

Stray bullet as a cardiac embolism

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Abstract

Bullet embolism is a relatively uncommon complication of gunshot injuries. Migration of bullets through bodily vessels presents unique clinical challenges and can lead to infection, thrombosis, ischemia, hemorrhage, and death. Potential lack of early symptoms leads to delayed or missed diagnosis and often-inadequate early management can potentially result in the loss of extremities or life. In this paper is presented an unusual case in which a stray bullet to the posterior aspect of the left side of the chest penetrated the thoracic cavity and traveled to the left femoral artery through the left ventricle, embolizing the vessel. The bullet was surgically removed from the left common femoral artery.

Keywords: Embolism, stray bullet

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Introduction

Celebratory gunfire (also called aerial firing or happy fire) is the shooting of a firearm into the air in celebration. Although practiced illegally, celebratory gunfire is culturally accepted in Lebanon and is fairly common, especially on New Year's Eve, during wedding ceremonies, national occasions, political events, and even at funerals.

Aerial firing may result in random death and injury. People can be injured, sometimes fatally when bullets discharged into the air fall back down to the ground. In Beirut, from March 30, 2016, to May 25, 2016, five people were the victims of stray bullets. One of the victims, a seven-year-old girl, received head injury and instantly passed away. The other four victims received a serious chest and abdominal injuries and were treated successfully. One of them, the subject of this report, received an aerial shot to the posterior aspect of the left chest, entering the left ventricle and finally found lodged in the left common femoral artery.

Bullet embolism after aerial firing is a rare yet fascinating phenomenon. The over growing incidence of aerial firing in civilian urban settings has

increased the possibility of encountering strange and undefined types of bullet injuries. This is particularly applicable because bullets fired into the air usually fall back with terminal velocities much lower than their muzzle velocity, which is when they leave the barrel of a firearm. When such bullets enter the body, most of their kinetic energy has been dissipated, so when they enter a bodily vessel with no kinetic energy, the flow of the bloodstream sweeps the bullet away along with the blood current to a different site, usually a branch of the vessel where it first entered, resulting in embolism. Most of these emboli are asymptomatic and cannot be accurately evaluated at the emergency ward. If the entry wound of a bullet does not match with clinical findings, remote imaging is often required, provided the patient remains hemodynamically stable (1).

Case report

An active healthy 24-year-old male was walking down the street and bent to pick up his keychain after accidentally dropping them. Suddenly he felt a severe sting under his left scapula. The patient asked his friend to examine his shoulder and was told that "it looks like a bullet injury, there is some blood". The patient was then admitted to a nearby hospital

and upon arrival, he was dyspneic, tachypneic, with PR=140/min, BP=120/70 mmHg, RR=28, saturation 99% on a face mask, and a temperature of 37.2°C. The patient suffered from chest pain and was conscious, alert, and oriented to person, place, and time.

The primary survey revealed clear airways, with bilateral decreased breathing sounds (left side). All peripheral pulses were palpable and symmetrical except the left dorsalis pedis, which was absent. Brief neurological examination showed GCS 15 moving all his extremities with gross intact sensory and motor functions. A large-bore intravenous access line was established on Ringer's lactate. Examination of the torso revealed a solitary wound in the left upper back, under the left scapula. There was no obvious active bleeding; the wound was circular with an abrasion zone and an 8 mm diameter. Upon secondary survey, no other wounds were detected. A chest X-ray was ordered as an adjunct to the primary work up, revealing bilateral pleural effusion L>R, with minimal left side pneumothorax. There was an absence of any foreign bodies. A total body scan was ordered and revealed:

- Left superior thoracic wall emphysema
- Minimal pneumothorax in left thoracic apex
- Mild bilateral pleural effusion (L > R)
- Minimal pericardial effusion
- Condensation at the base of the left lung with a linear tract from posterior of the left chest to posterior aspect of the left ventricle
- Small air bubble in the pericardium (cardiac wound)
- A bullet is detected in the left inguinal region adjacent to the left common femoral artery

At the theater, a chest tube was inserted in the left chest cavity. By this time the patient's lower left extremity became increasingly pale. Knowing that a bullet is lying in the left inguinal region, the surgeon immediately opened up the area to palpate the bullet inside the left common femoral artery and successfully removed it.

Next day the victim was transferred to Beirut Cardiac Institute for the possibility of an open heart surgery, upon arrival, a chest CT scan was performed, a cardiac echography as well as a transesophageal echography was performed. The CT scan did not

show any changes from the initial one and the echographies were both negative. The clinical evaluation found the patient in stable condition. A decision was made to observe him in the CCU and to treat him conservatively.

The patient's condition improved and he was discharged home, with normal breathing sounds, and normal heart sounds with no murmurs (BP=120/80 mmHg, PR=100/min). A chest X-ray on May 14, 2016, revealed clear lung fields, normal heart size and shape, and free pleural space.

Discussion

Historically, Thomas Davis reported the first bullet embolism in 1834. Between 1834 and 1996 only 160 cases of bullet embolism were reported (1). Embolization of a bullet is very uncommon, with an incidence rate of about 0.3%. Out of the 7,500 firearm injuries reported in the Vietnam war, only 22 cases were complicated by foreign emboli, with 19 arterial cases as reported by Rich and colleagues (2). Slobodan and colleagues mentioned that more than 70% of cases of missiles penetrate into the arterial circulation through either the thoracic or abdominal aorta or even through the heart (3). Bullet emboli are usually associated with a small caliber, low-velocity missiles. Patel et al. reported an embolus incidence of 55% with a 0.22-caliber handgun compared to only 27% with a shotgun (4). The gun and ammunition used in the trauma play an important role in the diagnosis because bullet emboli are more common with smaller, blunt nose, and short length or low-velocity bullets. For a projectile to become an embolus, two major prerequisites need to be satisfied. First, the bullet should have little kinetic energy remaining at the precise instant it enters the blood vessel. Second, the diameter of the bullet must be less than the diameter of the blood vessel it penetrates. This explains why the incidence of bullet embolism is so low in war scenarios.

In our present case, a stray bullet hit the victim under his left scapula, and the bullet was a 7.62 caliber, which can easily penetrate the skin.

Unfortunately, it did not hit the scapular bone or a rib or other solid tissues that could have halted its progression into the chest, causing pleural effusion. As was noticed, the bullet did not tumble, and instead went directly inside the chest nose ahead

and managed to cross forward to enter the left ventricle causing a little pericardial effusion.



Fig. 1: (a) The bullet after removal (cartridge 7.62x39mm). (b) the Inguinal surgical site where the bullet was removed, (c) External location of the entry wound. (d) Close view of the entry wound.

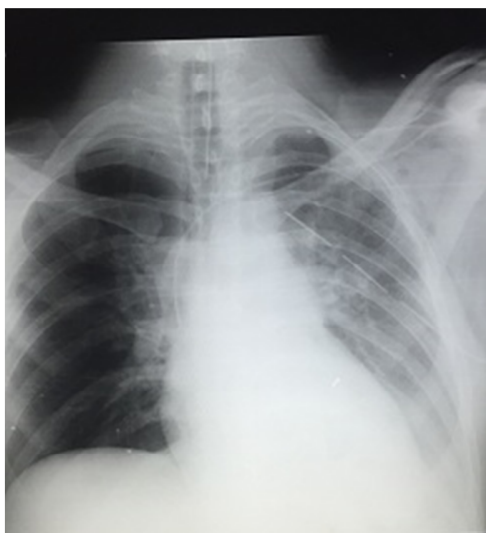


Fig. 2: Chest X-ray showing left chest tube and left pleural effusion.

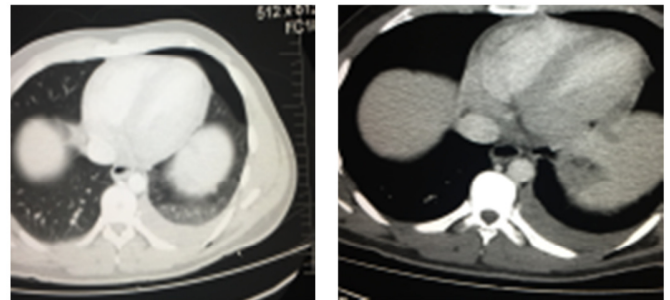


Fig. 3: CT scan of the chest showing left pleural effusion and left pneumothorax (left), and mild pneumopericardium (right).

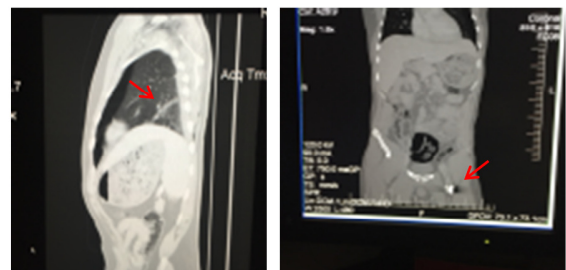


Fig. 4: CT Scan of the chest, abdomen, and pelvis showing gunshot tract (left, red arrow) and a metallic bullet in the left inguinal region (right, red arrow).

This did not increase in the following days because the inlet into the cardiac muscles of a young healthy adult had sealed. In the left ventricle, a foreign inert body was carried by the blood stream through the aortic valve to the aorta and was finally lodged in the left common femoral artery, causing the left lower extremity to become pale and painful. In 80% of cases, such emboli are symptomatic, causing claudication, and peripheral ischemia mainly in the lower extremity (5).

Bullet embolism should be suspected if the victim sustains a firearm injury, with no exit wound, and no missile is found in the area of direct trauma. In this case, a whole body X-ray should be performed, as the bullet may have traveled with the blood flow. MRI should be avoided in case the projectile has a ferrous component (6). Instead, a total body scan was used in the presented case in addition to cardiac and trans-esophageal echographies.

Conclusion

This case demonstrates how a bullet may migrate far from its entry wound. It is not always easy to predict the outcome of a stray bullet injury. The true path of a bullet or a pellet cannot be determined solely by considering the inlet wound site. Although the majority of stray bullet injuries to the body can be found lodged in the organ they were targeted at, they are rarely lethal. A bullet penetrating the chest is by itself a serious injury, however not finding the bullet anywhere around the chest area, complicates the case and presents the challenges brought about by arterial embolism. In this case, the single inlet with no exit wound and the fact that no bullet was identified around the target organ, were clear signs of bullet embolism. A thorough and meticulous search should be employed to save an organ or a life.

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