensive care unit.

The postoperative course was uneventful. Repeated neurological examinations resulted within normal limits (Figures 6-8).

Discussion

Penetrating injuries are an uncommon but complex type of trauma. Sometimes the aetiological noxa is withheld in the tissues penetrated during trauma, thus determining diagnostic, cosmetic and functional problems. Generally, the penetrating material is stiff enough to cross through different anatomic structures during a particularly violent collision caused by road or work accident or during an attack. The clinical situation of penetrating injuries may be accompanied by various pathologic conditions such as bone fractures, vascular lesions or neurologic deficits¹. Besides neurological deficits (depending on the injured area), seizures, CSF leaks, and cerebral infections are the most common complications occurring after a penetrating head injury. Infections with a broad spectrum of causative organisms may commonly develop three to six weeks after a trauma. To prevent any postoperative infections, wide spectrum antibiotic therapy is recommended⁴. Treatment of transorbital penetrating injury aims immediately to save a life through control of persistent bleeding and intracranial hypertension, prevention of infection through debridement of all contaminated and necrotic tissues, preservation of as much nervous tissue as possible, and restoration of anatomic structures through accurate closure of the dura and scalp¹. Currently, surgical management of these lesions tends towards minimizing the degree of debridement, preserving as much cerebral tissue as possible, and removing the bone fragments and foreign body if easily

accessible. It is crucial to prevent the foreign body from involuntary movement otherwise it can enlarge the damaged area. Early surgical exploration is likely to be successful in cases of retained foreign body. A transorbital or transcranial approach can be chosen depending on the location of the fragment. We believe that after adequate resuscitation, the goal of surgery is safe removal of the object without further damage to the brain, debridement of bone fragments, hair and other debris from the brain, evacuation of haematoma, meticulous haemostasis, removal of devitalized brain with preservation of all viable brain tissue, and appropriate repair and closure of the dura and scalp wound⁶. Another severe complication in these interventions is due to massive bleeding after removal of the FB. Since usually we operate in a hybrid operating room, we are often in contact with vascular surgeons and neurosurgeons. In this case, according to the neurosurgeons we chose this technique. This fact allowed us to work quickly and in a coordinated way. We catheterized the carotid arteries with balloons and, while we inflated them, we removed the piece of saw. After that we embolized the bleeding arterial branching with detachable coils to stop haemorrhage. This is a new way to approach this type of injury as in literature we found no cases where this procedure was used. As we do not work in a large hospital, we have the opportunity to collaborate effectively with other specialists such as neurosurgeons, neuroradiologists, vascular surgeons, etc. to decide the appropriate treatment. In our opinion this intervention minimized bleeding during the removal of the FB. Considering the good condition of the patient and the absence of complications during the follow-up, in our opinion this method is an effective treatment for this type of trauma.

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