Penetrating injury to the parapharyngeal space caused by a BB gun in a pediatric patient

Andre Isaac a,*, Zeinab AlQudehy b, Hamdy El-Hakim b

a Faculty of Medicine & Dentistry, University of Alberta, #301-10147 112 Street, Edmonton, AB, Canada T5K 1M1
b Pediatric Otolaryngology – Head and Neck Surgery, Stollery Children’s Hospital, Canada

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ABSTRACT

Non-powder firearm related trauma to the head and neck has the potential for significant morbidity and mortality. This is especially so in children, whose injuries tend to be particularly under reported and trivialized. We present a case of penetrating trauma in a three-year-old boy caused by a BB gun pellet fired in close range to the face, entering the right side of the head and landing within 3 mm of the carotid bifurcation, fortunately, without major neurovascular injury. Due to potential morbidity related to surgical exploration of the parapharyngeal space, a non-surgical approach was observed. The patient suffered no functional deficit from the injury. This case demonstrates the merits of the non-surgical approach to head and neck trauma. The literature pertaining to the epidemiology of this injury is reviewed, including the advantages and disadvantages of surgical and non-surgical management.

Penetrating trauma to the head and neck carries considerable risk for significant morbidity and mortality, and a large proportion of these injuries are wounds caused by firearms. A subset of these injuries are caused by non-powder firearms (such as BB and pellet guns), which use compressed air or gas to propel lead or steel ball pellets.

Epidemiological studies have shown that the majority of injuries caused by these weapons occur in patients under the age of 25 [1]. Injuries to the head and neck in particular carry a high risk of morbidity and mortality, estimated to be equal to that of low-velocity powder firearms [1–4]. Although the complications of firearm injuries to the head and neck are well recognized, those caused by air-powered guns are frequently under reported and under treated, particularly in the pediatric population [5,6].

We henceforth present a case of a firearm injury to the head and neck in a three-year-old boy caused by a close-range shot from a BB gun. This unusual case involved a remarkably fortunate pellet trajectory within 3 mm of the internal carotid artery, and was managed conservatively.

1. Case report

The trauma occurred in a previously healthy three-year-old boy from a rural community, who was playing unsupervised with a BB air gun, along with his two siblings. The gun was fired at his face a few centimeters from the ear, producing an entry wound just anterior to the right ear. The child did not lose consciousness, and was brought by his parents to a rural hospital where the bleeding was controlled with pressure. The patient’s only symptom was mild pain at the entry site, and in the right ear. His past medical and surgical histories were unremarkable, and his immunization record was up to date. On examination, he was an active boy with no signs of respiratory distress, and vital signs were stable. Local head and neck examination showed a wound 5 mm in diameter, located 2 cm anterior to the tragus. There was soft tissue swelling down to the angle of the mandible. The temporomandibular joint was fully mobile, with no functional impairment to cranial nerves II–XII. The rest of the head and neck and neurological examinations were also normal. A plain radiograph showed a small metallic foreign body on the right side deep to the mandible, although its exact position was difficult to identify (Fig. 1). It appeared to be lodged in the parapharyngeal space.

Due to the complexity of this anatomic location and the potential for serious complications, the child was transferred to the nearest trauma center for further evaluation. At the trauma center, the otolaryngology team recommended a computed tomography (CT) scan with angiography of the parotid region, which confirmed the location of the pellet in the right parapharyngeal space. The imaging localized the pellet to within 3 mm of the bifurcation of the carotid artery.
limited access to transportation and the remote location of the scar/cosmetic deformity, and no functional impairment. Due to the patient’s clinical status remained unchanged, with no functional impairment. As such, it was deemed that the attending morbidity from the surgical approach required was unwarranted at the present time. We thus elected to pursue non-operative management, with a watch and wait approach.

Three months following the injury, the patient was followed-up via a phone appointment and was doing quite well, with minimal scar/cosmetic deformity, and no functional impairment. Due to limited access to transportation and the remote location of the patient’s family, follow-up was delegated to the family physician at the parents’ request.

2. Discussion

Firearm injuries are typically classified into high and low velocity, according to the amount of kinetic energy transmitted by the bullet (greater or less than 1000 ft/s upon impact) [7,8]. Air-powered guns such as BB guns have historically been excluded from classification on the basis that these weapons are incapable of producing enough force to cause injury on the same scale as conventional firearms. However, recent studies of injuries caused by air guns have shown that trauma to vulnerable areas (such as the head and neck as well as the abdomen) may result in injuries comparable to that of low-velocity firearms such as hand guns [1–4,9–11]. In addition, the prevalence of these types of injuries is similar to that of powder firearms in the pediatric age group. Parents of children involved often fail to recognize the potential gravity of the injury, owing to the seemingly innocuous mechanism, and the characteristically small entrance wounds [2,10].

In the case presented, the wound caused by the BB pellet was quite innocuous, and the fact that the child had no immediate functional impairment dissuaded medical personnel from recognizing the severity of the injury initially.

In recent studies, about half of all BB and pellet gun injuries in the general population occurred in children between 5 and 14 years of age, and were responsible for approximately four deaths per year [12], 24% of which involved the head and neck [12]. The complex anatomy and compactness of vital neurovascular head and neck structures is one of the most important factors leading to the high complication rates of these injuries. In children, the relatively lower density of facial and cranial bones adds to this vulnerability, and decreases protection of vital structures [13,14]. Accordingly, several retrospective studies have shown that pediatric patients are at greater risk for central nervous system, ocular, and major vascular injury compared to adult patients [14]. One study spanning a 12-year period reported a 30% mortality rate from intracranial injuries in 101 children injured by non-powder guns in the United States [3].

CT is a superior imaging modality to plain films in assessing the location of the projectile, and extent of damage [13,15]. Most patients who escape immediate catastrophic consequence undergo CT angiography in order to assess the extent of neurovascular damage, and guide management decisions [16].

By extrapolating from the CT images, we postulated that the pellet likely was deflected off the mandible and certain nearby ligaments and fascia, and became lodged in the right parotid gland. This situation is quite rare. In the literature, there are only two reported cases of pediatric patients (6 and 12 years old) presenting with asymptomatic BB gunshot wounds that settled in the parapharyngeal space [17].

Management of head and neck trauma can be a complicated decision, requiring a careful risk-benefit analysis. Several studies advocated for a conservative non-operative approach when there is little risk of neurovascular compromise [18–21], and a few case reports have demonstrated that it can result in favorable long-term outcomes [17–19]. Some absolute indications for surgical intervention include profuse hemorrhage, an expanding or pulsatile hematoma, respiratory distress, or violation of the esophagus, trachea, or great vessels [21]. Although the parapharyngeal space in particular can be prone to infection [22], surgery required to remove a body in this space is invasive, and carries serious risks including arterial hemorrhage and airway compromise [19].

Of special interest in this case is the remarkable and fortunate missile trajectory that coursed within millimeters of vital head and neck structures without resulting in major damage. In fact, there have been case reports in the literature of similar dissecting missile trajectories from low-velocity firearm injuries [17,18,23]. This gives weight to the theory that although head and neck structures are thought to be vulnerable and susceptible to damage from penetrating trauma, the neurovascular and bony structures of the head and neck, along with their associated sheaths, muscles, tendons and ligaments, carry an inherent structural integrity that is able to resist certain biomechanical forces.
3. Conclusions

This atypical case illustrates that there are many complex factors at play in determining the trajectory and final location of a missile that penetrates the head and neck, and that air gun injuries deserve significant attention particularly when head and neck structures are involved, since morbidity and mortality are commonly underestimated. CT angiography is invaluable in the diagnostic work-up. The decision for operative vs. non-operative management requires precise risk-benefit analysis, and should be individualized according to case-dependent factors.

Consent

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

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Conflict of interest statement

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