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Radiology

A 14-Year-Old Child with Craniofacial Injuries Caused by Traumatic Gunshot

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Abstract **Case Report**

Ballistic trauma is an injury resulting from the impact of a projectile on the body. Gunshot wounds to the head are among the most lethal. Although they were rare in civilian practice, their incidence has increased in recent years in the civilian population due to the resurgence of armed conflicts and terrorism. Severe firearm-related head injuries in children are very rare and poorly studied; they are most often due to suicide attempts. CT is the imaging modality of choice. It aids in initial management, monitors progression. We present the case of a 14-year-old child admitted for a gunshot injury. The patient was initially hospitalized in the intensive care unit before undergoing initial imaging in our department.

Keywords: Gunshot, wounds of the skull; craniocerebral injuries, projectile, CT.

INTRODUCTION

Gunshot-related cranial injuries are characterized by the impact of a high-velocity projectile. They are severe cranial injuries that endanger life. A CT scan is the essential imaging examination. In an emergency situation, it allows for the initial assessment of traumatic lesions to the bones and brain parenchyma, determines the need for neurosurgical intervention, and helps therapeutic approach. If survival is achieved, CT and magnetic resonance imaging (MRI) are used to monitor progress and detect potential complications, particularly vascular or infectious issues specific to this type of trauma [1].

These injuries are primarily due to suicide attempts, less frequently from assaults or hunting accidents. Characterized by the impact of a high-velocity projectile, they often involve severe cranial trauma with significant morbidity and mortality. As with all cranial trauma, CT is the imaging modality of choice. It aids in initial management, monitors progression, and also has medico-legal implications [1, 2].

CASE REPORT

We present a case study. A 14 year-old male was admitted after suffering a gunshot wound to the frontal lobe. Upon initial evaluation, the patient displayed agonal breathing with a GCS score of 8.

CT imaging showed multiple individual metallic-density foreign bodies within the left frontal and parietal lobe, creating an artifact that complicates the exploration of the remaining parenchyma.

Entrance wound was detected at the level of the left frontal sinus with a complex displaced fracture of both the anterior and posterior walls and associated hemorrhagic sinus, as well as a frontal soft tissue hematoma measuring up to 15 mm in maximal thickness.

Exit wound was found at the left parieto-occipital region with overlapping bone at this level, causing protrusion into the cerebral tissue. with contusion and subarachnoid blood.

Fig 1: image of our patient showing entrance wound

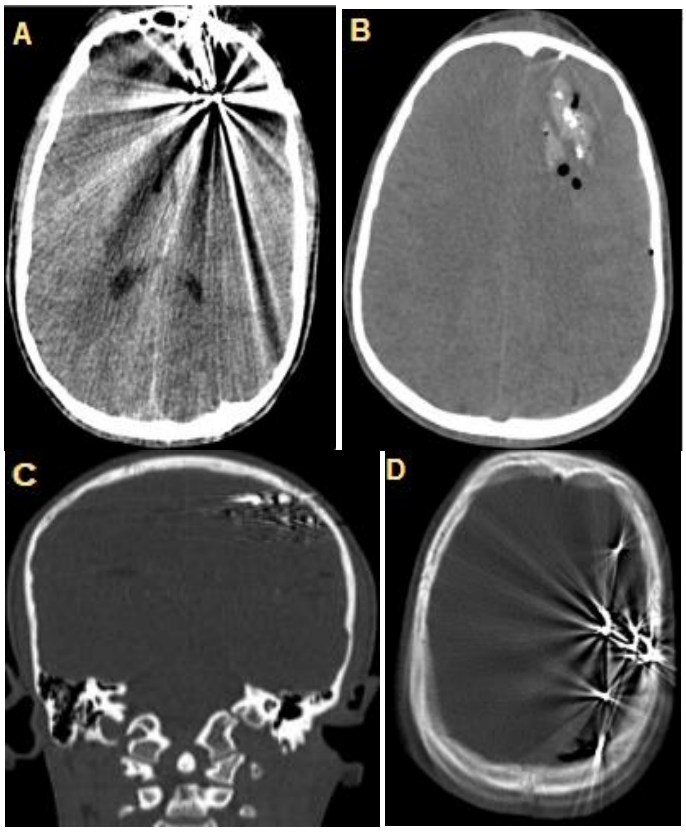

Fig 2: Cerebral CT scan in parenchymal and bone window showing frontal edema-hemorrhagic contusion on the left (B), metallic foreign bodies on the frontal-parietal lobe (A.C.D)

Fig 3: Computed tomography of the skull with 3D reconstruction and frontal projection

The injury was deemed non survivable and non-operable; thus, treatment was primarily supportive, He was hospitalized in the intensive care unit, afterward; the patient underwent surgical treatment with identification of a comminuted frontal depression fracture, creation of a frontal cranial flap, removal of a lead projectile from within the brain, repositioning of the flap. The postoperative care included antibacterial therapy and monitoring by specialists, highlighting the importance of comprehensive management in pediatric trauma.

The patient began breathing spontaneously and improved clinically to a GCS score of 10–12, his neurological status continued to improve.

Fig 4: Stages of surgery, extraction of intra-parenchymal foreign body

DISCUSSION

Entry and Exit Wounds

In gunshot injuries, the presence of both entry and exit wounds helps determine the trajectory of the projectile and the severity of the injury [1, 2].

When there is an entry wound but no exit wound, it is considered a penetrating trauma (with one or more projectiles remaining intracranially); whereas, if there is an exit wound in addition to the entry wound, the trauma is described as perforating. An intracranial entry wound is not necessarily present; it may be a non-penetrating trauma occurring either when the bullet ricochets off the bone or when it becomes lodged in a thick bone that it could not penetrate [5].

Ballistic Trajectory

The topography of the ballistic trajectory helps establish a prognosis for survival [1, 4]. For instance, bitemporal or frontoparietal trajectories generally have a better prognosis compared to transventricular

involvement, which is associated with very high morbidity and mortality [4].

Similarly, bi-hemispheric or multilobar trajectories (extensive involvement), those near vascular structures (with a risk of acute hemorrhage), or in the posterior cranial fossa (where edema has less tolerance on the brain stem) have a poorer prognosis [5].

Michael *et al*., found the ominous implications of deep nuclear/third ventricular injury and transventricular trajectory [1].

Complications

Injury-related complications significantly contribute to morbidity, particularly vascular complications such as vasospasm, traumatic intracranial aneurysm, and venous sinus occlusion, and increasing risk of infection beyond the first week post injury. Cerebrospinal fluid leakage, commonly resulting from dura mater lacerations, was most frequent in orbitofrontal and transtemporal patterns of injury [1].

Infectious Complications: these include infections of the subcutaneous soft tissues, abscesses, ventriculitis, encephalitis, or meningitis, which are often facilitated by the presence of organic debris (such as hair) or clothing materials [3].

Vascular Complications: Traumatic pseudoaneurysms resulting from direct laceration of the arterial wall are suspected when there is a secondary appearance of an intracerebral hematoma.

Less common vascular complications include arterial spasms or arteriovenous fistulas. These anomalies are typically detected using angiography or magnetic resonance angiography (MRA) [4].

Secondary Displacement of the Bullet: The bullet can migrate into the subarachnoid spaces. This movement primarily follows the direction of gravity and is easier when the bullet remains intact (smooth edge providing less resistance to movement). It may also be associated with the development of an intracerebral abscess in contact with the bullet. In cases of displacement, the bullet can cause acute obstructive hydrocephalus due to the blockage of cerebrospinal fluid [3, 6].

Finally, post-traumatic epilepsy is a prevalent complication that can manifest either early or late in patients with firearm-related traumatic brain injuries. These injury-related sequelae contribute to a 2.5 times increased risk of death compared with the general population [6].

CONCLUSION

Ballistic trauma refers to injuries resulting from the impact of a projectile on the body. Gunshot-related cranial injuries are among the most fatal. Although they were rare in civilian practice, their incidence has increased in recent years among the civilian population due to the resurgence of armed conflicts and terrorism.

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