Surgical removal of a bullet in the heart through a trans-mitral approach: a case report

Antonio Giovanni Cammardella 1*, Antonio Lio 1, Leonardo De Luca 2, Marcello Bergonzini 1, and Francesco Musumeci 1

1Department of Cardiac Surgery and Heart Transplantation, San Camillo Forlanini Hospital, via Gianicolense, 87, 00152 Rome, Italy; and 2Department of Cardiosciences, Division of Cardiology, San Camillo Forlanini Hospital, Rome, Italy

Received 29 January 2022; first decision 28 April 2022; accepted 10 October 2022

Background
Retained cardiac missiles have been considered bullets, shrapnel, or pellets included in the heart or the pericardial sac. In asymptomatic patients with retained cardiac missiles, the role of surgery is still debated.

Case summary
We describe the case of successful surgical treatment of a retained missile localized within the left ventricle in close proximity of the posterior mitral leaflet. The operation was performed through a transatrial approach, detaching the posterior mitral leaflet. The post-operative course was uneventful. The patient was discharged on the seventh post-operative day. At 30-day follow-up visit, the patient was in good conditions, with normal mitral valve function.

Discussion
The management of retained cardiac missiles should be individualized. If a decision is made to operate, multiple imaging techniques including echocardiography and computed tomography scan are mandatory to precisely locate the bullet.

Keywords
Retained cardiac missiles • Cardiac surgery • Mitral valve • Case report

ESC Curriculum
2.4 Cardiac computed tomography • 7.5 Cardiac surgery • 9.2 Trauma to the aorta or the heart • 2.2 Echocardiography • 4.3 Mitral regurgitation

Learning points
• Retained cardiac missiles are considered as bullets, shrapnel, or pellets that are included in the heart or in the pericardial sac. The management of intracardiac missiles should be individualized on patients.
• Multiple imaging techniques including echocardiography and computed tomography scan are mandatory in decision process.

Introduction
Retained cardiac missiles (RCMs) are considered as bullets, shrapnel, or pellets included in the heart or the pericardial sac.1 Surgical treatment is considered in case of risk of acute complications or haemodynamic instability due to cardiac tamponade, bleeding, or acute heart failure.1 On the other hand, some series reported optimal outcomes with a conservative management in stable, asymptomatic patients.2 However, to date, the role of surgery in these cases is still debated.

We describe the case of successful surgical treatment of a retained bullet localized within the left ventricle using a transmitral approach.
Timeline

| Dates       | Events                                                                 |
|-------------|------------------------------------------------------------------------|
| May 2021    | Emergency cardiorrhaphy through left thoracotomy for cardiac injuries from a chest shotgun |
| June 2021   | Admission to our hospital for atypical chest pain and evidence of left bundle branch block. Transthoracic echocardiography and computed tomography scan showed the bullet retained within the left ventricular chamber localized into the posterior wall. |
| 15 days later | Surgical removal of a bullet in the left ventricle through a trans-mitral approach |
| 7 days later | Patient was discharged home |
| 30 days later | Patient was in good conditions, with normal mitral valve function |

Case report

A 45-year-old man previously injured by a chest shotgun was referred to our Institution for a retained bullet in the left ventricle. The patient’s medical history included hypertension, diabetes, and thyroid dysfunction.

One month before the admission, the patient underwent an emergency cardiorrhaphy through a left thoracotomy. At that time, the patient was in a war zone, and the previous emergent operation was performed by a general surgeon with the aim to stop the bleeding. At the time of hospitalization, the patient was in stable clinical conditions with sporadic atypical chest pains and rate-dependant left bundle branch block (LBBB). At presentation, the physical examination did not show pathological signs, except for a left thoracic wound. Blood tests, including markers of cardiac injury, were all within normal limits. Transthoracic echocardiography showed the bullet retained within the left ventricular chamber localized into the posterior wall underneath the posterior mitral leaflet without signs of valve dysfunction or systolic dysfunction (Figure 1). Chest X-ray and angio-computed tomography (CT) scan confirmed the presence of the missile in the left ventricle wedged within the tendineal chordae underneath the posterior mitral leaflet (Figures 2 and 3).

Preoperative workup included a coronary angiogram showing unobstructed coronary arteries. After multidisciplinary discussion at the Heart Team, we decided to proceed with the surgical removal of the RCM. The operation was performed through median sternotomy with routine cardiopulmonary bypass. After aortic cross-clamping and cardioplegia delivery, the left atrium was opened, the posterior mitral leaflet was incised just above the RCM, and the bullet was removed (Figure 4). The edges were then sutured to re-establish continuity of P2 with a 4/0 braided suture. Posterior ring annuloplasty was then performed using a flexible Gore-tex band. The post-operative course was uneventful and the patient was discharged on the seventh post-operative day. Echocardiography performed at discharge did not reveal any residual mitral regurgitation.

Discussion

No univocal consensus has been reached regarding the clinical management of RCMs in stable patients. Historical recommendations have suggested prompt extraction of retained missiles. However, high intraoperative mortality (17%) and negative explorations (30%) have been reported, making the management of asymptomatic patients with RCMs not univocal.²

Direct and late complications of RCMs have included a variety of clinical manifestations: valve injury, intracardiac shunts, coronary damage,
Surgical removal of a bullet in the heart

Bullet embolization, endocarditis, pericardial effusions, and arrhythmias. However, some reports have suggested that missiles completely embedded in the myocardium or pericardium/pericardial space are well tolerated in case of stable and asymptomatic patients. On the other hand, a higher risk of embolization or thrombosis may prompt surgical removal if the RCM is located in a cardiac cavity or partially embedded within the myocardium.

An historical review of 322 patients with RCMs confirmed the long-term uncomplicated survival in patients treated with conservative strategies, but also recommended that the management should be tailored on a single case basis.

In our case, the decision to perform surgery was related to the risk of embolization and chest pain episodes. Due to its well-defined position with preoperative imaging, we have chosen the left atrial approach. Then, to avoid the risk of mitral chordae damaging, the posterior ventricular wall with the embedded bullet was reached detaching the posterior mitral leaflet. Finally, after mitral valve reconstruction, annuloplasty was performed to avoid the risk of residual mitral regurgitation.

In conclusion, the management of RCMs should be individualized. If a consensus is reached for an operation, multimodality imaging techniques, including echocardiography and CT scan, are mandatory to locate precisely the RCM. In the presence of bullets located within the posterior wall adjacent to the mitral valve apparatus, the transmitial approach seems an easy and reproducible technique (see Supplementary material).

Lead author biography

Antonio Giovanni Cammardella was born in 1986 in Italy. He received his medical training in 2011 and completed his residency in Cardiac Surgery in 2017 at the University Campus Bio-Medico in Rome. Cardiac Surgeon at San Camillo Forlanini Hospital since 2017. His main interests are in surgical and transcatheter treatment of heart valves diseases, coronary surgery and in advanced heart failure and transplantation.

Supplementary material

Supplementary material is available at European Heart Journal – Case Reports online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including the images and associated text have been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

References

1. Symbas PN, Picone AL, Hatcher CR, Vlassis-Hale SE. Cardiac missiles. A review of the literature and personal experience. Ann Surg 1990;211:639–648.
2. Lundy JB, Johnson EK, Seery JM, Pham T, Frizzi JD, Chasen AB. Conservative management of retained cardiac missiles: case report and literature review. J Surg Educ 2009;66:228–235.
3. Klein JA, Nowak JE, Sutherell JS, Wheeler DS. Nonsurgical management of cardiac missiles. Pediatr Emerg Care 2010;26:36–38.
4. Fyfe DA, Edgerton JR, Chaikin A, Kline CH. Preoperative localization of an intracardiac foreign body by two-dimensional echocardiography. Am Heart J 1987;113:210–212.