Gunshot wound to the head in pediatric patient. A case report and review of the literature

Herida por arma de fuego en la cabeza en paciente pediátrico. Reporte de caso y revisión de la literatura

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Resumen

Antecedentes: El traumatismo craneoencefálico es una patología grave en todo el mundo. Se ha reportado una incidencia cercana a 200 casos por cada 100.000 personas a nivel global. En Colombia, la carga de lesiones afecta principalmente a la población masculina económicamente activa entre los 12 y 45 años. Las heridas ocasionadas por proyectiles de arma de fuego son frecuentes en la práctica diaria del cuidado neurotraumatológico, siendo reconocida su alta mortalidad. Las heridas por arma de fuego en la cabeza suelen ser fatales y presentan un mal pronóstico neurológico.

Presentación del caso: Este caso describe la presentación de un paciente pediátrico que ingresó a un hospital universitario en Colombia tras sufrir una herida por arma de fuego en el cráneo. El paciente fue admitido en malas condiciones generales, estuporoso, hipotenso y con sangrado activo, presentando una heria por proyectil en la región frontal derecha. El examen neurológico evidenció disminución del estado de conciencia (escala de coma de Glasgow de 4/5), con pupila derecha de 2mm no reactiva y pupila izquierda de 3 mm débilmente reactiva. La tomografía computarizada mostró la trayectoria del proyectil, hemorragia intracraneal, edema cerebral y desviación de la línea media mayor de 10 mm. El paciente fue llevado a cirugía, donde se realizó una descompresión craneal bilateral de las regiones frontal, temporal y parietal con desbridamiento, como procedimiento de control de daños. El desenlace neurológico fue satisfactorio. En el control a 24 meses, el paciente presentó una escala de resultados de Glasgow de 5/5.

Conclusión: Es necesario realizar estudios que respalden la evidencia científica sobre la mejor opción para el manejo de las heridas penetrantes por arma de fuego en el cráneo en la población pediátrica.

Palabras clave

Traumatismo craneoencefálico, neurocirugía pediátrica, neurocirugía, traumatismo craneal, reporte de caso.

Abstract

Background: Traumatic brain injury is a serious pathology around the world. Incidence has been reported close to 200 cases per 100.000 people worldwide. In Colombia, the burden of injuries impacts

Keywords

Head injury, pediatric

more in the economically active Head injury, pediatric neurosurgery, neurosurgery, traumatic brain injury, case report. male population between 12 and 45. The wounds caused by projectile's guns are common in the daily practice of neurotrauma care, being aware of their high mortality. Gunshot wounds of the head are usually fatal and have poor neurological prognosis.

Case presentation: This case details the presentation of a pediatric patient who entered a University Hospital in Colombia after suffering a gunshot wound in the skull. The patient was admitted in poor general conditions, stuporous, hypotensive and with active bleeding, with a gunshot injury in the right frontal region. The neurologic exam had a decreased mentality (Glasgow Coma Scale of 4 / 5), with right pupil of 2mm, non-reactive, left pupil 3mm, weakly reactive. A computed tomography showed the trajectory of the projectile, an intracranial hemorrhage, cerebral edema and deviation of the midline greater than 10mm. The patient was taken to surgery. A bilateral cranial decompression of the frontal, temporal, and parietal with debridement were performed, as a damage control procedure. Satisfactory neurological outcome. The 24 months control of the patient evidenced a Glasgow outcome scale of 5/5.

Conclusion: It is necessary to perform studies that support the scientific evidence on the best option for the management of penetrating gunshot wounds in the skull in the pediatric population.

neurosurgery, neurosurgery, traumatic brain injury, case report.

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Background

Traumatic brain injury (TBI) is a serious pathology around the world. Incidence has been reported close to 200 cases per 100.000 people worldwide (1). According to the study of the World Health Organization about the global burden of diseases published in 2010 (2,3). Trauma is continuing being a public health problem and generates a significant burden on health systems in Latin American Countries. In Colombia, the burden of injuries impacts more in the economically active male population between 12 and 45; for example, in 2013 about 26.000 deaths occurred due to trauma and the vast majority of them were associated with interpersonal violence; of those injuries a certain percentage was associated with both, closed and penetrating TBI (4).

The wounds caused by projectile's guns are common in the daily practice of neurotrauma care, being aware of their high mortality (5,6). These lesions are more common in military trauma scenarios. Recently, an aggressive approach to damage control (DC) for the management of these lesions has been made by the military neurosurgeons in combat areas in Iraq and Afghanistan (7). Gunshot wounds of the head are usually fatal and have poor neurological prognosis. Usually, these types of injuries occur most frequently in areas of combat and armed conflict though in recent years a high number of cases have been presented in civil population due to common crime and the difficult control of the sale and illegal possession of firearms (8). This case details the presentation of a pediatric patient who entered a University Hospital in Colombia after suffering a gunshot wound in the skull as we described below.

Case presentation

A pediatric patient aged younger than five years was admitted to the emergency room of the University Hospital of Neiva after suffering an injury by gunshot in the head, stuporous, hypotensive and with active bleeding, with penetrating head injury in the right frontal region with an inlet orifice of approximately 3x3cm with non-apparent outlet. The patient presented with a Glasgow Coma Scale (GCS) of 7/15. Pupils were anisocoric, with right pupil of 2mm, non-reactive, left pupil of 3mm, weakly reactive, extensor posturing response only when applying painful stimuli. Immediately, fluid resuscitation began with bilateral intraosseous catheter and orotracheal intubation. A non-contrast CT revealed the path of the projectile with intracranial bleeding, cerebral edema and deviation greater than 10mm midline (Figure 1). It was assessed by a neurosurgeon who chose to carry neuro surgery to perform damage control in neuro trauma. A left decompressive craniectomy and control of the superior sagittal sinus bleeding with hemostatic material were performed. In the process, large cerebral edema and abundant bleeding were evidenced. It was technically not possible to install measuring device of intracerebral pressure (ICP) for unavailability in our center. Because the patient presented hemodynamic instability, it was decided to suspend proceedings and was transferred to the intensive care unit (ICU) where a pediatric infusion of dopamine and norepinephrine were initiated, with blood products, antibiotics, and anticonvulsants. At admission in ICU, the patient was in very poor condition with a high probability of dying in the next few hours and if it survived, the probability of permanent neurological sequelae were high. She was carried to second surgical time (6 hours after admission) where was made right decompressive craniectomy and intracranial hematomas drainage. Then, she was brought back to UCI with multiple support due to her poor hemodynamic condition. The patient remains in UCI where control TAC was taken after 48 and 72 hours, showing a progressive decrease in cerebral edema and significant ischemia in the territory of the right middle cerebral artery (Figure 2).

At the sixth postoperative (POP) day, clonic movements of right body side after stimuli without hemodynamic compromise that resolved spontaneously were evidenced. Therefore, there were not considered seizures and the same management was continued. The patient was discharged from the ICU after 16 days of POP. Due to multiple failed attempts at extubation, tracheostomy was practiced and she was transferred to the general pediatric ward to continue her rehabilitation. At 23 days of POP of the craniotomy, a fistula of cerebrospinal fluid (CSF) without neuroinfection was evidenced, so she was brought back into surgery for closure of the fistula. After a month of evolution the patient was undergone to a bilateral cranioplasty. Then, the patient was hemodynamically stable with functional tracheostomy and without drainage of the fistula. So, she was discharged from the hospital neurosurgery service with Glasgow outcome of 5/5 (GOS) Glasgow (15/15), with the mobility of all four extremities and successfully neurological recovery. She was discharged under medical advice and the patient returns to controls at 3, 6 and 12 months after the injury and was evaluated with a favorable neurological outcome. The patient is studying and has good intellectual development.

Discussion

Management of head injuries due to firearms has been reoriented in recent years. Traditionally, a conservative treatment of these patients was performed because such lesions were

characterized by poor prognosis in studies from the early 1980s (9). Based on the recent experiences of military neurosurgeons in conflict areas such as the Middle East (particularly Iraq and Afghanistan), where advanced neuromonitoring for surgical decision-making was not always available, the need for more aggressive surgical management was established. Initially, this was focused on a faster craniotomy, hematoma drainage and debridement of necrotic tissue (10). Years later, the term of damage control has appeared consisting of performing an early cranial decompression (11,12). This strategy has been enacted as an important option to improve survival and to reduce disability (13,14). In the aforementioned case, the benefit and the good results obtained in the surgical management of a patient with penetrating gunshot wound in the skull was highlighted.

Gunshot wounds are, are extremely serious injuries with high morbidity and mortality. Are linked to factors such as transventricular trajectory, injuries involving more than one lobe, single or multiple wounds crossing midline, effacement of basal cisterns, and perimesencephalic subarachnoid hemorrhage (15,16). One of the first classifications of gunshot wounds of the head was made by Cushing during his experience in World War I and later was refined by Matson in World War II, being the last the most used today (17,18). (Table 1) In our case, an initial CT showed an intracerebral hemorrhage, with cerebral edema and a deviation greater than 10mm midline which made this patient's injury classified as a grade IV.

Table 1. Matson classification for gunshot wounds in the skull (World War II)

Grade	Description
I	Scalp laceration Skull fracture, dura mater intact
II	Skull fracture with dural / brain penetration. A. Tangential: In skull without fragments of the projectile B. Penetrating: Fragments of the projectile in the brain C. Perforating: transfixing (side to side)
V	With aggravating factors: A. ventricular Penetration B. Fracture orbits or air sinuses C. Injury of dural sinuses

D. intracerebral hematoma

Different studies had reported that an adequate and aggressive management in these patients could produce favorable results (18,19,20) that correlate with results described and found in our case. The results of early decompressive Craniectomy have shown to present better results in the pediatric population (21), a finding that correlates with our case. Significantly, most studies in patients with injuries caused by projectiles of firearms on the skull, have been done in centers where exists the possibility of a constant neurological monitoring in the intensive care unit (21,22,23). In our case, due to lack of availability, no ICP monitoring was performed, instead of that, a monitoring of clinical and imaging evolution was done; this type of practice is already present in neuro trauma centers where there are no resources for constant neurological monitoring (24,25). Nowadays, in our center, the management of patients with penetrating head trauma it is performed with aggressive surgical and medical treatment, since patient arrival to the emergency department. Other studies in our center have shown that the use of specific management protocols based on physiological resuscitation helps to increase survival (26).

Conclusion

It was presented with a case of a patient, who was treated with aggressive management by resuscitation maneuvers and damage control surgery with early decompressive craniectomy, which was essential for a favorable neurological result and a satisfactory evolution at the discharge of the patient with good neurological outcomes. It is necessary to perform studies that support the scientific evidence on the best option for the management of penetrating gunshot wounds in the skull in the pediatric population.

Ethics approval and consent to participate:

Not applicable

Consent for publication:

Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and material:

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Competing interests

The authors declare that they have no competing interests

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Figure legends

Figure 1. Computed tomography, evidence the projectile.

Figure 2. Computed tomography postoperative control.