

## CASE REPORT

### CLINICAL CASE

# Unveiling an Asymptomatic Cardiac Air-Gunshot Injury



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### ABSTRACT

Interventricular septum pellet retention after air-gunshot injury in a persistently asymptomatic patient is a rare, clinically significant occurrence. Management involved monitoring, echocardiography, and computed tomography scans. After risk-benefit analysis, we favored a nonsurgical management without prophylactic antibiotics or colchicine. No post-traumatic pericarditis was observed. Patient remained asymptomatic and in excellent condition at 1-month follow-up. (J Am Coll Cardiol Case Rep 2024;29:102319) © 2024 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/>).

### HISTORY OF PRESENTATION

A 41-year-old man was medically escorted by the Urgent Medical Aid Services to the Cardiac Intensive Care Unit following an accidental intramyocardial injury secondary to an air-gunshot blast. The injury occurred when a 4.5-mm pellet was accidentally discharged from a high-power air rifle approximately 16.5 feet away, with a velocity of 1,050 ft/s and a power of 20 J. The projectile traversed through the left arm before penetrating the thorax at a point located on the left lateral aspect of the chest between the fourth and fifth intercostal space and between the middle and anterior axillary lines. This trajectory was precisely delineated during the physical examination, where no residual pellet was palpable. The orifices were small and well-defined, surrounded by slight ecchymosis, with no signs of active bleeding,

### LEARNING OBJECTIVES

- To understand the potential complications, variability in patient presentations, and clinical significance of retained intracardiac foreign bodies from AGWs to enhance diagnosis, management, and long-term patient care.
- To develop the ability to conduct a thorough risk-benefit analysis in cases of penetrating cardiac injuries, to guide the decision-making process between surgical extraction and nonoperative management.
- To appreciate the importance of a multidisciplinary approach in managing complex cases of penetrating cardiac injuries, fostering a collaborative attitude toward patient care and decision-making.

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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](#).

Manuscript received August 1, 2023; revised manuscript received February 23, 2024, accepted March 1, 2024.

**ABBREVIATIONS  
AND ACRONYMS****AGWs** = air-gunshot wounds**CT** = computed tomography**PCI** = penetrating cardiac injury**TTE** = transthoracic  
echocardiogram

discharge, or infection. The patient described intense laterothoracic pinching pain on the left side, rated at 6 of 10 on the Numerical Rating Pain Scale, which persisted for 1 hour and exacerbated on inspiration.

**PAST MEDICAL HISTORY**

The patient had no significant past medical history; however, active tobacco use and overweight were identified as cardiovascular risk factors.

**DIFFERENTIAL DIAGNOSIS**

Initial differential diagnoses included conditions such as pneumothorax, pleural effusion, myocardial contusion, pericardial tamponade, myocardial infarction, thromboembolic events, and arrhythmias. These were ruled out through clinical assessments and imaging studies, leading to the definitive diagnosis of a penetrating cardiac injury (PCI).

**INVESTIGATIONS**

On admission, the patient's vital signs were stable, displaying body temperature at 36.5 °C, blood pressure of 130/80 mm Hg, heart rate of 80 beats/min, respiratory rate of 16 breaths/min, and oxygen saturation of 98% on room air. Diagnostic tests, including a chest radiograph (**Figure 1**), an emergency computed tomography (CT) scan (**Figure 2**), and a transthoracic echocardiogram (TTE) (**Figure 3**), (**Videos 1 and 2**), revealed an unfragmented metallic foreign body

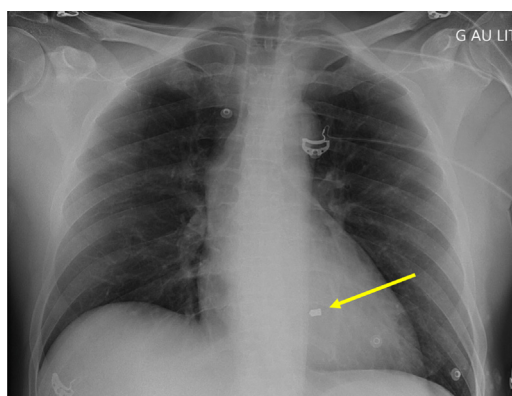
lodged in the interventricular septum, a sub-centimetric circumferential layer of pericardial effusion, and a normal left ventricle ejection fraction. Laboratory findings included elevated leukocyte count (12.59 G/L), C-reactive protein (41 mg/L), troponin (194 ng/L), N-terminal pro-B-type natriuretic peptide (59 ng/L), and D-dimer levels (430 ng/L), indicating an inflammatory response and potential cardiac injury. Cardiovascular examination revealed no signs of peripheral hypoperfusion, palpitations, lipothymia, syncope, heart failure, or irregular heart sounds. Additionally, there were no indications of venous thrombosis. The abdomen was soft, nontender, and nondistended, with no signs of guarding or rigidity. Extremities were warm and well-perfused, with strong peripheral pulses and no signs of edema or cyanosis. Neurologically, the patient was alert, oriented, and responsive, exhibiting intact cranial nerves, normal strength, and reflexes in all extremities, with no focal deficits identified.

**MANAGEMENT**

Given the exceptional nature of this case and the scarcity of published data on retained myocardial pellets, a multidisciplinary team comprising cardiothoracic surgeons, anesthesiologists, traumatologists, cardiac imaging specialists, and intensive care cardiologists conducted a meticulous benefit-risk analysis, weighing the potential benefits and risks of surgical extraction vs nonoperative management. In the absence of clinical symptoms and abnormal visceral/structural CT findings, the team opted for a nonsurgical approach, favoring regular clinical, biological, and CT surveillance over probabilistic antibiotic therapy owing to the lack of hyperthermia and inflammatory syndrome. A follow-up CT scan (**Figure 4A**) confirmed the stability of the pellet's position and absence of complications, leading to the patient's safe discharge on day 7.

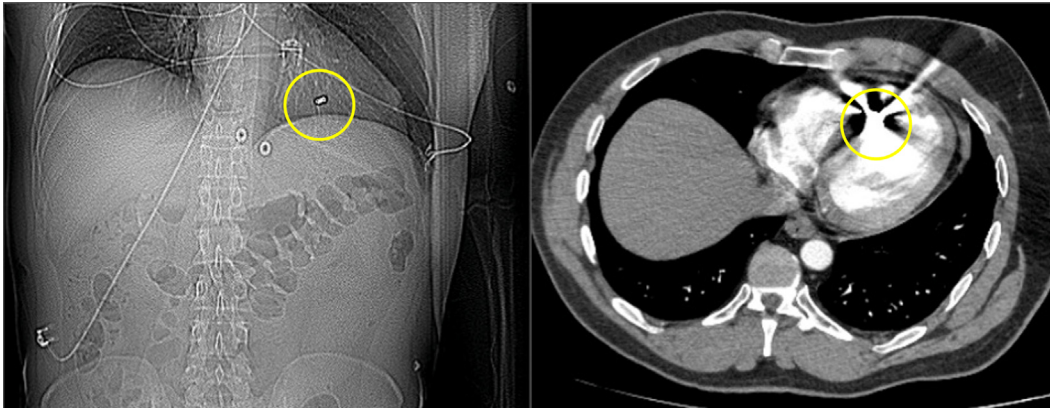
**DISCUSSION**

This case highlights the clinical implications of penetrating cardiac injuries with subsequent retained foreign bodies, particularly from air-gunshot wounds (AGWs). Despite the high potential lethality of these injuries, the successful outcome in this patient underscores the viability of nonsurgical management in certain contexts. High-velocity air guns can attain muzzle velocities of up to 1,200 ft/s, greatly exceeding the 350 ft/s velocity threshold necessary to pierce human skin and harm vital organs. The

**FIGURE 1** Initial Chest X-Ray (Day 0)

Initial chest x-ray (day 0) unveiling a pellet within the mediastinal region (yellow arrow).

**FIGURE 2** Emergency CT Scan (Day 0)

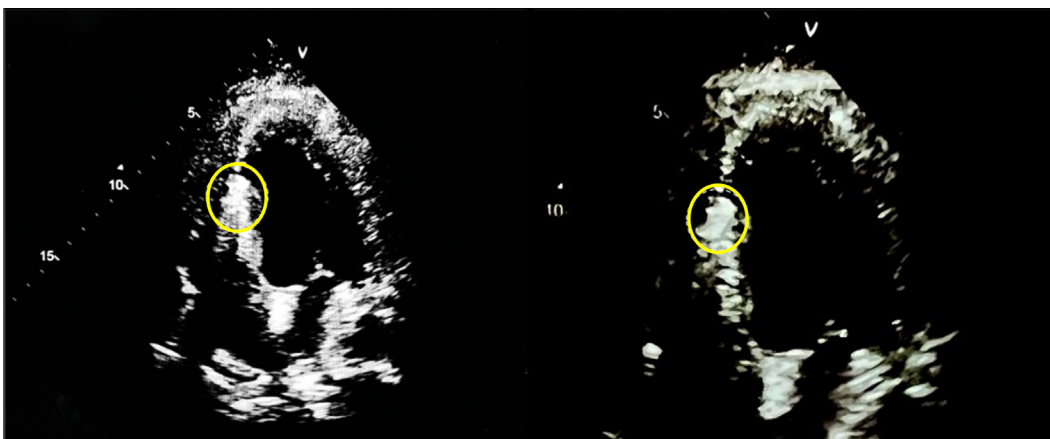


Emergency computed tomography (CT) scan (day 0) depicting the projectile's trajectory and its lodgment in the interventricular septum (yellow circle).

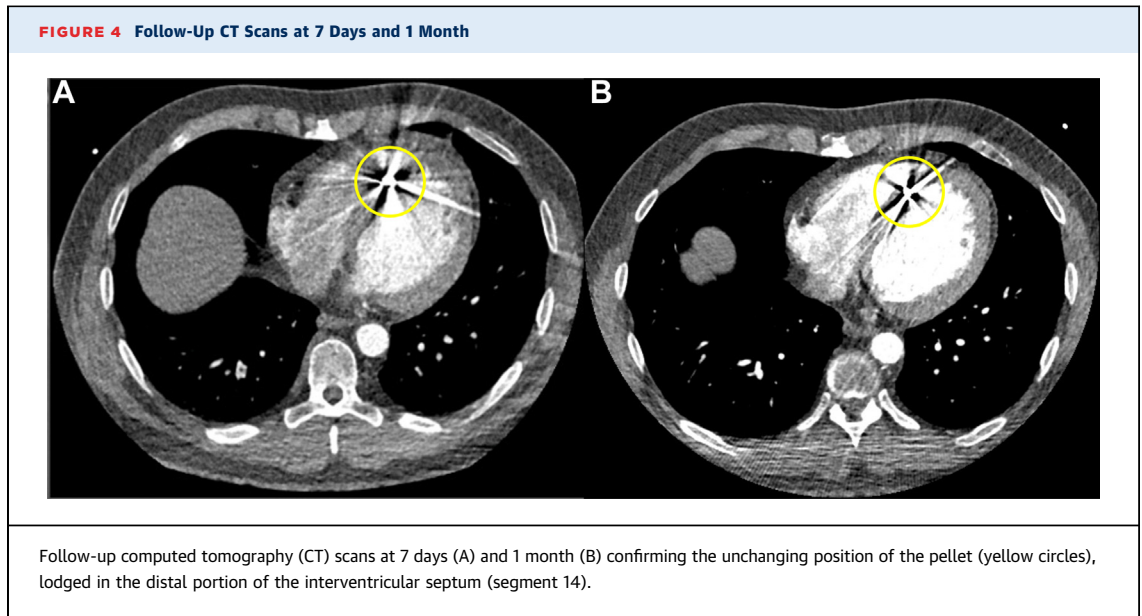
management of these injuries is critical, given their potential lethality, comparable to that of low-velocity powder firearms.<sup>1,2</sup> The rarity of such cases, coupled with the unique asymptomatic clinical presentation observed in this report—despite a retained foreign body in a critical anatomical location—emphasizes the need for a thorough risk-benefit analysis by a multi-disciplinary team to guide the management strategy. Historically, the survival rate for patients enduring a

PCI and reaching a medical facility alive was below 10%.<sup>3</sup> This figure may have improved with advancements in prehospital transportation. However, the mortality rate remains substantial for patients with PCIs who make it to the hospital, with reported rates up to 67%, varying based on the context and severity of the injury.<sup>4</sup> Furthermore, the mortality rates for cardiac gunshot wounds requiring thoracotomy in an emergency department setting are

**FIGURE 3** TTE (Day 0)



Transthoracic echocardiogram (TTE) (day 0) pinpointing the pellet's location (yellow circle) in the interventricular septum.



alarming close to 100%.<sup>5</sup> Therefore, swift transportation, accurate diagnosis, and a strategic management approach determined by a thorough risk-benefit analysis are vital for optimizing patient outcomes and survival. The management of PCIs involving retained foreign bodies demands an exhaustive evaluation of the patient's overall clinical stability alongside possible complications and risks associated with both surgical and nonsurgical options. The literature provides an array of management strategies, encompassing observation, pericardial drainage, and cardiac exploration.<sup>2</sup> A variety of complications may arise, including pericardial tamponade, cardiogenic shock, myocardial infarction, and peripheral artery projectile embolus. Further complications such as hemothorax or cardiac tamponade may lead to hemorrhagic shock. Retained foreign bodies carry the risk of long-term complications, such as endocarditis, myocardial erosion, systemic embolization, pseudoaneurysm, ventricular septal defect, conduction system injury, and valvular damage.<sup>6-8</sup> Therefore, maintaining a schedule of regular follow-ups, interval CT scans, and TTEs is crucial for the surveillance of potential long-term complications. The decision to pursue nonsurgical approach in this case was founded on careful consideration of the potential benefits of surgical extraction vs the risks and possible complications associated with nonoperative management. Whereas empiric colchicine therapy is frequently

administered as a preventive measure against post-traumatic pericarditis, its effectiveness in curbing incidence remains inconclusive.<sup>6</sup> Specifically, in this case, the patient was not indiscriminately given either antibiotics or colchicine prophylaxis, and he did not develop post-traumatic pericarditis.

#### FOLLOW-UP

One month post incident, the patient underwent an assessment by the cardiac surgery team during a scheduled consultation. The patient remained entirely asymptomatic and in excellent general condition. The biological check-up yielded no signs of sepsis, with all inflammatory biomarkers returning negative. Furthermore, complete healing was observed in all cutaneous entry and exit orifices with no evidence of abscess development at the sites of injury. Analysis of the 1-month follow-up CT scan (Figure 4B) affirmed the stability of the pellet position within the apical interventricular septum, and no other anomalies were detected.

#### CONCLUSIONS

This case study reports the potential complexities and challenges inherent in managing PCIs with retained foreign bodies, particularly those resulting from AGWs. The infrequency and asymptomatic nature of such cases underscore the pivotal role of multidisciplinary collaboration and comprehensive

risk-benefit analysis in devising an effective management strategy. Despite the historically high lethality of these injuries, the successful outcome in this patient underscores the feasibility of nonsurgical management in certain scenarios. This case contributes valuable insights to the sparse literature on air-gunshot cardiac injuries, underscoring the need for further research and the establishment of robust, evidence-based guidelines to enhance patient outcomes.

## FUNDING SUPPORT AND AUTHOR DISCLOSURES

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

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## REFERENCES

1. Laraque D, American Academy of Pediatrics Committee on Injury, Violence, and Poison Prevention. Injury risk of nonpowder guns. *Pediatrics*. 2004;114(5):1357-1361. <https://doi.org/10.1542/peds.2004-1799>
2. Alejandro KV, Acosta JA, Rodríguez PA. Air gun pellet cardiac injuries: case report and review of the literature. *J Trauma*. 2003;54(6):1242-1244. <https://doi.org/10.1097/01.TA.0000071290.41225.AB>
3. Campbell NC, Thomson SR, Muckart DJ, Meumann CM, Van Middelkoop I, Botha JB. Review of 1198 cases of penetrating cardiac trauma. *Br J Surg*. 1997;84(12):1737-1740.
4. Asensio JA, Ogun OA, Petrone P, et al. Penetrating cardiac injuries: predictive model for outcomes based on 2016 patients from the National Trauma Data Bank. *Eur J Trauma Emerg Surg*. 2018;44(6):835-841. <https://doi.org/10.1007/s00068-017-0806-6>
5. Tyburski JG, Astra L, Wilson RF, Dente C, Steffes C. Factors affecting prognosis with penetrating wounds of the heart. *J Trauma*. 2000;48(4):587-591. <https://doi.org/10.1097/00005373-200004000-00002>
6. Smith BM, Loomis E, Erz L, Shaub TF, Espinal E, Shenoy R. A case report of a retained interventricular septal bullet after gunshot wound. *J Surg Case Rep*. 2021;2021(5):rjab179. <https://doi.org/10.1093/jscr/rjab179>
7. Willemsen P, Kuo J, Azzu A. Dysrhythmia from an intrapericardial air gun pellet: a case report. *Eur J Cardiothorac Surg*. 1996;10(6):461-462. [https://doi.org/10.1016/s1010-7940\(96\)80116-3](https://doi.org/10.1016/s1010-7940(96)80116-3)
8. Mills EE, Birnbaum PL, Davis JW. Asymptomatic gunshot wound to the heart with retained intracardiac pellet. *Ann Thorac Surg*. 2014;97(1):e15-e16. <https://doi.org/10.1016/j.athoracsur.2013.08.023>

**KEY WORDS** air gun, asymptomatic, cardiac, conservative management, gunshot, interventricular septum, multidisciplinary approach, nonsurgical management, penetrating cardiac injury

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