Pulmonary artery bullet embolism—Case report and review

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ABSTRACT

INTRODUCTION: Bullet embolism, an uncommon but serious complication of penetrating vascular trauma, poses a unique clinical challenge for the trauma physician. Migration of bullets can lead to infection, thrombosis, ischemia, hemorrhage and death.

PRESENTATION OF CASE: We report a patient in whom a bullet embolized from the left femoral vein to the right pulmonary artery, a situation ultimately managed by observation alone.

DISCUSSION: Bullet embolism should be suspected when the number of penetrating entry wounds exceeds the number of exit wounds. Patients with radiographic studies showing a bullet outside the established trajectory require further evaluation. Most bullet emboli are arterial, and are generally symptomatic presenting with early signs of ischemia. Venous emboli are less common, and they are generally asymptomatic. Most venous bullet emboli travel in the direction of the blood flow and may lodge in the pulmonary arterial tree causing serious complications. Management of bullet emboli in the pulmonary arterial tree remains controversial and specific guidelines have not been clearly established. However, the available data in the literature suggest that pulmonary artery embolism can be observed in the asymptomatic patient.

CONCLUSION: Symptomatic pulmonary bullet emboli should be managed with endovascular retrieval when available or operative therapy. Asymptomatic intravascular bullet emboli may be managed conservatively as seen in our patient.

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1. Introduction

Bullet embolism is a rare, potentially life threatening complication of penetrating missile trauma. In 1834, Thomas Davis first reported the case of a wooden fragment embolizing from the venous circulation to the right ventricle in a 10-year-old boy. While bullet embolism can be venous or arterial, venous embolism is less frequent. We describe a venous bullet embolism from the left femoral vein to the right pulmonary artery. The management of bullet embolism in the literature is reviewed and discussed.

2. Presentation of case

A 20-year-old male presented to our hospital with a gunshot in the right buttock. He was alert and hemodynamically stable. Examination revealed a single right buttock entry wound, without hematoma or active bleeding. His distal lower extremity pulses were normal. Chest and pelvis X-rays were unremarkable (Fig. 1A), and left thigh X-ray identified a bullet in the left thigh soft tissues (Fig. 1B). Computed tomography (CT) of the abdomen and pelvis demonstrated a track from the right buttock with the bullet resting next to the left femoral vein (Fig. 1C). The following day the patient developed increased swelling of the left thigh. CT angiogram with lower extremity runoff showed the bullet had migrated to the right internal iliac vein, without evidence of contrast extravasation (Fig. 1D). This was confirmed on bilateral lower extremity venogram (Fig. 1E). Given the bullet size (>10 mm) and shape, retrieval was deemed unfeasible. In attempts to prevent bullet migration, the right internal iliac vein was embolized using an Amplatzer vascular plug (Fig. 1F). The patient was discharged the following day.

Two weeks later, the patient returned with increasing right lower extremity pain and swelling. Right lower extremity ultrasound showed a deep venous thrombus within the right common femoral and popliteal vein. On repeat venogram, the previously noted bullet was no longer in the right iliac vein. An IVC filter was placed and deep vein thrombolysis was performed on the right lower extremity. Chest X-ray (Fig. 1G), chest CT (Fig. 1H), and
angiogram now localized the bullet to the right middle lobe pulmonary artery (Fig. 11). Attempts at endovascular bullet retrieval were unsuccessful. Because the patient was asymptomatic, the decision was made to treat the patient conservatively. After four years’ follow-up, the patient remains asymptomatic.

3. Discussion

Bullet embolism occurs when a small-caliber low velocity bullet penetrates a vascular structure and enters the blood stream.\(^1,^4\) A review of 7500 gunshot wounds during the Vietnam War demonstrated a 0.33% incidence of bullet embolism.\(^1\) To date, less than 200 reported cases exist in the medical literature.\(^5\) Bullet embolism should be suspected anytime there is: (i) an odd number of missile wounds, (ii) a bullet lies outside the established trajectory, or (iii) a wandering bullet is demonstrated on radiographs.\(^2\) While bullet migration usually occurs immediately after trauma, delayed migration up to 14 years later has been reported.\(^1,^4\) Initial management of all bullet emboli includes localization with total body radiography and removal when appropriate.\(^4\)

Bullet embolism can be either venous or arterial. Arterial emboli, 80% of all missile embolisms, often lodge in distal arteries.\(^3,^5\) Missile size, gravity, patient position, muscular and respiratory movement, and force of blood flow influence bullet migration.\(^3,^6\) Arterial bullet embolization often presents early with symptomatic ischemic complications. Arterial emboli often warrant surgical retrieval because of increased associated morbidity and mortality.\(^5,^7\)

In contrast, 70% of venous bullet emboli are asymptomatic.\(^4\) Most venous bullet emboli travel in the direction of the blood flow but can also travel in a retrograde, or even paradoxical (arteriovenous or venoarterial) fashion.\(^5,^9\) Migrating venous bullets lodge in the right ventricle more often than the pulmonary arterial tree since they tend to be trapped beneath the tricuspid valve or corda tendinae.\(^3,^5,^9\)

Management of bullet emboli to the pulmonary arterial tree includes open thoracotomy, endovascular extraction, or observation.\(^5,^6\) Recent endovascular advances have less morbidity and encourage prophylactic removal of pulmonary artery bullet emboli.\(^2,^7,^9\) If retrieval fails, successful outcomes with conservative management have been documented.\(^8\) A recent review showed that 44% of pulmonary artery bullet embolisms were managed successfully with observation.\(^10\)

Due to the asymptomatic nature of most venous emboli, management remains controversial.\(^5\) Some authors have recommended that any bullet that embolizes to the left heart should be removed.\(^5,^6\) However, in selected cases, patients could be safely observed.\(^5\) As recommended by some authors, right ventricular bullet emboli could be observed if the bullet is less than 5 mm, firmly lodged, with no evidence of arrhythmia or valvular dysfunction.\(^9\) Observation is also appropriate when bullets lodged in the pulmonary tree do not cause pulmonary infarction, pulmonary abscess, or erosion in the bronchus.\(^7\) In a recent report, the authors emphasize the use of endovascular retrieval of bullet embolism.\(^5\) These techniques have reduced the morbidity and
mortality of intracardiac bullet retrieval, and have favored prophylactic retrieval of bullet emboli to prevent complications.\(^5\)

In the case presented, initial management was directed at preventing further migration of the bullet from the right internal iliac vein with unsuccessful results. It is unclear whether the right lower extremity DVT was secondary to the bullet or the Amplatz vascular plug placement. Further attempts to retrieve the bullet from the right pulmonary artery proved unsuccessful and long-term observation was pursued.

4. Conclusion

Symptomatic cases of pulmonary bullet emboli warrant retrieval. Endovascular extraction should be the first line treatment when feasible. Surgical intervention should be considered when endovascular procedures fail. In asymptomatic cases, most authors recommend conservative management, but management guidelines have not been clearly established. In our case, after failure of endovascular bullet retrieval, we decided to proceed with conservative management. Our patient remained asymptomatic with close follow-up for four years and no signs of pulmonary complications.

Conflict of interest statement

None.

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Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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