Case Report

Craniofacial Impalement Injury: Projectile Fragment to the Head

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Abstract

Circular saws and angle grinders are two of the most dangerous pieces of electrical equipment on a worksite. Besides the danger that any high-powered, sharp piece of equipment possesses, these pieces use circular saw blades that can splinter into projectile fragments. A 60-year-old male was cutting a steel pipe with a circular saw when a fragment of the 12-inch blade flew off, impaling him in the upper face just to the right of the midline. He was wearing eyeglasses, the bridge of which was driven into his skull on impact of the fragment. He was brought to the trauma center where he underwent imaging of his face and head. This revealed that the blade and his glasses had penetrated 1.2 cm into the right frontal lobe of the brain, resulting in facial fractures and intraparenchymal hemorrhage. He underwent bifrontal craniotomy, removal of the blade and his glasses, evacuation of hematoma, and dural reconstruction. Postoperatively, he was awake with a Glasgow Coma Scale of 15 and no neurologic deficits. The complex nature of craniofacial injuries makes a multidisciplinary approach to these patients essential. Prompt diagnosis and treatment by the appropriate specialists are vital to optimize patient outcomes.

Keywords: Brain injuries, cranial trauma, craniocerebral trauma, head injuries, head trauma, missile, missile injuries, penetrating

Introduction

Impalement injuries to the craniofacial region are rare injuries that often result in significant morbidity and mortality. It is estimated that there are 1.7 million traumatic brain injuries (TBIs) of all causes annually in the United States, with 275,000 hospitalizations and 52,000 deaths, and this incidence has been increasing.[1] Males are twice as likely as females to suffer from these injuries.[2] Penetrating injuries are the leading cause of mortality in TBI, accounting for 40% of deaths, with most of these being due to gunshots.[3] While gunshots are the leading cause of death from TBIs, the incidence of impalement injuries is not recorded because they are so rare.

A high clinical suspicion of intracranial pathology with appropriate workup and treatment is needed to optimize patient outcomes with impalement injuries. These injuries often affect the torso or extremities due to the larger surface area and ease at which these objects can penetrate. The head and face, however, have a smaller area with protective reflexes to move away from these objects, usually sparing or minimizing injury.[4] Impalement injuries to the craniofacial region are best cared for at centers that can provide specialized surgical services that are comfortable with severe maxillofacial trauma with a concomitant traumatic brain injury.

Case Report

A 60-year-old male was using a circular saw when a fragment of the 12-inch blade broke off, impaling him in the upper face just to the right of the midline [Figure 1]. He was wearing a pair of eyeglasses, the bridge of which was driven into his skull on impact of the fragment. He remained awake and alert on arrival. After evaluation, he underwent a CT scan of his head and face. This revealed a fracture of the anterior and posterior walls of the right frontal sinus, the ethmoid sinus, and the nasal bone, with the blade and his glasses penetrating 1.2 cm into the right frontal lobe of the brain [Figure 2]. The anterior sagittal sinus was also involved [Figure 3]. It did not penetrate deep

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Access this article online

Quick Response Code:

Website: www.archtrauma.com

DOI: 10.4103/atr.atr_25_18

How to cite this article: Quang CY, Rosal LM, Blair SG, Simmons JD, Rusyniak WG, Brevard SB. Craniofacial impalement injury: Projectile fragment to the head. Arch Trauma Res 2018;7:30-2.

enough to involve the pericallosal or callosal marginal vessels, so we chose to forgo an angiographic study as there was no concern for injury to the anterior cerebral artery [Figure 3].

After neurosurgical and otolaryngological consultation, the patient was taken to the operating theater where a skin flap was raised, and the temporalis muscles were reflected exposing the root of bilateral zygomas. A single burr hole was placed at the root of the zygomas, and bilateral craniotomy was performed up to the level of the saw blade. The saw blade and glasses were removed, and the anterior sagittal sinus was ligated with a nonabsorbable suture, both proximal and distal to the injury. Further hemostasis was achieved using bipolar electrocautery. After thorough irrigation with normal saline mixed with bacitracin, we made sure that we had achieved hemostasis, then placed surgical on the lacerated cortical brain. An intracranial pressure (ICP) monitor was placed, the dura was then reapproximated and covered with DuraGen, and the bone flaps were replaced and secured into place. Postoperatively, he was awake and alert with a Glasgow Coma Scale of 15 and no neurologic deficits. Reimaging was performed on postoperative day 3 after the ICP monitor had been removed [Figure 4]. The patient convalesced well and was discharged to a rehabilitation facility on hospital day 12.

Discussion

Impalement injuries can be the result of gunshots, knives, missiles, shrapnel, and/or work-related accidents. Despite the mechanism of injury, the damage can be quite severe, resulting in permanent disability or death. For hospitalized TBI survivors, it is estimated that long-term disability is seen in 43.3% of this patient population.[5] As of 2008, it was estimated that there were 3.2 million Americans living with disability subsequent to a TBI,[6] with 50% of these being due to penetrating traumas.[7]

Embedded foreign objects from impalement often offer a tamponade effect even when a major vascular injury is present. For this reason, when an impalement injury is encountered, the object should be gently stabilized and only removed in the operating room where massive hemorrhage can be controlled

Figure 1: Perioperative image demonstrating the skin flap site for bilateral craniotomy marked out in purple

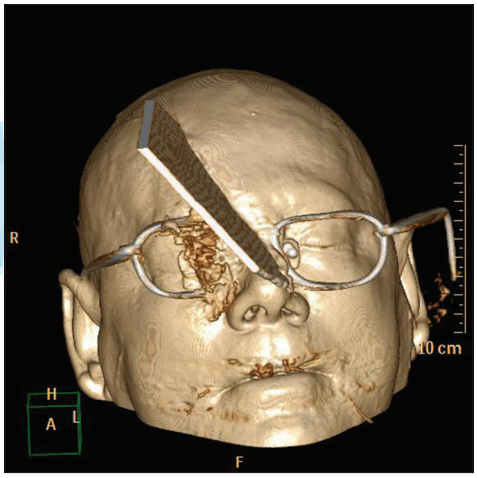

Figure 2: Three-dimensional recontruction of craniofacial impalement

Figure 3: Axial computed tomographic image showing intracranial penetration with associated intraparenchymal hemorrhage

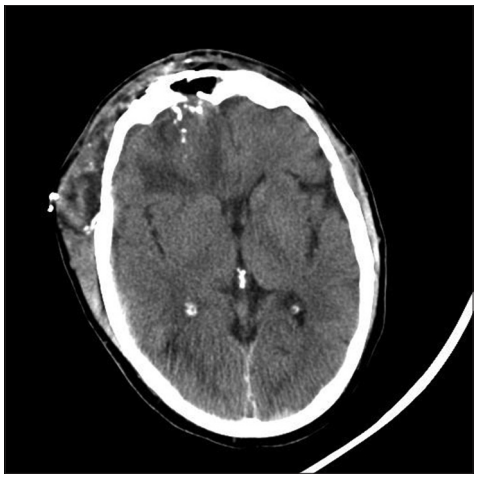

Figure 4: Axial computed tomographic image, postoperative day three after intracranial pressure monitor had been removed

if present to help prevent primary focal neurologic injury from hemorrhage. In our case, the superior sagittal sinus was lacerated with a tamponade effect from the saw blade. As we have previously published, sagittal sinus injuries can be divided into thirds. Anterior sagittal sinus lacerations can be ligated, there is an approximate 50% mortality associated with ligation of the middle third of the sagittal sinus, and 100% mortality associated with ligation of the posterior third of the sagittal sinus.[8] Intubation in the emergency room should be strongly considered if there is any possibility of respiratory distress and/or patient combativeness that could result in dislodgement of the embedded foreign object.

Obtaining radiographic data is a quintessential step in the preoperative evaluation of these patients. Advanced imaging using computed tomography (CT) with three-dimensional reconstruction offers the most useful information when evaluating craniofacial injuries. A noncontrasted CT scan should always be obtained before any angiographic imaging as the contrast can mask or mimic underlying hemorrhage.[9] Concerns for arterial vascular injury should prompt the addition of CT angiography. Even with metallic objects, the most useful data for preoperative planning are gained from obtaining the appropriate CT scan in the hemodynamically stable patient.

The complex nature of craniofacial injuries makes a multidisciplinary approach to these patients essential. Prompt diagnosis and treatment by the appropriate specialists is vital to optimize patient outcomes.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Faul M, Xu L, Wald MM, Coronado VG. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalization and Deaths 2002-2006. Atlanta, GA, USA: Centers for Disease Control and Prevention National Center for Injury Prevention and Control; 2010. p. 1-71. Available from: http://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf. [Last accessed on 2017 Mar 03].
2. Langlois JA, Kegler SR, Butler JA, Gotsch KE, Johnson RL, Reichard AA, *et al*. Traumatic Brain Injury-Related Hospital Discharges: Results from a 14-State Surveillance System, 1997. Washington, DC, USA: Centers for Disease Control and Prevention NCfIPaC, MMWR Surveillance Summaries; 2003. p. 1-18.
3. Adekoya N, Thurman DJ, White DD, Webb KW. Surveillance for traumatic Brain Injury Deaths-United States, 1989-1998. Washington, DC, USA: Centers for Disease Control and Prevention NCfIPaC, MMWR Surveillance Summaries; 2002. p. 1-16.
4. Eppley BL. Craniofacial impalement injury: A rake in the face. J Craniofac Surg 2002;13:35-7.
5. Selassie AW, Zaloshnja E, Langlois JA, Miller T, Jones P, Steiner C, *et al.* Incidence of long-term disability following traumatic brain injury hospitalization, United States, 2003. J Head Trauma Rehabil 2008;23:123-31.
6. Zaloshnja E, Miller T, Langlois JA, Selassie AW. Prevalence of long-term disability from traumatic brain injury in the civilian population of the United States, 2005. J Head Trauma Rehabil 2008;23:394-400.
7. Corrigan JD, Selassie AW, Orman JA. The epidemiology of traumatic brain injury. J Head Trauma Rehabil 2010;25:72-80.
8. Rusyniak WG, George ED. Missile Injures of the frontal and middle fossa. In: Apuzzo ML, editor. Brain Surgery Complication Avoidance and Management. 1st ed., Vol. 2.Ch. 38. New York, NY, USA: Churchill Livingston; 1993. p. 1335-50.
9. Le TH, Gean AD. Neuroimaging of traumatic brain injury. Mt Sinai J Med 2009;76:145-62.