Bullet embolization from an aorto-caval fistula to the heart

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Abstract

Bullet emboli to the heart as a result of penetrating trauma are rare. We report a case of a 19-year old male who suffered a gunshot wound to the abdomen, resulting in an aorto-caval fistula and subsequent venous embolization of the bullet to the right ventricle. Successful surgical removal of the foreign body under cardiopulmonary bypass was performed.

Keywords: Aorto-caval fistula • Venous embolization

INTRODUCTION

The most common foreign body embolized to the heart are from iatrogenic sources. They include: catheters, pacemaker electrodes, orthopaedic instrumentation and stents [1]. Embolization of traumatic foreign bodies, however, remains rare, but has been previously reported in the literature. Upon entry, bullets either exit or remain embedded within tissues. It is rare that the projectile will lose its energy and come to rest within the lumen of vasculature. The occurrence rate is approximately 0.3% in penetrating trauma [2]. While endovascular approaches have been previously described, the size of the bullet in this case rendered percutaneous removal difficult.

CASE REPORT

A 19-year old man arrived to the emergency department following an altercation. On initial examination, two entrance gunshot wounds were found but with no evidence of any exit wounds. An entry wound was found in the left lower quadrant of the abdomen and a second in his left parieto-temporal region. At that time, he was taken to the operating room for an exploratory laparotomy. An intraoperative angiogram was performed, and an infrarenal aorto-caval fistula was seen. A primary end-to-end repair of the aorta and lateral venorrhaphy of the inferior vena cava was performed. There was no evidence of a foreign body in the operative field. A postoperative chest X-ray demonstrated a foreign body within the cardiac chambers (Fig. 1). A chest computed tomography (CT) confirmed the location of the bullet within the ventricle (Fig. 2). Based on these findings, we suspected a bullet embolus from the aorto-caval fistula to the right ventricle. Transthoracic echocardiogram confirmed that the bullet was in the right ventricle with no damage to the cardiac structure.

The patient then underwent open surgical retrieval of the bullet through a median sternotomy and cardiopulmonary bypass. A right atriotomy was performed. The tricuspid valve was inspected and was found to be free of damage. However, an area of fibrinous filaments under the mid-septal leaflet was noted, indicating that the bullet had been embedded there prior to advancing to its final resting position within the pulmonary valve. The bullet was removed in its entirety. After an uneventful recovery, he was discharged home on postoperative day 3.

DISCUSSION

Since the first documented case of a foreign body embolus by Davis in 1834, only a limited number of cases have been reported in the literature. Bullet emboli should be suspected in any patient who has a gunshot wound without a corresponding exit wound, when the signs and symptoms do not correlate with those expected from the suspected course of the missile, or when radiological studies show that missile location deviating from the path of penetration [3].

Traumatic foreign objects invade the vasculature via direct propulsion into the lumen or erosion into the vessel wall [4]. Subsequent embolization exists in two types: 80% being arterial and 20% being venous [5]. Of the arterial emboli originating in large vessels and embolization to peripheral vessels, approximately 80% become symptomatic resulting in limb claudication or peripheral ischaemia [3]. Venous embolization from the peripheral vasculature 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 [3].

Currently, two rare subtypes of venous embolization exist [5]. The first is retrograde embolization where the object moves against the normal direction of blood flow and occurs in 15% of venous cases. The second is paradoxical embolization, where the object moves from the venous circulation, through a right-to-left shunt, traverses into the arterial circulation and behaves similarly to an arterial embolus.
Surgical intervention in the treatment of symptomatic patients has been clear. The most common symptoms that would indicate the need for surgery include fever, pericarditis, effusions, arrhythmia, thrombi and cardiac neurosis—namely anxiety [1]. Objects >5 mm in diameter, or an irregular shape, are also indications for removal [2].

The treatment of asymptomatic foreign bodies remains controversial. The risk of further embolization, occlusion of a major vessel and development of septic or cerebral emboli must be weighed against the risks of surgery [2]. Actis Dato et al. outline their recommendations on asymptomatic objects [1]: foreign bodies immediately discovered after injury are associated with an increased risk of infection, embolization or erosion and should be removed. Asymptomatic foreign objects that are completely embedded in myocardium, or those found late after initial injury, may be treated conservatively.

**CONCLUSION**

Bullet embolization to the heart is a rare entity. This diagnosis should be considered when there is no evidence of an exit wound, and the projectile is not found in the expected trajectory. These emboli should be surgically removed in order to prevent complications such as infection, migration, arrhythmias, valvular damage and further embolization. Failure to do so may place the patient at a higher risk of cardiac irritability possibly years later. We present a case of aorto-caval fistulization with subsequent embolization of the bullet to the right ventricle. Successful surgical removal was performed in our case. However, risk vs benefit should be assessed prior to any surgical retrieval.

**REFERENCES**


**eComment. Foreign bodies in the heart**

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We read with great interest the paper by Pan et al. regarding a bullet embolization to the right ventricle through an aorto-caval traumatic fistula in a 19-year-old patient [1]. The foreign body was removed uneventfully under cardiopulmonary bypass. Orthopaedic materials such as cement [2] and Kirschner wires [3-4] are among the most common iatrogenic materials that can migrate to the heart chambers. We recently published the case of an 80-year old female patient with a Kirschner wire in her right ventricle [3]. We would like to point out several important points concerning the mechanism of migration of foreign bodies to the heart.

As stated by the authors [1], foreign bodies can enter venous system through a direct protrusion into the lumen or by a slower erosion of the vascular wall. In this case scenario, the foreign body migrates to the heart from a peripheral vein and ultimately lodges in the right heart chambers or the pulmonary artery vasculature. Direct penetration of the foreign bodies with sharp extremity is another possible explanation of migration of these devices to the heart. The migration is due to regional bone resorption, muscle activity, gravity and negative intra-thoracic pressure [5]. They can eventually puncture the heart after passing through adjacent structure and muscles causing pericardial effusion or pericarditis.

To avoid potential Kirschner wire migration, several safety measures should be taken: bending the subcutaneous ends of the pins, rendering it properly secured, removing all devices after definitive healing and bone fixation, and following these patients up on a regular basis. Potential migration may be prevented by applying these simple measures.

Conflict of interest: none declared.