Orbitozygomatic approach for bullet retrieval from the temporal fossa

Su Min Cho, BSc^a , David Cho, DDS^b , Andrew Read-Fuller, DDS, MD^c , and Ivan Vrcek, MD^d

^aTexas A&M College of Medicine, Bryan, Texas; ^bDepartment of Oral and Maxillofacial Surgery, Baylor University Medical Center, Dallas, Texas; ^cDepartment of Oral and Maxillofacial Surgery, Texas A&M College of Dentistry, Dallas, Texas; ^dTexas Eye and Plastics, Dallas, Texas

ABSTRACT

Gunshot wounds involving the periorbital region pose numerous challenges due to the high morbidity related to direct and collateral ophthalmic injury. Additionally, the critical structures of the orbit are often injured, resulting in a variety of serious sequelae. The technique for bullet retrieval is also a special concern, given the limited space in the orbit and presence of critical structures. We present a 34-year-old woman who received a gunshot wound through the right orbit, with the main bullet fragment lodging itself at the junction of the anteroinferior temporalis fossa and the skull base. We retrieved the fragment through an orbitozygomatic approach, where we dissected posterolaterally through the superior orbital fissure to reach the temporal fossa. Several smaller bullet fragments were also extracted along the way to the temporal fossa. The orbitozygomatic approach was particularly useful in this case due to the nature of the gunshot wound where the bullet had traversed through the globe and orbit to the temporal fossa. This approach avoided the need for a direct incision, which avoided potential frontal branch injury and further temporalis muscle trauma. It also provided a means to seal the small cerebral spinal fluid leak.

KEYWORDS Bullet; eye; gunshot; oculoplastic; ophthalmology; orbitozygomatic

Gunshot wounds to the face have a reported mortality rate of approximately 15% and morbidity rate of 30%.^{1–3} Injury to the orbit and/or the globe is a particularly devastating finding, with resultant poor visual prognosis and potential serious functional sequelae. Most open globe injuries can be repaired without the need for primary enucleation, but severe globe ruptures with significant loss of tissue or disorganization of the globe ultimately require either an evisceration (removal of intraocular contents while keeping the scleral shell) or enucleation.⁴ In addition, extraction of the projectile fragment can cause challenges. With the bullet lodged within the face/head, prompt surgical removal is necessary to debride the damaged tissue, repair the nearby structures, and allow for a cosmetically pleasing recovery. The surgical approach necessary to retrieve the bullet is highly dependent on the trajectory of the bullet. Here we present a case where an orbitozygomatic approach was used to extract a bullet lodged near the base of the anterior temporal muscle fossa.

CASE PRESENTATION

A 34-year-old black woman presented with trauma to her right eye as the result of a gunshot wound. The night before, she had presented to the emergency room with a gunshot wound to the abdomen that required immediate exploratory laparotomy with subsequent resection and anastomosis of small bowel segments. Examination showed significant swelling on her right orbit, with a laceration superonasal to the right upper eyelid, which had been sutured by general surgery. A piece of cornea was seen attached to a piece of sclera, protruding between the lids with significant hemorrhage. The right eye was grossly disorganized. Computed tomography scan of the orbit revealed a sequela of ballistic injury to the right orbit, with numerous bullet and bone fragments within the right orbit, rupture of the globe, stretching of the optic nerve, edema/hemorrhage within the extraocular muscles, and fractures involving all the walls of the right orbit (*Figure 1*). The right globe was deemed unsalvageable, and oculoplastic surgery was consulted for ballistic fragment retrieval, enucleation, and orbital reconstruction.

Corresponding author: Ivan Vrcek, MD, Texas Eye and Plastics, 9301 N. Central Expressway, Dallas, TX 75231 (e-mail: ivan.vrcek@gmail.com)

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Figure 1. (a) Anterior-posterior radiograph, (b) lateral radiograph, and (c) computed tomography scan showing a bullet fragment lodged on the anteroinferior temporal fossa and a ballistic injury to the right orbit.

Figure 2. Retrieval of the main bullet fragment via the orbitozygomatic approach.

Exploration of the globe showed an apparent entry wound from a high-velocity projectile in the medial corneoscleral limbus that seemed to track through the globe superolaterally toward the anteroinferior temporal fossa. A 360-degree peritomy was performed, after which we isolated the rectus muscles and tagged them with 5-0 Vicryl sutures. The rectus muscles were then disinserted from the globe. We severed the optic nerve and extracted the globe. We began our exploration toward the orbital apex and temporal fossa in order to identify the foreign body. The trajectory involved a course directly through the superior orbital fissure. Small metal fragments were encountered and removed to be sent over for histopathologic analysis. We then dissected posteriorly to the orbital apex using an orbital zygomatic

approach to the anteroinferior temporal fossa. We found that the high-velocity projectile had lodged itself near the base of the temporal muscle fossa and the anterior cranial fossa. Some cerebrospinal fluid leakage was noted. We carefully removed the foreign body while taking care to preserve the normal anatomy and avoid violating the dura as much as possible (*Figure 2*).

We sealed the cerebrospinal fluid leakage by packing it with fat. We subsequently reconstructed the fracture in the posterior orbit in preparation for an orbital implant insertion to take the place of the globe. We used a 1.0-mm-thick Medpor Titan barrier implant to reconstruct the posterior and superior aspects of the orbit as well as the orbital apex. The posterior orbit reconstruction was especially necessary to prevent the orbital implant from sinking back into the space behind the orbit and possibly coming in contact with the skull base. In addition, it was critical to re-create the normal volume of the orbit. We inserted a 22-mm acrylic implant into the muscle cone and attached each of the rectus muscles to the implant by sequentially suturing them using 5-0 Vicryl. We then closed the Tenon's and conjunctiva and placed a robust suture tarsorrhaphy. The patient tolerated the procedure well.

DISCUSSION

In this case, the bullet had traversed through the right globe and lodged at the anteroinferior temporal fossa at the junction with the skull base. The right globe was severely traumatized and disorganized and was not salvageable. Several approaches were entertained to access the large (2-cm) bullet fragment. One option was to create a direct incision in the temporal region to access the projectile. This would have

resulted in additional surgical site morbidity as well as potential damage to the temporalis muscle and frontal branch of the facial nerve. Instead, we opted to use an orbitozygomatic approach to the anterior cranial fossa and temporalis fossa.

The main fragment could have been removed through numerous approaches. For example, surgeons can effectively extract a bullet from the infratemporal fossa via a preauricular incision with temporal extension and temporalis muscle reflection.⁵ Most surgeons would likely utilize similar approaches when attempting to extract a bullet on the temporal fossa due to the proximity between the incision and the target. However, our case was complicated by the fact that the bullet had first gone through the orbit before reaching the temporal fossa. The bullet had caused extensive internal damage on the way to the anteroinferior temporal fossa. Hence, the orbitozygomatic approach was necessary to follow along the path of the bullet and extract all of the small bullet fragments, bone fragments, and damaged tissue along the way to the main bullet body. The orbitozygomatic approach allowed for a more thorough visual investigation of the path of damage. The preauricular incisional approach, though effective in removing fragments near the temporal fossa, would have posed some difficulties in removing the smaller fragments along the bullet path in this case.

This case required a thorough understanding of the anatomy of the orbit and the surrounding structures. Dissection

and exploration posterolaterally from the orbit toward the temporal fossa required care and precision to avoid damaging residual surviving vessels, muscles, and nerves. We advocate the consideration of the orbitozygomatic approach in select cases, particularly those in which there is significant orbital trauma.

ORCID

Su Min Cho <http://orcid.org/0000-0002-8959-3564>

David Cho <http://orcid.org/0000-0002-5244-1014>

Andrew Read-Fuller <http://orcid.org/0000-0001-8443-0873>

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