

Removal of a Bullet from the Septum after a Cardiac Gunshot

S Neragi-Miandoab, J Claridge, J Schwartz, M Bakhos

Citation

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Abstract

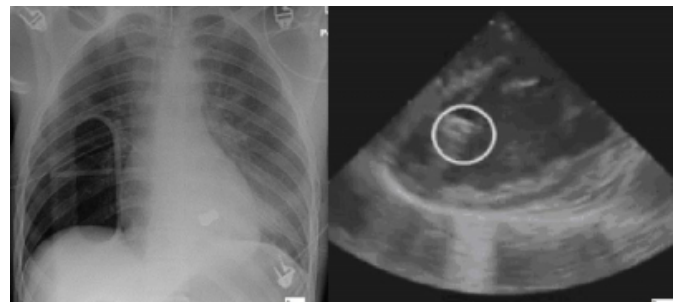
Most gunshot wounds to the heart are rapidly lethal because of cardiac tamponade or exsanguinations. The immediate clinical manifestations or cause of death from a retained missile are usually related to cardiac bleeding with or without tamponade. The intermediate manifestations of cardiac injury include myocardial infarction with cardiogenic shock, and bullet embolus to a peripheral artery. Late complications include missile erosion through the myocardium, endocarditis, pseudoaneurysm, ventricular septal defect, and valvular damage. A removal of bullet from the heart using cardiopulmonary bypass might be necessary to avoid possible complications. Use of CPB for these injuries allows for extensive rotation and retraction of the heart in a bloodless and motionless operative field.

CASE DESCRIPTION

We report a case involving a 16-year-old male who suffered a gunshot wound to the left upper arm and left chest at the level of the fourth intercostal space. The patient was initially hemodynamically unstable in the Emergency Department with a heart rate of 110-120 and a blood pressure 95/55 mmHg. He was tachypneic with decreased breath sounds over the left hemithorax. Bilateral 36 French chest tubes were placed and 350 ml of blood was immediately evacuated from the left chest. Chest x-ray (CXR) demonstrated a bullet overlying the cardiac silhouette (Fig. 1a). The focused assessment for the sonographic evaluation of trauma patients (FAST) in the ER was highly suspicious for pericardial tamponade. The patient was emergently transported to the operating room for a planned subxiphoid pericardial window and possible sternotomy. Copious bright red blood was discovered in the pericardium and the incision was promptly extended to a median sternotomy. Inspection of the heart demonstrated a single wound to the lateral apex of the left ventricle. Prolene sutures were used to close the cardiotomy and control the bleeding from the left ventricle. A transesophageal echocardiogram (TEE) revealed a foreign body in the septum of the left ventricle (Fig. 1b).

Figure 1

Figure 1: Right Transesophageal echocardiogram showing bullet in septum, Left CXR demonstrates bullet overlying cardiac silhouette

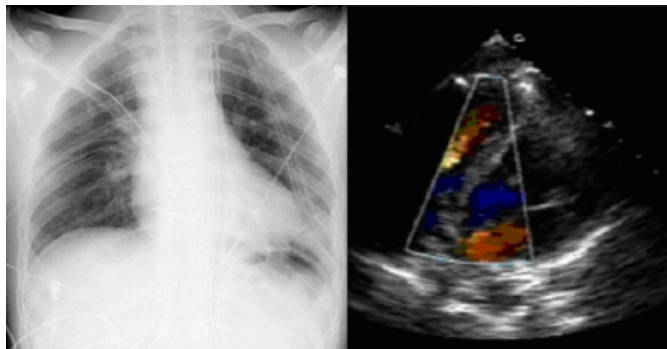


Cardiopulmonary bypass (CPB) was then initiated after cannulating the ascending aorta and venae cavae. The aorta was cross clamped and the cold blood cardioplegia solution was injected both antegrade and retrograde. The empty heart was palpated, which confirmed the presence of a bullet in the distal septum. The bullet was retrieved via a transverse incision in the apex of the left atrium, which was closed with a running 3-0 Prolene suture. The repaired entry wound to left ventricle was reinforced with 3-0 pledgeted Prolene suture. A bullet hole in the lower lobe of the left lung was identified and repaired. The patient did not require inotropic support or blood replacement during his care in the intensive care unit. He was extubated in less than 12 hours postoperatively and the chest tubes were removed on postoperative day 2. An transthoracic echocardiogram

(Figure 2) on postoperative day 4 demonstrated no ventricular septal defect. The patient was discharged home in good condition four days after his injury.

Figure 2

Figure 2: Postoperative CXR, bullet has been removed. Transthoracic echocardiogram on postoperative day 4 shows no evidence of ventricular septal defect or other abnormality



COMMENT

Cardiac gunshot wounds are among the most lethal injuries with a reported case fatality of 70% to 80% [1]. Tayal et al. [2] reported a sensitivity and specificity of 100% for FAST in detecting pericardial effusions after cardiac injury and this is the diagnostic test of choice to rapidly identify injury to the heart and imminent pericardial tamponade. A CXR is mandatory for patients with gunshot wounds to the chest and thoracostomy is performed for identified hemothorax or pneumothorax. TEE is useful for identifying extent of cardiac damage, ventricular septal defect or valve injury. The sensitivity of TEE for detecting pericardial fluid/tamponade is 97%; with a specificity of 100%, and an accuracy of 99% [3]. Computed tomography has a 100% sensitivity, 97% specificity, and 97% accuracy in visualizing cardiac tamponade [4]. However, its use is recommended for hemodynamically stable patients. Treatment of gunshot wound to the heart is dictated by the patient's condition and assumed injury. Presence of cardiac tamponade mandates pericardial window by subxiphoid approach, which may be diagnostic and therapeutic. The necessity of median sternotomy and exposure of the heart depends on severity of bleeding and the amount of the blood in the pericardial sac.

Issues that could be debated are the timing of the removal of the bullet and the use of CPB. We had a serious concern of bullet embolization and clot formation in this patient. Secondly, we were concerned about a large septal defect given the caliber of the bullet, which would have exposed the patient to acute cardiac failure. A second operation under conditions of compromised ventricular function would add

to this patient's morbidity and mortality. Furthermore, it would have required a longer hospital course and redo-sternotomy which is associated with increased morbidity.

Bullet embolization is a rare and unusual complication of penetrating gunshot injuries. An analysis of approximately 7,500 Vietnam casualties with known vascular trauma revealed the incidence of bullet embolization to be 0.3% (22 patients) [5]. The use of CPB to remove a bullet from the heart might be necessary to avoid systemic embolization of the bullet or clot. Furthermore, the use of CPB for severe cardiac injuries allows for extensive rotation and retraction of the heart in a bloodless and motionless operative field [6, 7]. Fedalen et al. [8] reported off-pump removal of a bullet from the outer surface of the myocardium, however, off pump removal of a bullet from the septum is not advisable.

The intermediate manifestations of cardiac injury include myocardial infarction with cardiogenic shock, pericardial tamponade, and bullet embolus to a peripheral artery. Late complications include missile erosion through the myocardium, systemic embolization of the bullet, endocarditis, pseudoaneurysm, ventricular septal defect, and valvular damage. These late complications can occur between one month and 20 years after the injury underscoring the necessity of long-term follow-up in these patients [9]. We recommend an echocardiogram shortly before discharge from the hospital and few months after intracardiac injury. Patients with more severe myocardial, valvular, or septal damage may need yearly long term follow up to identify late complications.

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Author Information

Siyamek Neragi-Miandoab, MD, PhD

Department of Surgery, Case Western Reserve University Hospital and Metro Health System

Jeffrey A. Claridge, MD

Department of Surgery, Case Western Reserve University Hospital and Metro Health System

Jeffrey P. Schwartz, MD

Department of Thoracic and Cardiovascular Surgery, Loyola University

Mamdouh Bakhos, MD

Department of Thoracic and Cardiovascular Surgery, Loyola University