

## MINI-FOCUS ISSUE: CHEST WOUNDS

BEGINNER

## CASE REPORT: CLINICAL CASE

# Cardiac Gunshot Injury

## A Serendipitous Miss!



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## ABSTRACT

Penetrating cardiac injuries carry a grave prognosis. We present a rare case of thoracic gunshot injury where the bullet ricocheted and lodged in the pericardium without causing damage to the adjacent cardiac structures. Multimodality imaging helped in localizing the bullet, assessing damage, and planning safe surgical removal without cardiopulmonary bypass. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2021;3:16-9) © 2021 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/>).

A 38-year-old man, a bystander victim of gun violence, was struck by a bullet on his way to work. The entry wound was located below the right clavicle (**Figure 1**). The patient reported precordial pain that increased on inspiration and radiated to the ridge of the left trapezius. The patient was hemodynamically stable, and the cardiovascular

examination was normal. There was no significant past medical history.

## DIFFERENTIAL DIAGNOSIS

The differential diagnosis included hemothorax, pneumothorax, hemopericardium, pericarditis, and myocardial contusion.

## INVESTIGATIONS

The chest radiograph showed a bullet shadow inside the cardiac silhouette with the tip pointing away from the direction of entry wound, a finding suggesting that the bullet had ricocheted from the thoracic wall (**Figure 2**). The electrocardiogram showed diffuse ST-segment elevation and PR-segment depression suggestive of either pericarditis or myocardial contusion (**Figure 3**). Hemoglobin and hematocrit values were 14 g/dl and 42.4%, respectively. The total leukocyte count and renal parameters were normal. Cardiac troponin I was elevated (1.32 ng/ml). The patient underwent a nongated contrast enhanced computed tomography (CECT) scan of the thorax to

## LEARNING OBJECTIVES

- In patients with thoracic gunshot wounds, ricochet bullets can cause cardiac trauma.
- Multimodality imaging should be used to assess damage and localize the projectile.
- Transthoracic or transesophageal echocardiography may be particularly useful when computed tomography shows prominent artifacts.
- Treatment of patients with asymptomatic retained cardiac foreign bodies should be individualized by weighing the risk of surgery with the probable benefit.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

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**FIGURE 1** Bullet Entry Wound in the Right Upper Chest



also confirmed the intrapericardial location of the bullet.

### MANAGEMENT

The patient underwent surgical exploration 4 days after presentation. A midline sternotomy was performed. A tear was observed in the parietal pericardium near the right atrial appendage, and the bullet was removed. There was no damage to the left ventricular wall or any other chamber. The pericardial effusion was drained, and the pleural effusion was managed conservatively. The entry wound was allowed to heal by secondary intention. The patient was discharged 3 days after the surgery on oral antibiotics and continues to do well.

### DISCUSSION

We report a rare case of thoracic gunshot injury, where the bullet ricocheted to lodge in the pericardium without causing any damage to other cardiac structures. The clinical presentation was compatible with pericarditis caused by the intrapericardial foreign body. This case underscores the utility of multimodality cardiac imaging in diagnosis and management of patients with penetrating cardiac injuries and cardiac foreign bodies.

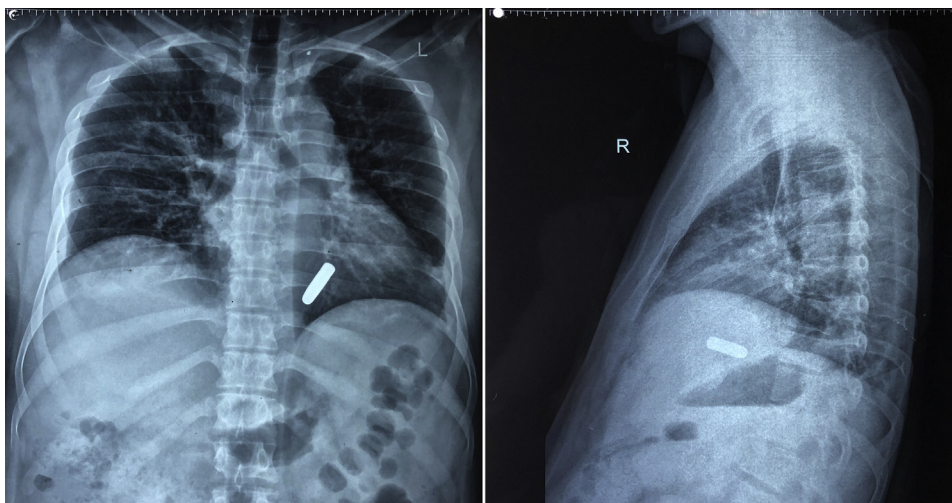
### ABBREVIATIONS AND ACRONYMS

**CECT** = contrast-enhanced computed tomography

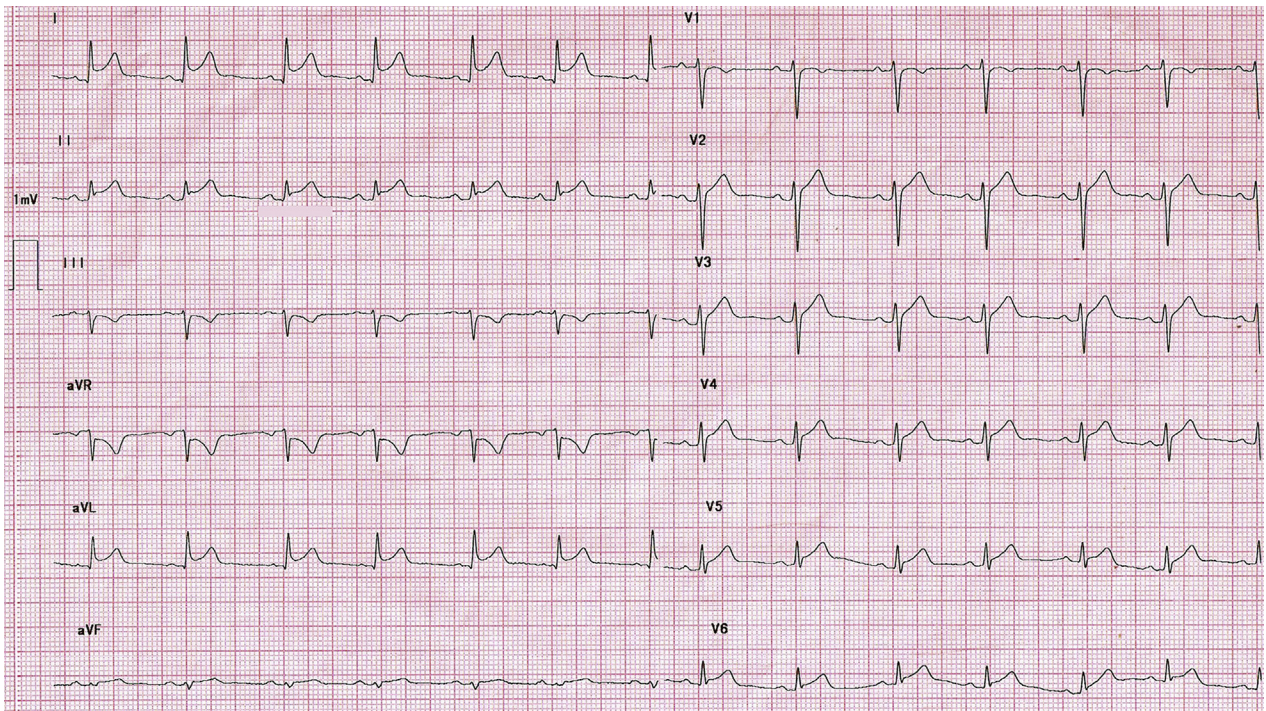
localize the bullet. However, prominent beam-hardening artifacts caused by the metallic bullet prevented exact localization, and the site of the bullet was deemed to be probably intracardiac (Figure 4).

Echocardiography resolved the ambiguity about the location of the bullet. The transthoracic echocardiogram showed the bullet lodged inside the pericardium along the inferolateral aspect of the left ventricle, with clear separation from the epicardium. There was mild pericardial effusion (Figures 5A and 5B, Video 1). Transesophageal echocardiography

**FIGURE 2** Chest Radiographs in the Anteroposterior and Lateral Views Showing an Intrathoracic Bullet



**FIGURE 3** The 12-Lead Electrocardiogram Showing Diffuse ST-Segment Elevation in Limb Leads and Precordial Leads With Depression of the PR Segment



Cardiac gunshot wounds are associated with high mortality rates of up to 90% (1,2). The most common presentation is with hemothorax and pericardial tamponade; however, patients can rarely be asymptomatic and present only with foreign bodies in

the heart. Cardiac anatomy dictates the pattern and extent of injury. The right ventricle, being anterior, is most commonly involved, followed by the left ventricle, right atrium, and left atrium (3).

Imaging plays an important role in managing such patients by defining the extent of the injury and chamber involvement. CECT of thorax provides high-resolution imaging to assess the extent of the damage. However, metallic foreign bodies result in beam-hardening artifacts, which may obscure anatomic details. In the present case, CECT was inconclusive and could not exclude an intracardiac location of the bullet. Echocardiography resolved this dilemma and confirmed the location to be intrapericardial (4).

The management of stable patients with asymptomatic intracardiac projectiles is debatable. It has been suggested that patients with retained bullets should be kept under observation without any intervention; surgery for removal of such foreign bodies may cause more damage to the surrounding structures than the projectile itself (5). However, careful assessment of the extent of damage by using multiple imaging modalities can help in individualizing treatment for every patient. In our case, the patient had clinical pericarditis, and echocardiography confirmed the bullet to be intrapericardial. This allowed

**FIGURE 4** Nongated Computed Tomography

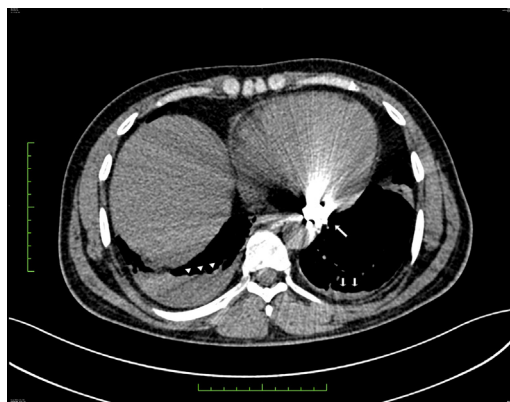
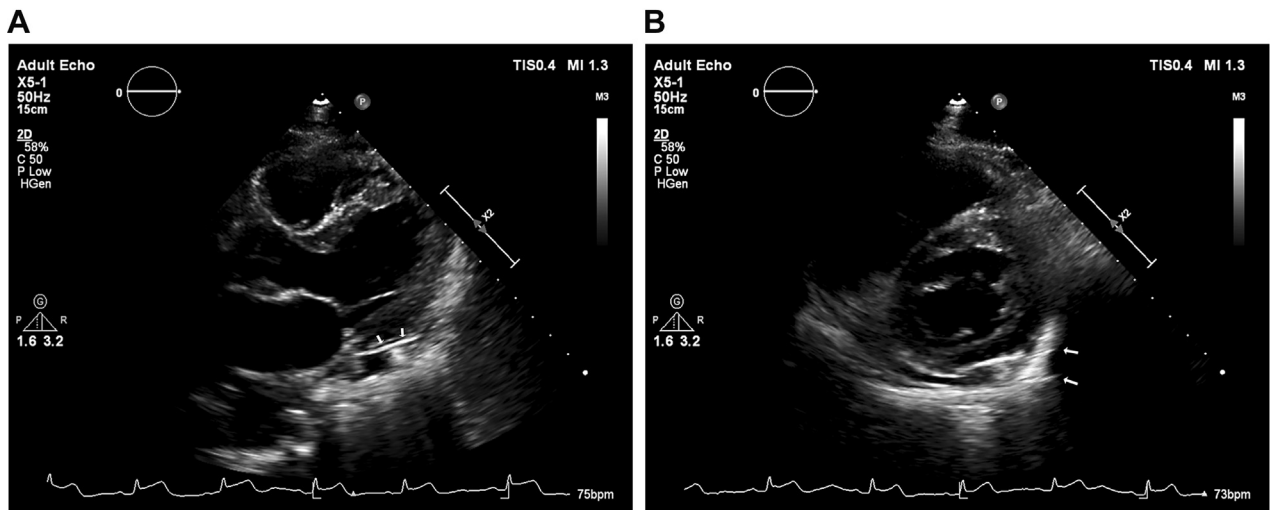


Image of the thorax showing a foreign body (long arrow) with beam-hardening artifacts obscuring exact localization. There is mild bilateral pleural effusion, right (arrowheads) more than left (short arrows). Minimal pericardial effusion is also noted.

**FIGURE 5** Echocardiographic Views



**(A)** 2-dimensional transthoracic echocardiogram showing the bullet (**arrows**) inside the pericardium as 2 parallel shadows along the inferolateral aspect of the left ventricle. ST-segment elevation can also be noted in the accompanying electrocardiogram trace. **(B)** The 2-dimensional transthoracic echocardiography in the parasternal short-axis view showing the intrapericardial bullet as 2 parallel shadows (**arrows**). Mild pericardial effusion is also noted.

successful surgical removal of the bullet without cardiopulmonary bypass.

#### FOLLOW-UP

The patient was asymptomatic at 6 months of follow-up.

#### CONCLUSIONS

Multimodality imaging is useful in localizing an intracardiac foreign body, assessing damage, and

planning appropriate management in a hemodynamically stable patient.

#### AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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**KEY WORDS** cardiac trauma, echocardiography, gunshot injuries, penetrating cardiac injury, pericarditis, sternotomy, thoracic injuries

**APPENDIX** For a supplemental video, please see the online version of this article.