

CASE REPORT

INTERMEDIATE

CLINICAL CASE

Chronic Ventricular Septal Defect and Retained Bullet After Gunshot



Best Not to Reopen Old Wounds

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ABSTRACT

Penetrating cardiac trauma from gunshots is usually fatal. We describe the case of a 62-year-old male presenting with ST-segment elevation myocardial infarction. A retained bullet embedded into the left ventricle was identified incidentally along with a ventricular septal defect from a gunshot wound decades prior. The ventricular septal defect and retained bullet were managed conservatively. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;18:101924) © 2023 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Surviving cardiac perforation from gunshot wounds is uncommon.¹ In select cases, missiles can become embedded into cardiac structures with variable symptomatology, presenting diagnostic and therapeutic challenges.² Occasionally, retained intracardiac bullets can be silent for several years.¹ The management of patients with chronically retained bullet(s) is dictated by symptoms, risk of embolization, erosion, source control if infection present, and effect on other cardiac structures. We describe a patient with incidental finding of a

chronically retained intracardiac bullet and a traumatic ventricular septal defect (VSD).

CASE PRESENTATION

A 62-year-old man with past medical history of hypertension and gunshot wound to the chest in the 1980s, presented to a non-percutaneous coronary intervention-capable hospital with crushing chest pain. Pain was midsternal and crescendo in nature, intermittent over the preceding 2 weeks, becoming sustained and with increased intensity on the day of presentation.

Initial electrocardiography was reported as having anterior ST-segment elevations without reciprocal changes, in which he was treated with thrombolysis (tenecteplase), subcutaneous enoxaparin, clopidogrel, and aspirin. Initial troponin I was elevated 4.6 µg/L (reference value, <0.04 µg/L). He was transferred subsequently to a percutaneous coronary intervention-capable center where he

LEARNING OBJECTIVES

- To discuss assessment of a chronically retained intracardiac bullet and traumatic ventricular septal defect.
- To understand the role of surgical vs conservative management of retained cardiac bullet.

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**ABBREVIATIONS
AND ACRONYMS****LV** = left ventricle**PCI** = percutaneous coronary intervention**VSD** = ventricular septal defect

underwent coronary angiography, which revealed a right dominant circulation, proximal right coronary artery occlusion with collateralization from the left coronary system, as well as a 70% lesion in the proximal and mid left anterior descending and moderate disease (40%-50%) in the left circumflex. A bullet was noted adjacent to the left ventricle (LV) apex that moved synchronously with heart contractions (Video 1). An inferior basal VSD with left-to-right shunt and outpouching of the inferior wall was visualized with LV injection, which was concerning for an acute ventricular septal rupture secondary to his myocardial infarction.

He was transferred emergently to our center for surgical assessment. On arrival, he was hemodynamically stable and was not in heart failure. A transthoracic echocardiogram showed normal LV size with ejection fraction 54%, a thin akinetic basal to mid inferior wall, and hypokinetic basal inferior septum suggestive of chronic infarct. An echogenic structure 2.0 × 0.5 cm was seen near the myocardium of LV apex, along the distal inferior wall. A small restrictive 0.4- to 0.5-cm VSD was visualized at the mid inferoseptum (Videos 2 and 3) with a left-to-right shunt (peak gradient of 99 mm Hg). The wall segments adjacent to the VSD contracted normally. The right ventricle was grossly normal in size with mildly decreased systolic function; however, the mid to distal right ventricular free wall was severely hypokinetic. This finding was felt to be related to an old infarct and suspected to be the site of cardiac penetration of the retained bullet.

A cardiac computed tomography scan localized the bullet to be lodged in the apical left ventricular cavity, not embedded into the myocardium but in close proximity to the apical wall. (Figure 1). There was no perforation of the myocardium or active leak of contrast. Repeat catheterization documented a pulmonary artery pressure of 27/6 (17) mm Hg and a Qp:Qs of 1.2.

The case was discussed among cardiology and cardiovascular surgery staff and, given his hemodynamic stability, restrictive, asymptomatic VSD, and chronically retained, epithelialized bullet with low risk of embolism, the decision was to leave the bullet in situ and to not pursue VSD closure. He was treated with percutaneous coronary intervention to his left anterior descending and right coronary artery and discharged home in stable condition. The source of the VSD was likely related to the previous gunshot wound where the bullet entered the right anterior aspect of the chest, at the level of the lower costal

margin mid clavicular line, puncturing the right ventricle and the interventricular septum causing a VSD, and terminating in the LV apex.

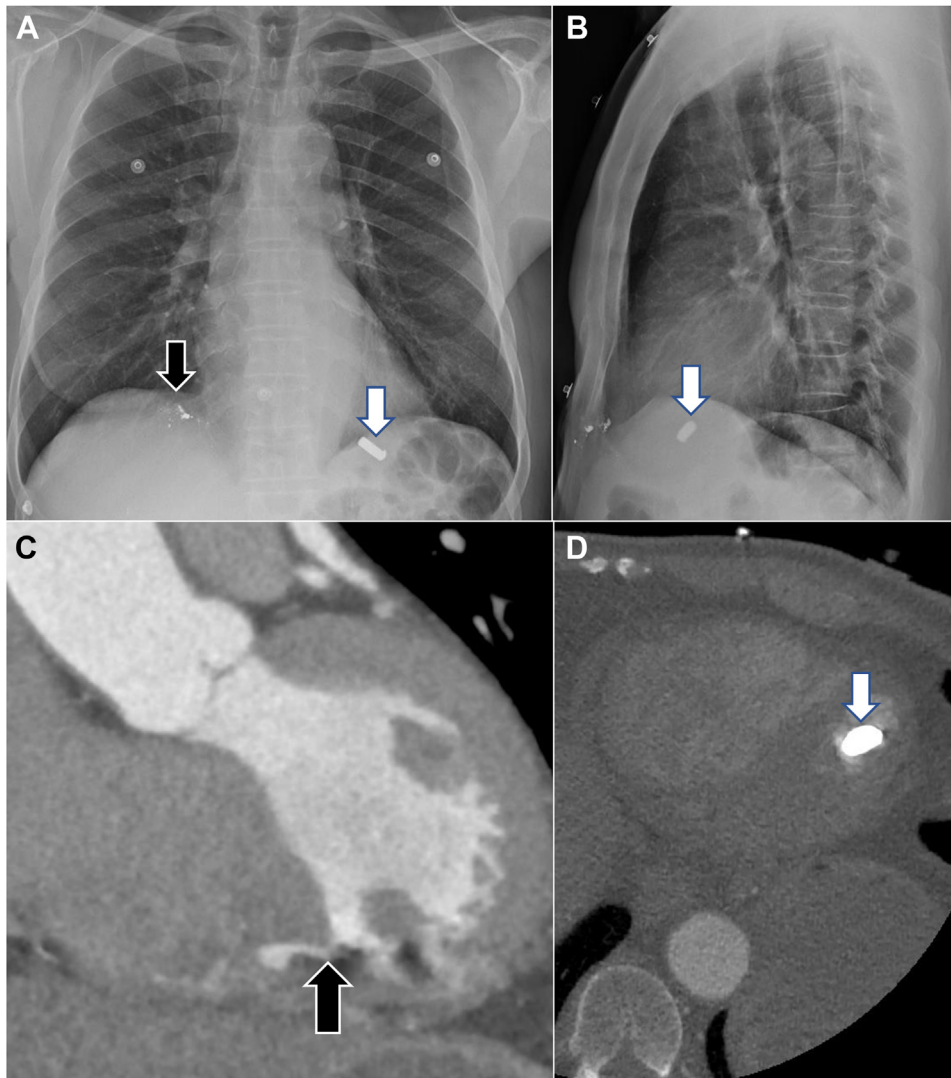
DISCUSSION

Our patient presented with chest pain and electrocardiography findings consistent with an anterior ST-segment elevation myocardial infarction, but had incidental findings of a retained intracardiac bullet and VSD. Although initially thought to be resulting from his acute myocardial infarction, collective diagnostic data supported the hypothesis that the VSD had formed as a result of his gunshot injury. The normal contraction of myocardial tissue adjacent to the VSD, along with its location (inferoseptal), and initial presentation of an anterior ST-segment elevation myocardial infarction would be supportive of a traumatic VSD, considering the history of gunshot wound and retained bullet.

The patient's finding of traumatic VSD with chronically retained intracardiac bullet is rare. Most patients with cardiac gunshot wounds who survive to hospital present acutely with hemodynamic instability, usually in relation to penetration of the myocardium and resulting cardiac tamponade and/or exsanguination.¹ Patients with retained intracardiac missiles have 2 possible routes of entry into the cardiac system, direct entry from penetrating trauma or embolization from peripheral sites.³ Embolization to the left side of the heart is rare because entry requires direct injury or access through the pulmonary veins or patent foramen ovale.¹ In our case, embolization to the left heart would not explain the muscular VSD. Because of the lack of documentation from the patient's remote gunshot wound care, it is impossible to know for certain the true course of the retained bullet, but most likely penetrated the right ventricle (where there is now a wall motion abnormality), caused the VSD and ultimately was lodged into the LV.

Traumatic VSD is a known complication of penetrating cardiac injury though it is quite rare (1%-5% of cases).⁴ Traumatic intracardiac defects can also be fatal, especially in cases where they remain unrecognized.⁵ Patients with retained intracardiac missiles can become symptomatic from consequential sepsis, conduction defects, dysrhythmias, intracardiac shunts, hemorrhage, pericardial complications, embolization, and/or erosion.³ Retained bullets composed of lead can leach resulting in lead toxicity.⁶ "Cardiac neurosis"—anxiety caused by an awareness of the retained missile and limitation of activity to avoid its migration—is also a recognized symptom of

FIGURE 1 Posteroanterior and Lateral Chest Radiographs



(A and B) Posteroanterior and lateral chest radiographs demonstrating bullet in the left ventricle (**white arrow**) and bullet fragments in the right lower anterior chest wall (**black arrow**). **(C)** Coronal reconstruction of a computed tomography scan demonstrating a ventricular septal defect communicating the left and right ventricle likely created by the bullet trajectory. The bullet was lodged in the left ventricular apical cavity in **(D)** (**white arrow**) close to the apical inferior wall.

intracardiac foreign bodies.¹ Some patients are initially asymptomatic, but can develop symptoms years later when the initial management was conservative.² Our patient was entirely asymptomatic for >40 years and was unaware of his retained intracardiac missile or his VSD.

Management of symptomatic patients with intracardiac foreign bodies is surgical removal.² However, treatment of asymptomatic intracardiac foreign bodies is less certain. Left-sided intracavitary missiles

or missiles seen shortly after injury, partially embedded into the myocardium, can result in endocarditis, thrombi, emboli, or dysrhythmia and should be excised.² However, early completely embedded into the myocardium or late partially embedded but encapsulated or epithelialized, intracardiac bullets can be left in situ,² with 1 case remaining in situ for 70 years.⁷

Our patient's intracardiac bullet had been present for >40 years and epithelialized into the apex of the

LV, in the absence of symptoms. Its extraction may have caused undue harm. Furthermore, the traumatic VSD was restrictive and did not meet indications for intervention. Clinical and echocardiographic follow-up was recommended.

CONCLUSIONS

This case describes a 62-year-old man with a retained bullet in the LV that likely caused a traumatic VSD. Given his prolonged asymptomatic state, chronic stable retained bullet, and restrictive VSD, he was treated conservatively and will have close clinical follow-up. This case highlights the need for careful

clinical consideration of chronic intracardiac missiles and traumatic VSD.

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KEY WORDS gunshot wound, intracardiac bullet, missile, retained bullet, ventricular septal defect, VSD

 **APPENDIX** For supplemental videos, please see the online version of this paper.