



Air-gun pellet at C1: a case report and literature review

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Background: Air-gun pellet injuries commonly occur in children between the age of 1–18 years old. These injuries could be fatal because it linked to injury to vital organs such as brain, heart, and eyes. In the literature, there are few studies that reported spine injury by air-gun pellet. Our case is a C1 foreign body in a pediatric patient without any neurological deficits after an air-gun injury.

Case Description: A 6-year-old boy, known case of Hirschsprung disease presented to the emergency department after an air-gun injury in June 2021. On examination, the patient was hemodynamically stable, and asymptomatic. Neurological exam was intact with power 5/5 in C5–S1 and sensation 2/2 in C5–S1. Computed tomography (CT) of the cervical spine showed a foreign body at C1. After discussing the treatment options with his parents, we treat the patient conservatively by close follow-up and analgesia only. After 1 week, the patient presented to the clinic and the patient was still asymptomatic. A cervical X-ray at that time done and showed no changes in the position from the initial CT. Weekly follow-up was difficult for the family to adhere to due to their socioeconomic status. Therefore, the patient was followed up over the phone call through telemedicine at 6 months and 1 year after the injury.

Conclusions: The treatment of these types on injuries is highly controversial. The treatment options could be surgical or non-surgical (conservative) such as antibiotic use. Also, there is always a debate about the choice of the treatment options.

Keywords: Cervical foreign body; air-gun pellet; cervical spine; pediatric spine; case report

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Introduction

Almost all air-gun pellet injuries occur among children under the age of 18 years and very rarely among infants (1). Air-guns have been linked to brain (2-6), heart (7-10), eye (2,4,5,11), sinus (12,13), and abdominal (14) injuries and intrauterine fetal injury (15), with some injuries being fatal. In addition, air-gun pellets that impact the skull can cause a growing skull fracture, which is a rare but clinically significant complication of traumatic skull fractures (16). The literature contains infrequent descriptions of spinal

injuries caused by these guns. Despite the risk of serious injury from air-guns, they remain widely available in toy stores and are sold in an unregulated manner. Even though these weapons are sometimes viewed as little more than toys, they are extremely dangerous and can cause significant serious and fatal injuries, particularly among children and adolescents (17). Unfortunately, the general population thinks that trauma caused by air-gun is negligible (17). However, the damage caused by pellets, particularly when it involves the brain or spine, can be significant. For example,

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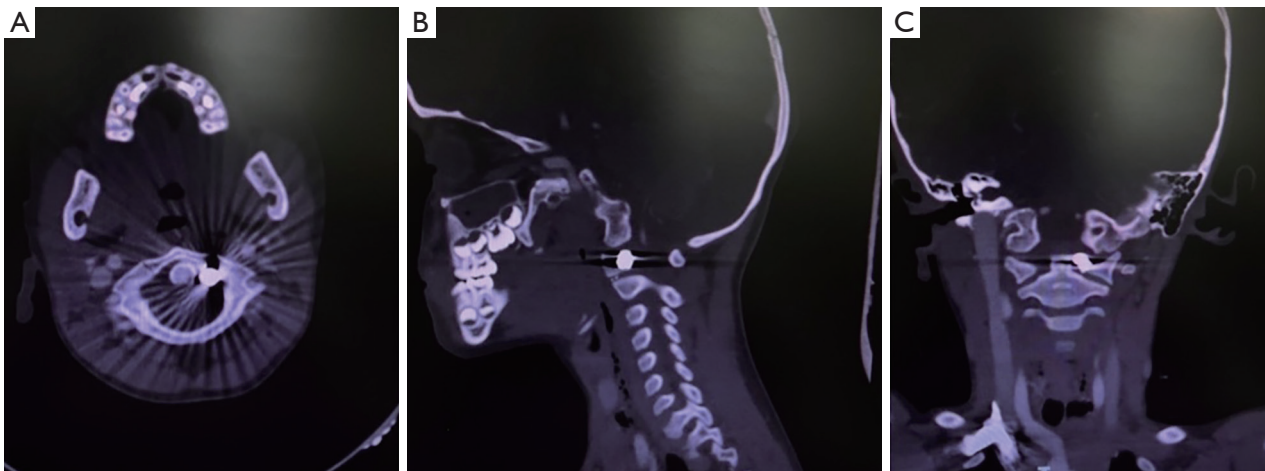


Figure 1 (A) Axial section, (B) sagittal section, and (C) coronal section of cervical CT showing that the pellet is at the C1 level. CT, computed tomography.

in one case, a 2-year-old boy experienced fever and neck rigidity 4 days after being accidentally shot with an air-gun in the back of the neck; clinical examination revealed a pellet lodged in the C1 spinal vertebra (2). There are other injuries that can impact the C1 junction such as chiropractic manipulation, which is more in adults than pediatric population (18).

We report a case of a C1 foreign body after a history of air-gun injury. In this case, the patient was asymptomatic and did not have any neurological deficits. We present this case in accordance with the CARE reporting checklist (available at <https://jss.amegroups.com/article/view/10.21037/jss-23-42/rc>).

Case presentation

A 6-year-old boy with a history of Hirschsprung disease presented to the emergency department after an air-gun injury in June 2021. When playing with his siblings, the boy pointed the gun inside his mouth and accidentally shot himself. On examination the patient had stable vital signs and was conscious, oriented, and alert. In addition, he was completely neurologically intact with power 5/5 in C5–S1 and sensation 2/2 in C5–S1 with no wounds. Computed tomography (CT) of the cervical spine showed a foreign body at C1 (*Figure 1*). Since the patient was asymptomatic, and after discussing management options with the family, we opted for conservative management under close outpatient follow-up and analgesia only.

One week after the injury, the patient came to the clinic for follow-up and cervical X-rays were done at this time (*Figure 2*). The images showed no changes in the location of the pellet from the initial CT, and the patient was still asymptomatic. Given the family's financial and social condition, and the fact that they lived in a rural area distant from our institute, close follow-up on a weekly

Highlight box

Key findings

- Our case is a child with a C1 foreign body after history of air-gun pellet injury without any neurological deficit and asymptomatic. Based on the image we believed that the pellet was stopped by left anterior part of transverse ligament. We treat the patient conservatively with analgesia and close follow-up. The child remains asymptomatic and neurological intact after 1 year follow-up. Also, new images showed no changes comparing to the initial image.

What is known and what is new?

- The management of such injuries depend mainly on the signs and symptoms of patient and stability of injury based on the images. The treatment options are either surgical or conservative such as antibiotics.
- We are reporting a very rare case with unusual presentation and managed with close follow-up and analgesia only.

What is the implication, and what should change now?

- Our case can help other physician in managing such patient with these types of injuries and maybe develop a clear guideline for the management.

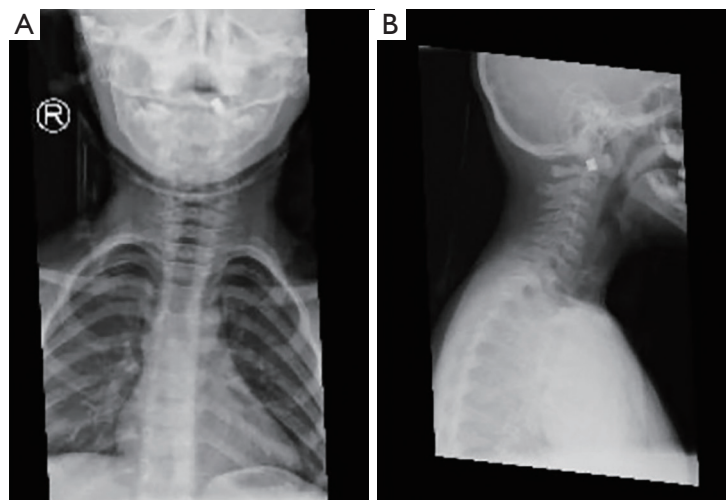


Figure 2 (A) Anterior-posterior view and (B) lateral view of cervical X-ray showing that the pellet is at the C1 level.

basis was not possible for the family. Therefore, the patient was followed up over the phone call through telemedicine 6 months and 1 year after the injury. At the 1-year follow-up, the family was encouraged to visit the clinic for a follow-up CT, but they were unable to do so given the financial burden. The parents reported that there was no change in their son's mental or physical status, and he is active and able to complete his daily activities without any issues or signs of weakness or pain. Multiple solutions were offered to the patient's family to arrange for a final CT; however, the family declined the offers given their son's apparently perfect condition. Telemedicine follow-up remains ongoing, and the patient's family has been educated and encouraged to seek help immediately if any changes in the patient's condition occur. Up to now, the patient is still asymptomatic without any new active issues. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent for publication of this case report and accompanying images was not obtained from the patient or the relatives after all possible attempts were made.

Discussion

Spinal injuries caused by air-gun have been described infrequently in the literature, but they do occur. These are preventable injuries that usually affect unsupervised male children who inflict the injury on themselves or a friend (19). In one case, a pellet was found to be lodged in the C1

spinal vertebra of a 2-year-old boy with fever and neck rigidity 4 days after he was accidentally shot with an air-gun in the back of the neck (2). In 1997, the largest case series reported 16 children injured while playing with air-guns (1). Entrance wounds included 10 through the orbit, 2 in the temporal region, 2 in the front of the neck, and 2 in the sub-occipital region. Complications were reported in several patients, including ocular globe wounds requiring exenteration, meningitis, cerebrospinal fluid fistulas, brain abscess, traumatic aneurysm, wandering intra-ventricular bullet, and carotid-cavernous fistula.

Between 1990 and 2000, the United States Consumer Product Safety Commission reported 39 deaths related to non-powder guns. Of those deaths, most resulted from cardiovascular or intracranial injuries and 32 occurred in children under the age of 15 years. In addition, long-term disabilities occurred, including hemiparesis and monocular blindness. The incidence of injury caused by these weapons is 12.9 per 100,000, with approximately 5% of the injuries requiring hospitalization. Injury from air-gun occurs approximately 21,000–37,000 times yearly in the United States, with a mortality rate of four cases per year (20). In 2009, another case series on non-powder firearm injuries was conducted with a population of 29 pediatric patients (21). Most of the patients were boys with a mean age of 11 years. Of the 29 patients, 9 required surgery, 6 sustained significant morbidity, and 2 died. These 17 patients had serious injuries as evidenced by the need for operation, the location (intracranial, solid organ, hollow viscus, or ocular), and the occurrence of permanent disability or death.

For assessing the extent of injury, plain X-rays are sufficient to locate the metallic body, but CT scans are required to determine the extent of damage and the course of the projectile (20,22). Angiography is needed in case of active bleeding, changes in neurological status, bruits, or enlarging hematoma (23). The presence of metallic foreign bodies of unknown physical nature preclude the use of magnetic resonance imaging.

The algorithm for managing such type of injury is highly controversial. The debate centers on the use of aggressive treatment, which is surgery, versus a more conservative approach, which is antibiotic use. Surgery is indicated if a patient presents with signs and symptoms such as cerebrospinal fluid leak, instability or worsening neurological condition, toxicity, or vascular injury, among others (21). Some authors advocate the use of early surgical management, including removal of any bone fragments and the foreign body, debridement of the wound, application of water-tight dural closure, and reconstruction if necessary (24,25). However, surgery may not be possible if there is a risk of aggravating the neurological damage. Currently, not removing the fragments from an otherwise healthy organ is an accepted approach (24,26). Prophylactic antibiotics and anticonvulsants as needed are common components of conservative management, in light of complications such as infection and epilepsy (20).

Our decision to pursue conservative treatment was guided in part by the family's financial and social condition. Because they lived in a rural area far from our institute, close follow-up on a weekly basis was very costly for them and thus difficult to accomplish. Therefore, the patient was followed-up over the phone calls through telemedicine. The patient was ultimately unable to return to the clinic for follow-up cervical CT, but his parents reported that he appeared to be entirely normal and healthy.

Conclusions

We describe a case of a C1 foreign body after a history of air-gun injury. Despite the injury, the patient was asymptomatic and had no neurological deficits. Our patient was treated conservatively. Close follow-up was very costly and difficult for the family to adhere to owing to their financial status and distance from the clinic. After 1-year of follow-up, the patient was still asymptomatic and neurologically intact. The algorithm for managing such type of injury is highly controversial, as there is always a debate over the benefits of more aggressive treatment,

which is surgery versus a more conservative approach, which is antibiotic use.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at <https://jss.amegroups.com/article/view/10.21037/jss-23-42/rc>

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://jss.amegroups.com/article/view/10.21037/jss-23-42/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent for publication of this case report and accompanying images was not obtained from the patient or the relatives after all possible attempts were made.

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