

Gunshot Injury to Chest - A Miraculous Escape

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Abstract: *Thoracic gunshot injury can have variable presentation. The risk of injury to heart, major blood vessels and the lungs should be evaluated in every patient thoroughly and surgery should be considered as early as possible whenever indicated. We present a case of accidental gunshot injury to chest which got successfully removed surgically. A preoperative echocardiogram and chest computed tomography are definitively required to determine the bullet location (myocardium versus pericardium).*

Keywords: Gunshot injury, thoracic injury, retained bullet

1. Introduction

Gunshot injuries to heart are highly fatal as many of them die before reaching hospital. Retained intracardiac missiles are rare, with only 322 cases reported in the literature from 1940 to 2009. [1] It is important to localise the bullet lodgment in chest to decide the further course of action

2. Case Report

We present a case of a 38 year old male patient who presented to the casualty with accidental gunshot injury to chest and had received primary care at some other hospital and then referred to our center for further management. Patient gave history of accidentally being shot while he was walking on the road. The bullet was aimed at someone else who escaped with a minor bruise on the shoulder, but then it bounced and struck this patient on the chest.

The patient was conscious, oriented and haemodynamically stable with normal sinus rhythm on ECG. On physical examination he had a lacerated wound on right upper chest in mid-clavicular line just below the clavicle. Air entry on right side of chest was decreased.

Biochemical investigations were found to be within normal limits. In the Chest X-ray, a bullet was visible just above the diaphragm in cardiac shadow (Fig.1).

Ultrasonography FAST (Focused assessment with Sonography in Trauma) showed normal abdominal organs. Computed tomography chest and abdomen was done which showed metallic foreign body between aorta and ventricle and minimal right haemothorax of 1 cm thickness (Fig.2). 2D Echocardiography was carried out which showed minimal pericardial effusion, echogenic foreign body posterior to left ventricle, normal valvular function and no wall motion abnormality.

Although the patient was stable, a decision of bullet removal was taken as the bullet appeared to be located in the pericardium.

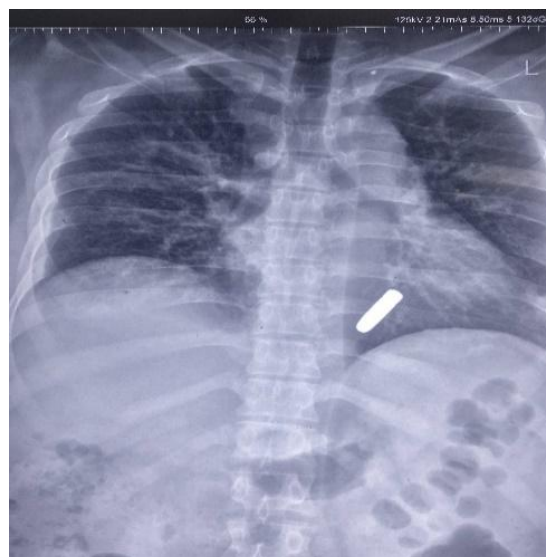


Figure 1: Chest X-ray shows bullet lying in the cardiac shadow

After arrangement of adequate blood products, patient was taken into the operation theatre. Cardiac bypass machine was kept ready as the trajectory of the bullet was not known. After securing invasive monitoring, patient was induced with injection Fentanyl and Etomidate. Injection Rocuronium was given for muscle relaxation. After induction, Transesophageal Echocardiography (TEE) was done which also showed the bullet location in the pericardium with normal valvular function and no wall motion abnormality (Fig.3).

On performing sternotomy, thickened edematous pericardium was seen. Pericardectomy was done, yellowish fluid was drained from the pericardial cavity.

A 1 cm rent was found in the pericardium near right atrium. Bullet was seen lying behind the left ventricle (Fig. 4 and 5) which was removed successfully in a single piece. Lungs were assessed and it showed lung contusion on right apex. A

right sided chest drain was placed for haemothorax. Heart was examined for any injury if present but none was found



Figure 2: Chest computed tomography showing metallic foreign body between aorta and ventricle

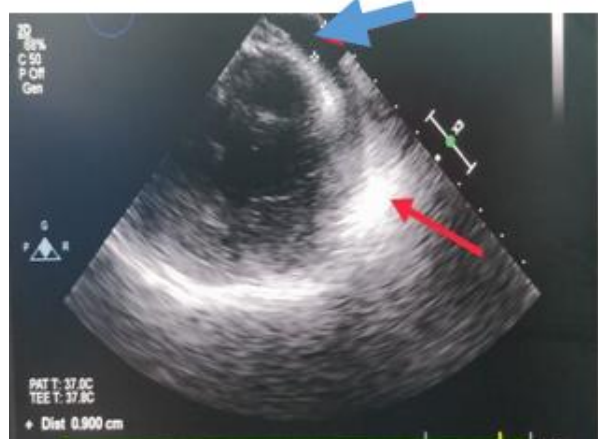


Figure 3: Transesophageal echocardiography scan

Blue arrow showing pericardial effusion, red arrow showing bullet

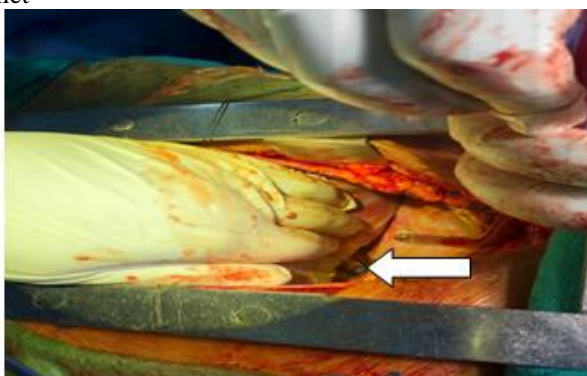


Figure 4: Bullet can be seen lying behind the left ventricle in the pericardial cavity

Patient remained haemodynamically stable throughout the procedure. Blood pressure and ECG were monitored during heart manipulation. After completion of surgery patient was shifted to ICU where extubation was done after return of spontaneous respiratory efforts and adequate muscle power. There was no complication in post-operative period and patient was discharged after 7 days of hospital stay.

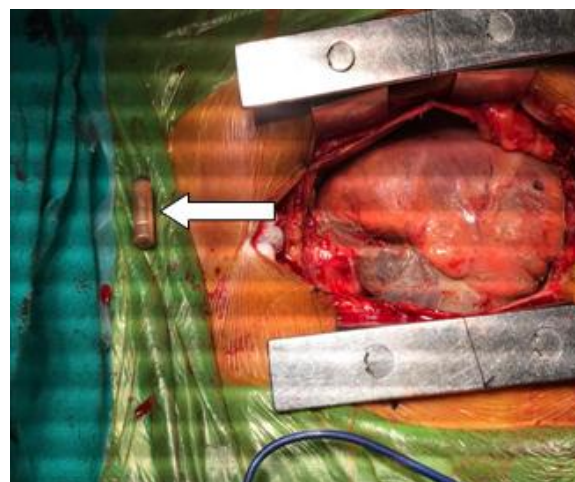


Figure 5: Bullet after removal from the pericardial sac

3. Discussion

Injuries to the chest have high morbidity and mortality due to the presence of vital organs. Gunshot wounds are associated with higher mortality as compared to stab injury due to more tissue injury. It is estimated that 80-90% of patients with gunshot wounds to heart do not reach hospital alive in India.^[2] There has been rapid proliferation of illegal firearms with sharp increase in firearm fatalities.^[3]

Gunshots cause cavitory lesions and inflict damage by disrupting tissues, causing haemorrhage, and permitting the entrance of infection.^[4] Generally, three factors determine the severity of a gunshot injury: the amount of kinetic energy transferred by the bullet to the surrounding tissues, the internal organs and structures damaged by the bullet, and the bullet's final disposition.

As this bullet had initially hit another person, its velocity decreased and it did not cause much injury to the patient. The bullet entered through right upper chest grazing the upper lobe of left lung, it further slowed down and traversed towards the heart. After penetrating the pericardium near right atrium, it probably just slipped towards the apex of the heart and got lodged within the pericardial sac and thus didn't cause any injury to cardiac muscles leading to fatal blood loss.

Projectile injuries to the heart can be divided into contusion of myocardium, laceration and puncture of chambers, disruption/rupture of valves and leaflets, disruption/perforation of septum and injury to coronary vessels.^[5]

Patients presenting with retained cardiac missiles are rare in the reported literature. It is uncommon to see an acute presentation without any symptoms. It is recommended to individualize treatment based on timing of presentation, accompanying symptoms, and characteristics of the foreign body, including location. The most common modalities currently used for localization include computed tomography and echocardiography.^{[6],[7]}

The need for removing bullets depends on clinical manifestations, location and size. Low-risk bullets are smaller than 5mm and located completely in the myocardium, while those located in the pericardium and intracavitary, with a risk of infection from passing through contaminated areas or in patients with arrhythmia or valvular dysfunction should be removed.^{[1], [6], [7], [8]} In this case the size of the bullet was 2 cm and was lying in the pericardial sac.

Bullets are usually made of a lead core and a copper or brass jacket. Lead leaking out of the bullet may cause systemic toxicity as has been reported in case of bullets bathed in synovial joint fluid^{[9], [10]} or intervertebral disc space.^[11]

Bullets causing venous emboli may remain silent until vascular injury or flow obstruction is caused.^[12] The bullet may migrate via several routes like it may travel locally along the intermuscular space or lumen or along the vein or artery to some distant site.^[13] Migration of a bullet from the abdomen to the right ventricle after a gunshot causing bowel perforation has been reported by Palmen et al.^[14] Venous embolization to the vena cava, right ventricle, or pulmonary arteries can cause symptoms such as perforation, further embolization, endocarditis, septic emboli, dyspnoea, haemoptysis, and chest pain in approximately 30% of patients.^{[15], [16]}

In 1955, Valle examined 42 soldiers with metallic foreign bodies retained in the heart, mediastinum and pericardial cavity. The author observed a subgroup of 12 patients with intrapericardial metallic foreign bodies who were managed conservatively initially because foreign bodies were smaller than 0.5 cm, developed pericardial effusion between four and 26 months after the trauma. The author concluded that the free foreign bodies in the pericardial cavity should be removed, regardless of their size.^[17]

Burkhart et al, in 1998, compiled 31 cases of foreign bodies retained in the pericardial sac. They found that the ten patients who had undergone early removal, recovered well. Fifteen out of the 21 patients who were initially followed-up, presented with various symptoms attributed to the presence of foreign bodies and underwent surgeries for bullet removal. The authors concluded that the "large" and free floating bodies in the pericardial cavity, usually cause symptoms and should be removed. They emphasized that the conservative approach must be adopted with extreme caution, only in selected cases, such as smooth metallic foreign bodies smaller than 1 cm, which are minimally contaminated and cause no symptoms.^[18]

Hence the decision to manage retained intracardiac foreign bodies should be taken wisely. Keeping the above stated facts in mind, it was decided in our case to surgically remove the bullet as it was in the pericardium and had already caused pericardial effusion.

Surgical management includes sternotomy and removal of bullet on or off bypass. It is recommended to keep bypass on standby even if not required initially. From anaesthesia point of view, there can be fall in right ventricular preload, venous

return and impairment of cardiac function due to anaesthetic agents, opioids and other drugs. High PEEP can lead to decrease in venous return. Hence induction and maintenance should be smooth preventing cardiovascular collapse. During inspection and repair, abrupt manipulation and elevation of heart can lead to arrhythmias and cardiac arrest. Any risk factor should be identified and treated aggressively to maintain hemodynamic stability.

4. Conflict of Interest

Nil

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