PEDIATRIC AIR GUNSHOT PENETRATING HEAD INJURY WITH GOOD OUTCOME: A CASE REPORT

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Abstract: Ball bearing (BB) and pellet guns are non-power guns but their related injuries have been reported worldwide. They represent a significant cause of injury especially among children and teenagers. *Their potentially harmful and lethal effects have been well documented in the medical literature since the early 1980s. Fatality rate is closely related to the damaged part of the brain and the level of the damage. In this Case Report we documented a 6-years-old girl was getting shot at the head by herself, who initially want to play around, using her neighbour's Air gun rifle. The pellet trajectory passed through the left frontal lobe, left temporal lobe, left posterior putamen, posteriorly left crus posterior of internal capsule, left occipital horn of lateral ventricle, left occipital lobe, and ended at left cerebral falx between both medial surfaces of occipital lobes. Directional slope of the pellet was medially upward, with its tracking left Intracerebral Hemorrhage (ICH) with perifocal edema and Intraventricular Hemorrhage (IVH) dominant in the left lateral ventricle. After 8 days management, the patient was discharged from our hospital with stable condition, GCS 15 without any significant neurological deficits. Intracranial intracerebral pellet due to air gun shot injury, may have fatal and lethal manifestation if the pellet damage the eloquent area and/or deep area of the brain (hypothalamus, thalamus and brain stem). If accessible the foreign body or pellet should be removed immediately for better outcome.*

Keywords: *Head Injury, Air Gun Shot, Intracerebral Haemorrhage*

INTRODUCTION

Ball bearing (BB) and pellet guns are non-power guns but their related injuries have been reported worldwide. They represent a significant cause of injury especially among children and teenagers.[1] BB/pellet gun related injuries and their potentially harmful and lethal effects have been well documented in the medical literature since the early 1980s.[2] Non-powder guns or air guns are often considered as toys in American society. Approximately 2 to 2.5 million non-powder firearms are sold annually in the United States. A BB gun-related injury could be defined as a gunshot wound from a pistol or rifle that fires a ball pellet. Air compression is operated by a spring or pump action mechanism; or by a carbon dioxide cartridge. Although most BB guns fire low-velocity missiles, some can still shoot to penetrate the abdomen, thorax, facial sinuses and even the cranium. If airguns projectile velocities increase as is the current trend, resulting injuries will likely increase in severity.[1-4]

Airguns (AG) are categorized as low-velocity missiles (muzzle velocity <300 m/s), but even 60–100 m/s is enough to fracture bone. Recent studies state the muzzle velocity in some BB guns can be 364 m/sec. Given these numbers, BBs possess enough kinetic energy to penetrate skin and, depending on the body region, to fracture bone. About 80–90% of air gun injuries occur in population with age under 19 years, especially boys, with most of them are caused by the gun's careless use.[5,6]

A total of 191 cases were identified: 53 children from Cincinnati, 27 children from Kansas City, 9 children from Harborview Medical Center, and 12 children from Children's Hospital and Medical Center. Males made up 81%, and the median age was 10.9 years (range, 0.5 to 18.8). Of the children, 80% were white, 18% were black, 1% was Asian or Native American. A total of 58 children (57%) had commercial insurance, 23 (23%) had Medicaid, and 18 (18%) were self-insured; insurance information was missing on 2 subjects.[7]

Pellet guns were recorded as the offending weapon in 26 cases (26%), whereas BB guns accounted for the remaining 75 shootings (74%). The victim was most frequently shot by a friend (N = 30, 30%) or sibling (N = 21, 21%). In 24 cases (24%), the medical record did not identify the shooter. Most of the shootings were identified as unintentional (N = 72, 71%); however, five victims (5%) were assaulted, and one (1%) committed suicide. Intent was not recorded in 23 cases (23%).[7]

Three percent (3%) of children with intracerebral injuries was died. One of these was an adolescent suicide, whereas two other children, 2 and 7 years of age, died of unintentional injuries. One child with an intracranial injury developed a cerebrospinal fluid leakage that resolved without surgical intervention. Another child had dizziness that resolved several weeks after injury. Two children had residual neurologic deficits: one with hemiparesis, and another with loss of cognitive function. Both of these children required inpatient rehabilitation. Two children with neck injuries suffered acute nerve paresis, but fully recovered after discharge. One child who was shot in the hand had numbness of a finger acutely and was lost to follow-up.[7] This case report discuss an interesting case of patient with wide intracranial lesions caused by pellet air gun injury without any significant neurological deficit in the outcome.

CASE

After getting permission from the patient's parent, we reported a case of 6-years-old girl who came to ER at Ulin General Hospital with decrease of consciousness just after getting shot at the head by herself, who initially want to play around, using her neighbour's Air gun rifle that usually used for bird's hunting. She was shot at left frontal lateral aspect of the

head and directly lost her consciousness, followed by two projectile vomiting, but there is no history of seizures. We performed ER management according to ATLS, we cleared the airway, breathing and circulation. Patient's vital signs were stable. According to mini neurological state examination of the patient, the patient's Glasgow Coma Scale (GCS) is E2V2M5, pupils are bilaterally equal and reactive, and no lateralization sign was documented. Based on local physical head inspection, at the left lateral frontal superiorly to zygomatic bone region was found a 3mm x 3mm penetrating wound showing a pellet enters the intracranial cavity (Figure.1). No blood clot is found. After we explored the head, we didn't found any indications of bullet exit wound. Thus, we suspected that the pellet was still in the cranial cavity.

After all conditions were clearly stable, we performed Head CT-Scan trauma series with bone 3D reconstruction (Figure.2). Based on the Head CT Scan we found bone fracture caused by the pellet penetrating to the head at left frontal region just prior of coronaria suture and superiorly of zygomatic arc bone. Segmented fractures entering the intracranial cavity in the surface of frontal lobe, the pellet trajectory passed through the left frontal lobe, left temporal lobe, left posterior putamen, posteriorly left crus posterior of internal capsule, left occipital horn of lateral ventricle, left occipital lobe, and ended at left cerebral falx between both medial surfaces of occipital lobes. Directional slope of the pellet was medially upward, with its tracking left Intracerebral Hemorrhage (ICH) with perifocal edema and Intraventricular Hemorrhage (IVH) dominant in the left lateral ventricle (Figure.3).

Laboratory investigations showed Hemoglobin was 10,3 mg/dl, leukocytosis (19.700/mm3), and normal value for other blood component. There is no abnormality on coagulation function test.

We performed an immediate craniotomy evacuation extraction of foreign body (pellet) procedure, intraoperative from frontotemporal site we found a 3mm x 3mm open wound (where the pellet entered). On the lower side we found a 3mm x 5mm fenestrated bone with dural tearing and 3cc epidural bleeding. Debridement was performed in this step.

Using a C-Arm Guide and microscope from left parietooccipital site, we performed a 3cm x 3cm craniotomy, duratomy and corticotomy. Within 7 cm depth from surface of the brain we successfully found the pellet surrounded by blood clot (Figure.4). In this step we extracted the pellet using microforcep and debridement, also coagulated using bipolar cauterized and surgicel ® post-extraction.

After the surgical procedure was done, the patient was administered to the pediatric intensive care unit (PICU) for 3 days observation and 1 day use of ventilator. During the treatment at PICU, the patient was given antibiotic (Cefriaxone 750 mg/12 hours/iv and Metronidazole 100 mg/8 hours/iv) for 7 days. The patient was also given Manitol 35cc/8 hours/iv for 5 days to reduce the brain edema.

After 8 days management, the patient was discharged from our hospital with stable condition, GCS 15 without any significant neurological deficits.

Figure 1. Pellet enters from left frontal lateral aspect of the head, there is no active bleeding from entering wound.

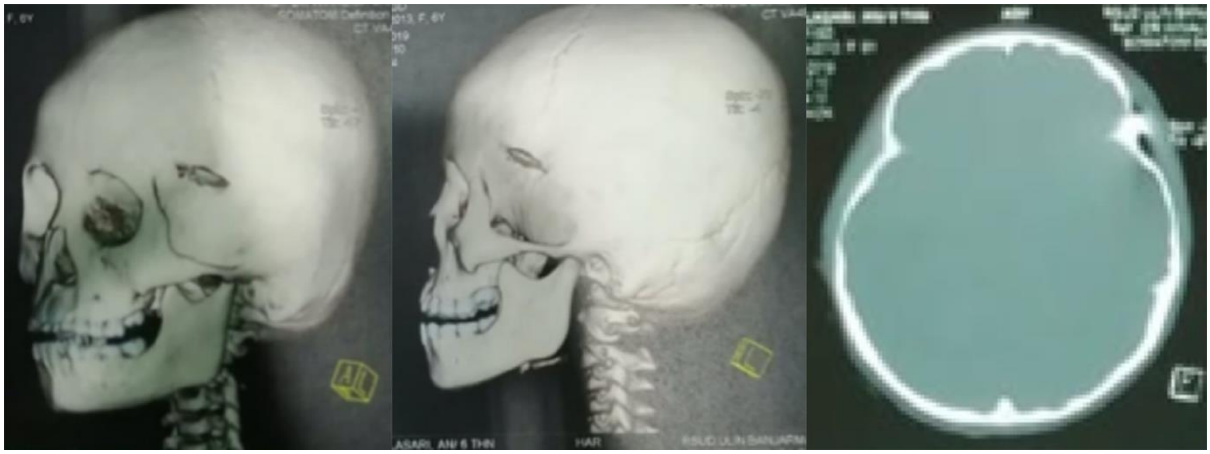

Figure 2. Head CT-Scan Bone Window and 3D bone showing defect and fracture from entering pellet at region just prior to coronaria suture and superiorly to zygomatic arc bone.

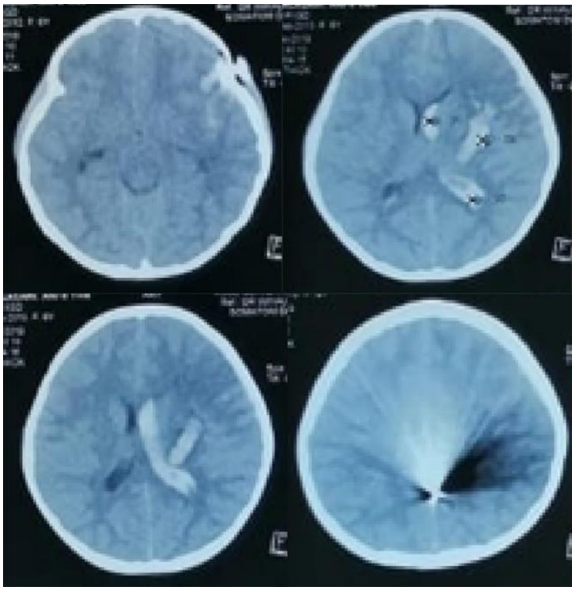

Figure 3. Head CT-Scan Brain Window showing the pellet trajectory passed through the left frontal lobe, left temporal lobe, left posterior putamen, posteriorly left crus posterior of internal capsule, left occipital horn of lateral ventricle, left occipital lobe, and stopped at left cerebral falx between both medial surfaces of occipital lobes. The pellet's slope direction was medially upward, with its tracking left ICH with perifocal edema and IVH.

Figure 4. Diablo pellet 4.5 mm (.177 in) caliber after removal from intracranial.

DISCUSSION

Some Cases of AG pellets penetrating injury were published. The head is the most commonly penetrated part of the body, and the orbit is the most common part of the skull resulting in cerebral injury[8,9,10,11,12,13] The majority of fatal incidents were reported involving children and adults.[8,10,12] Pellets have entered through the eyes, temple or forehead, and then penetrated the brain.

Non-fatal injuries following AG pellet penetration include significant brain damage causing permanent impairment and those which involving the eyes may result in blindness.[13,14] Furthermore, possible points of entry for pellets are the thin bones of the skull, especially the temporal and the occipital squamae.[9,10,12] Fatality rate is closely related to the damaged part of the brain and the level of the damage.[8,9,12,15,16]

The foreign body or pellet should be removed if they are accessible.[14] Miner[8] suggested that the foreign body may be left if it is inaccessible. Intracerebral abscess can be a long-term problem if the AG pellet or foreign body can't evacuated.[9,11,12] There are limited clear indications to perform removal of all bullet

fragments. Clear indications for bullet removal, are fragment movement, abscess formation, vascular compression, and also hydrocephalus.[17] Shaw and Galbraith[19] reported the fatal case of cerebral abscess that developed around a pellet and resulted in death after 19 months.

The AG injuries to the head may be fatal due to brain injury following penetration of relatively thin areas of the skull since there is a potential for damage to the cerebrum, cerebral vessels or brain stem.[18] Therefore, it is essential that all purchases of AGs be recorded and controlled. Havali[18] recommend that the cases suffering from AG injury be managed in accordance with the protocol for gunshot wounds. Furthermore, if a foreign body is left in the wounded region, these patients should be treated with combined antibiotics to prevent intracerebral abscess or other types of infection. Early surgery and complete debridement should be applied in the case of CSF leakage or intracerebral hemorrhage.[20]

In this case after we remove the pellet from intracranial we found diablo pellet 4.5 mm (.177 in) caliber. It can develop a muzzle velocity of 330 to 340 ft/sec, which exceed the impact velocity of 150 to 170 ft/sec required to pierce the skin, and approach the additional 200 ft/sec required for bone penetration.[11]

In this patient the trajectory of the pellet don't damage the eloquent area and/or deep area of the brain (hypothalamus, thalamus and brain stem) with fatal and lethal manifestation. So after we performed an immediate craniotomy evacuation extraction of foreign body (pellet) procedure, patient was supported at PICU and observation for 8 days then the patient was discharged from our hospital with stable condition, GCS 15 without any significant neurological deficits. BB guns should be considered more than toys. The ongoing number of fatalities raises concern about the amount that may occur in the future.[6] Limitation of this case report CT Scan Control after operation wasn't performed on the patient because there are limitations for the payment cost.

CONCLUSION

In conclusion intracranial intracerebral pellet due to air gun shot injury, may be have a fatal and lethal manifestation if the pellet damage the eloquent area and/or deep area of the brain (hypothalamus, thalamus and brain stem). If accessible the foreign body or pellet should be removed immediately for better outcome.

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