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Case Report

Rescue of a Child with Fatal Cardiothoracic Injuries from an Air Gun: A Case Report

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Abstract

Background: Mortalities resulting from firearms to the chest are still common worldwide. Although relatively uncommon compared to other age groups, gunshots that occur in children are fatal catastrophic events especially those that penetrate the thoracic cage. Air guns (pellets) are less devastating than conventional fatal firearms, but they can be fatal particularly in children.

Case presentation: We present successful management for a child presented with major cardiothoracic injuries caused by an air gunshot (pellet) that penetrated the chest and passed through the heart and lung to the posterior mediastinum.

Conclusions: The young age and penetration into the thoracic cage could make air guns as lethal as conventional firearms.

KEYWORDS

Pellet; Cardiac injuries; Child; Case report

Article History

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Introduction

In the United States from 2002 to 2014, a registry of childhood firearm injury reported an average of 1297 mortalities in children and 5790 were successfully managed for gunshot wounds each year [1]. Pellet gun injuries occur frequently in children and are potentially fatal but effective and rapid management by all involved specialties can save the cases. We present a case of 11-year-old boy came to the emergency department with an air gunshot (pellet) that penetrated the chest and passed through the heart and lung to the posterior mediastinum.

Case presentation

This is an 11-year-old boy who was shot by his younger brother with a pellet gun in the right upper part of the chest. He presented with chest pain, mild tachypnea and dizziness. He was fully conscious and oriented. Blood pressure measured 80/45 mmhg, heart rate was 105 beats/minute, and oxygen saturation was 92%. Hemoglobin (Hb) was 10.6 g/dl and the other routine laboratory results were within normal. Initial care was done by adjusted fluids infusion, pain relief and mask oxygen. He was taken to radiology department for chest x ray and computerized tomography (CT) to the chest. The CT scan showed moderate to large fluid collections in both the pericardium and the right pleura, and a contusion in the right upper lobe of the lung. It also showed the location of the pellet, which appeared to be wedged in the posterior mediastinum adjacent to the right of the esophagus, near the right inferior pulmonary vein. (Figure 1a-Figure 2a).

Transthoracic echocardiography (TTE) showed moderate to large fluid collection in the pericardium with some evidence of tamponade and normal intracardiac structures. He was taken to theater room as an emergency case at 3 am. The patient was placed in supine position and general anesthesia was inducted. Cardiac anesthesia team was able to ensure central and

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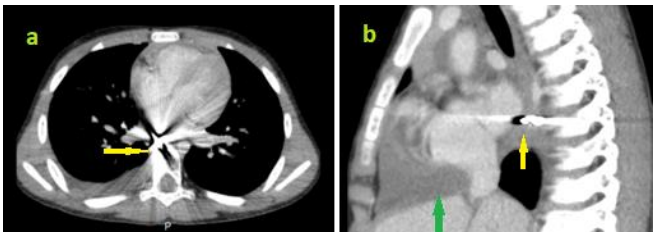

Figure 1: Computerized tomography of the chest showing the tracks of the pellet through the cardiothoracic structures (yellow arrows) and pericardial collection (green arrow).

peripheral venous accesses, arterial line insertion, establish of full cardiovascular and pulmonary monitoring and maintain hemodynamic state. Adjusted fluids infusion and small dose of vasoactive inotropic drug were enough to maintain circulation. The chest was prepped and draped. Midline sternotomy was done. The thymus was excised. The pericardium was ballooned with dark blood. The pericardium was opened and a large amount of blood was evacuated. Heparin was given. The aorta, and right atrium were cannulated. Cardiopulmonary bypass (CPB) was started. We found two cardiac lacerations indicating inlet and exit points of the pellet; the inlet point was at the superior vena cava- right atrial (SVC- RA) junction (Figure 3a) and the exit point was in posterior wall of the left atrium near the right lower pulmonary vein (Figure 3b, c). Both were repaired (Figure 3c, d). The pellet was wedged in the posterior mediastinum to the right of the esophagus in the vertebral body and was removed (Figure 3). Two small inlet and exit lacerations on the right lung were also repaired (Figure 2b). A laceration at the SVC- RA junction was repaired with 5-0 proline (Figure 3b). The heart was lifted from the apex to expose the laceration in the posterior wall of the left atrium which was also repaired with 5-0 proline. The posterior pericardium was opened and the pellet was removed from the right paraoesophageal space where it had lodged itself on the vertebral body (Figure 3c). Some paraoesophageal and paravertebral venous bleeding was controlled with stiches. The descending aorta was dissected to rule out any injury and it was intact. The right vagus nerve was partially lacerated by the pellet track. It was left untouched.

The CPB was weaned off and the CPB time was recorded 47 minutes. Protamine was given. The cannulae were removed. Three chest drains were inserted. The chest was closed. The patient was transferred to pediatric cardiac intensive care unit (PCICU) in good condition without vasoactive inotropic drugs. One unit of packed RBCs was transfused as Hb dropped to 8.7 g/dl. Patient was extubated after 6 hours of PCICU admission. He was transferred to surgical ward after 36 hours post-surgery and discharged home in a good clinical condition after 7 days from hospital admission. The clinical and radiological follow up of the patient in the outpatient clinic revealed good clinical condition and unremarkable radiological findings.

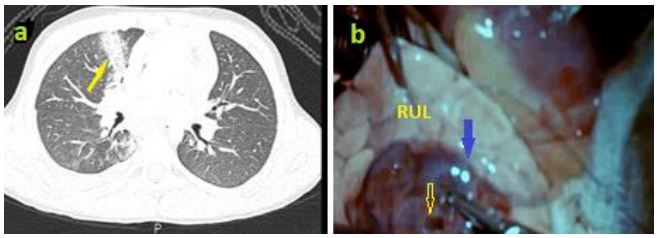

Figure 2: Lung injury by the air gun (pellet): a- Computerized tomography of the chest revealing the lacerated track of the pellet through the RUL (yellow arrow). b- Intraoperative image of lung injury showing penetration of the pellet to RUL (yellow arrow) with surrounding hematoma (blue arrow). RUL: right upper lobe of the lung.

Discussion

Air guns (pellets) should never be estimated as “toys” and should always be considered as the same as conventional lethal gun shots given their potential for injury and mortality [2].

Pediatric cardiac trauma is uncommon variety of injury with high in hospital mortality. Blunt cardiothoracic trauma in children usually associates with concomitant cardiac and pulmonary contusions. Mylonas KS et al presented a systemic review for pediatric cardiac trauma and they reported that penetrating cardiothoracic injuries accounted for 28.2% of the reported trauma and may be more incidental than previously recorded [3].

Nakamura DS et al described four cases of thoracic air gun injuries in children. Potentially lethal injuries of the heart and lung occurred. All children were treated surgically by removing all the pellets from the ventricular myocardium in

two cases, from the right atrial appendage for the third case, and from the right middle lobe of the lung for the fourth case. All of the cases were rescued and the postoperative course was uneventful. They concluded that the use of air guns by children could be fatal so it was mandatory to strictly regulate their use in addition to the need for public education regarding potential risk [4]. In our case, a boy was shot by his younger brother with a pellet gun in the right upper part of the chest. We found two cardiac lacerations, the inlet point was at the superior vena cava- right atrial (SVC- RA) junction and the exit point was in posterior wall of the left atrium near the right lower pulmonary vein. Both were repaired. The pellet was wedged in the posterior mediastinum to the right of the esophagus in the vertebral. The boy survived and the recovery was uneventful.

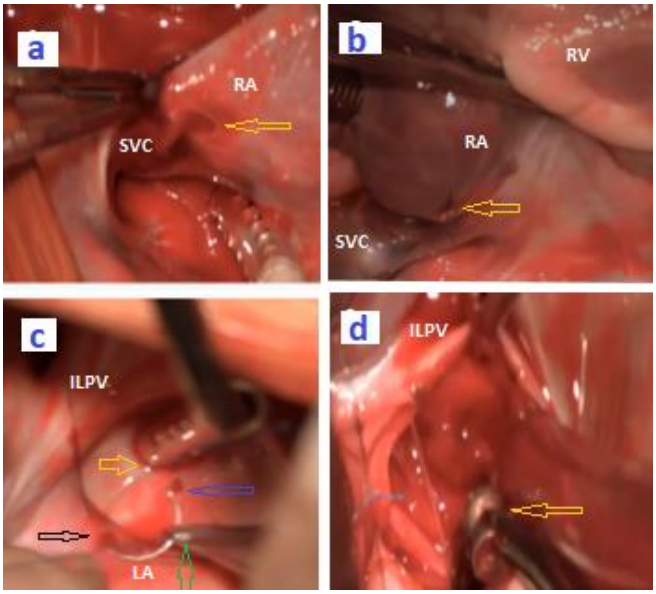

Figure 3: Intraoperative images of penetrations by the air gun (pellet) to cardiac and mediastinal structures: a- Inlet of the pellet to the heart: laceration at the SVC-RA junction (yellow arrow). b- Repaired previous laceration in fig A-1 by 5/0 prolen. c- Exit of the pellet from the heart at the posterior wall of LA adjacent to ILPV (black arrow), inlet of the pellet to the mediastinum adjacent to the esophagus and vertebral column (blue arrow), suction tip in the posterior mediastinum (yellow arrow), taking suture to repair the hole in the LA (green arrow). d- Extraction of the pellet from the posterior mediastinal structures (yellow arrow). SVC: superior vena cava, RA: right atrium, LA: left atrium, ILPV: inferior left pulmonary vein.

Conservation versus exploration in cardiac injuries from the air guns was outlined by Alejandro KV [5]. They stated that conservative management for at least 24 hours was rationale in patients who were hemodynamically stable. Patients presented with large pericardial collections can be managed by subxyphoidal pericardial window and monitoring of vital parameters. Thoracotomy or even sternotomy can be an option for the unstable patients that do not respond to basic resuscitation, including pericardial drainage [4,5]. In the current patient, the hemodynamic condition was borderline and the CT scan revealed life-threatening injuries to the heart, lung and mediastinum, so it made sense to perform a moderate sternotomy rather than conservation. Remove or not to remove the pellet is debatable. The exact location of the pellet should be determined. Removal is indicated if the pellet is located within heart chambers. Other possible considerations for pellet removal include patients who develop symptomatic arrhythmias [5]. We removed the pellet from the posterior mediastinum as it was well visualized and easy to extract.

Conclusion

Although air guns (pellets) are less injurious than conventional lethal firearms, they should not be considered as toys and can be fatal particularly in children. Penetrating cardiothoracic injuries are of high risk of mortality and rapid hemodynamic resuscitation, diagnosis and definitive management could achieve survival.

Conflict of interest: Authors declare no conflict of interest.

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