SCIENTIFIC LETTER

EXTRACTION OF PERICARDIUM RETAINED MISSILE

ABSTRACT

Penetrating precordial trauma is a high-mortality condition that requires a trained multidisciplinary team to guide its management.

The context of the hemodynamically unstable patient is well understood and accepted. However, there is a knowledge gap when a hemodynamically stable patients present with a missile retained in cardiac structures. Currently, there are no guidelines on the surgical indication or surgical approach. These continue to be variable.

We present the case of a 47-year-old male patient with a gunshot chest trauma, hemodynamically stable with a missile retained in the pericardial sac that underwent videothoracoscopy with successful extraction. In addition, we made a review of the literature of cases with similar characteristics reported in recent years.

Keywords: *gunshot wounds, pericardium, thoracoscopy, heart injuries, foreign-body migration*

Authors:

David F. Semanate[1],
Manuel A. Giraldo[1],
Sergio D. Leon[1],
Víctor R. Bucheli[2,3]

[1] General Surgery Resident, Universidad del Valle, Cali, Colombia
[2] Cardiovascular Surgeon, Centro Médico Imbanaco, Cali, Colombia
[3] Faculty of the General Surgery Department, Universidad del Valle, Cali, Colombia

Correspondence:
Manuel A. Giraldo
E-Mail: Man_giraldo@hotmail.com

Received: 09/22/2021 Accepted: 10/12/2021

INTRODUCTION

Twenty five percent of deaths in trauma patients involve cardiothoracic injuries. More specifically, mortality rates for penetrating cardiac trauma are as high as 70-80%[1,2].

Generally, in cases of gunshot lesions, patients require immediate maneuvers to correct underlying lesions. A gunshot chest trauma with the missile retained in the mediastinum in a hemodynamically stable patient is an extremely unusual clinical situation[3].

A missile may reach the cardiac structures or pericardium by two different mechanisms, namely, indirectly by embolization from distant sites or directly after impacting the thorax; in these cases the missile may be lodged in the myocardium, free in cardiac chambers, or in the pericardial space where it may lodge[4].

As this is an infrequent occurrence, there are no established guidelines at present and management continues to be controversial; it is accepted that a free missile in the pericardial sac must be removed as there is a risk of complications such as pericarditis, myocardial erosion and even embolization[5].

We are presenting here the case of a patient with a missile retained in the pericardium that was successfully removed with a minimally invasive procedure by videothoracoscopy. We also made a literature review of similar cases reported in recent years.

CASE REPORT

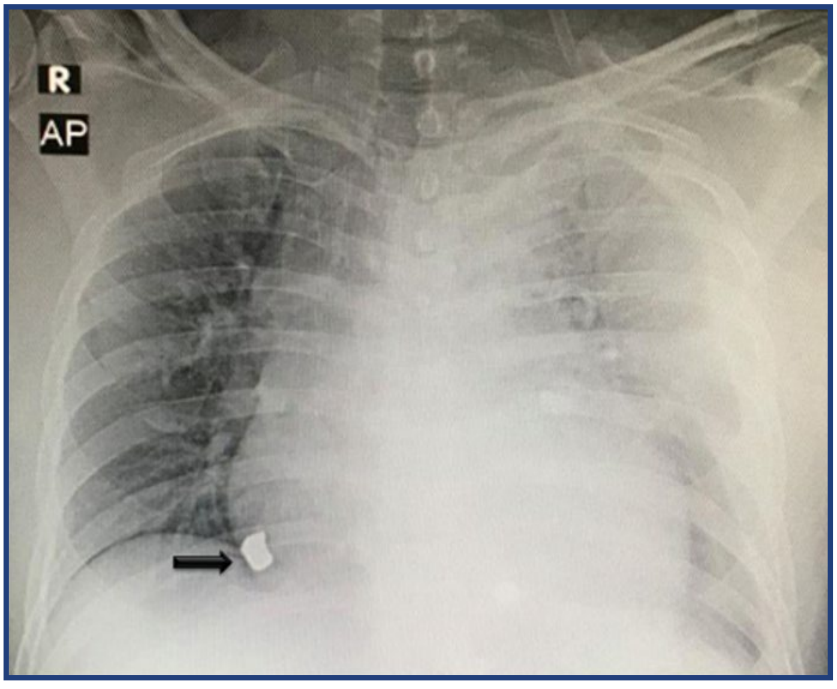
We are presenting the case of a 47-year-old man that arrived at the emergency service with a gunshot wound. At admission, with vital signs within the normal range, the physical examination revealed three wounds: in the mesogastrium, in the second intercostal space with left mid-clavicular line and in the left scapular region.

At the same time, a reduction of respiratory sounds was identified in the left hemithorax with signs of peritoneal irritation. A left closed thoracostomy was performed collecting 400 ml of bloody fluid, and an exploratory laparotomy with Grade III trauma findings in the ascending colon. Following surgery, the patient evolved satisfactorily. Three days later we performed a thorax x-ray that showed the presence of a missile within the cardiac silhouette *(Figure 1)*. The finding was confirmed with contrast CT. In light of these findings, a transthoracic echocardiography was performed evidencing a moderate amount of pericardial effusion with no hemodynamic impact and a missile lodged in the pericardial sac.

Before initiating the procedure, the open surgery team was set up as well as the extracorporeal circulation machine in such a way that, in case of hemodynamic decompensation, cardiopulmonary *bypass* could be initiated.

It was decided to proceed to videothoracoscopy; 10 mm trochars were inserted in the fifth left intercostal space with axillary line and in the seventh intercostal space with left anterior axillary line, and a 5 mm

FIGURE 1. Missile observed within the cardiac silhouette (black arrow). Radiopacity in left hemithorax compatible with hemothorax.



trochar in the third intercostal space with left mid-clavicular line. A clotted hemothorax was drained and then a broad longitudinal pericardiotomy was performed, draining 400 ml of hemopericardium. A gunshot missile lodged in the pericardial sac towards the base of the heart on the atrioventricular sulcus was removed *(Figure 2)*; pericardioscopy was done without observing evident myocardial or large vessels lesion. Lavage of the pericardial sac was performed with no active bleeding. Finally, the thorax tube was placed in the left pleural space. Post-op evolution was satisfactory, and the control echocardiography reveled no alteration. The patient was discharged without complications.

DISCUSSION

A missile retained in the mediastinum in a hemodynamically stable patient is a very unusual condition and it should be suspected when identifying the presence of a foreign body in the mediastinal region by image studies as part of the initial approach[4,5]. In spite of this, due to the difficulty involved in finding the exact location of the missile with these methods, a large number of cases will require transthoracic or transesophageal ultrasonography to confirm its location and possible physiological impact[5].

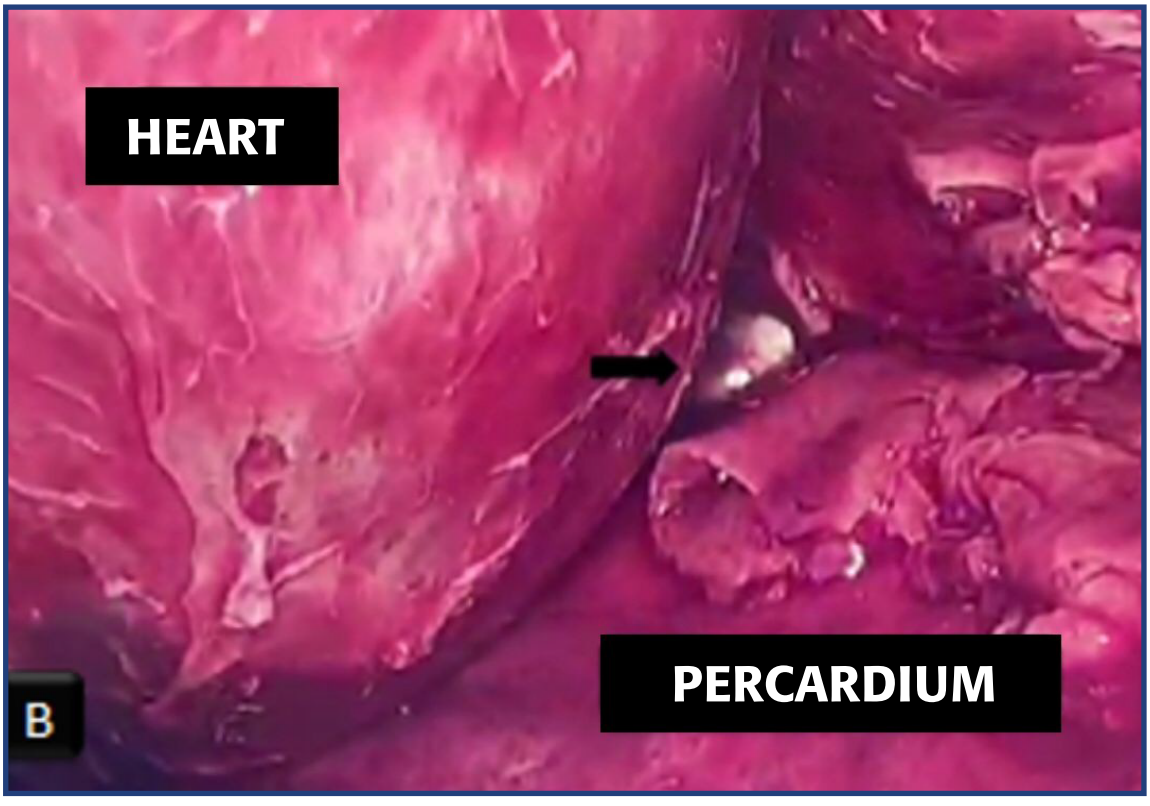
Immediate surgery indication for patients with precordial wound an hemodynamic instability is well established, however, at present there are no management guidelines for the clinical situation under discussion; as a result and according the literature review conducted by our group of similar cases reported during the last two decades *(Table 1)*, there is great variability[6,7,8].

At present, the use of videothoracoscopy is more and more frequent in certain acute trauma conditions[9] and in trauma management following thoracic trauma[10]; however, the possibility of sustaining a cardiac or any mediastinal structure lesion was until recently considered a contraindication given the high risk involved[11].

In our case, the patient required surgical intervention because of the penetrating abdominal trauma and signs of peritoneal irritation without significant cardiothoracic clinical signs. Then, further studies confirmed the presence of a foreign body in the pericardial sac, which, due to the hemodynamic instability and given the availability of physical resources and skilled staff, it was decided to remove the foreign body by a minimally invasive approach, having the necessary equipment at hand in case of requiring converting to open approach as well as an extracorporeal circulation unit.

Removal route and removal vs. non-removal indication remain controversial and are subject to broad discussion; in spite of this, we believe that given the high risk of unnoticed complications with vital

FIGURE 2. Missile lodged in pericardial sac towards the heart base on the atrioventricular sulcus (black arrow).



structures[7,8,12], it is recommended, when technically feasible, to proceed to removal of the foreign body through the route that best suits the practical and structural possibilities of the attending team.

Finally, we stress the importance of videothoracoscopy as a well-founded technique to manage thoracic trauma in well-selected patients, including extraction of mediastinal foreign bodies.

TABLE 1. Clinical case reports of patients with missile retained in the mediastinum during the period 2000-2021 in English and Spanish language literature.

Authors	Year	Sex	Age (years)	Localization	Initial diagnostic method	Management	Complication	Complication time	Result
Muñoz et al.	2021	M	19	Pericardium	X-ray	Videothoracoscopy (VATS)	None	NA	Survived
Coleman et al.	2020	M	39	Left ventricle	X-ray	Conservative	None	NA	Survived
Volpe et al.	2018	M	34	Intracavitary (RV)	X-ray	Extraction through sternotomy	Pulmonary thrombo-embolism	ND	Survived
Lapa et al.	2017	M	26	Septum	CT	Extraction through sternotomy	Embolization towards RECA	Intraoperative	Survived
Mishra et al.	2017	M	26	Pericardium	X-ray	Conservative	Erosion of the left inferior pulmonary vein + tamponade	31 days	Died
Imbert et al.	2016	M	59	Left pulmonary artery	X-ray	Unsuccessful extracction through sternotomy	Migration to basal segmentary artery	3 months	Survived
Xiao et al.	2015	M	46	Aortic root	CT	Conservative	None	NA	Survived
Mills et al.	2014	M	20	Left atrial wall	X-ray	Extraction through sternotomy	None	NA	Survived
Maffei et al.	2010	M	30	Lateral wall of LV	X-ray	Unsuccessful extraction through open sternotomy	Extra cardiac migration (not defined); possible migration to left pulmonary vein was assumed	Perioperative	Survived
DeBlois et al.	2006	M	26	Left ventricular wall	X-ray	Conservative	None	NA	Survived

Conflicts of interest
The authors have no disclosures to declare.

REFERENCES

1. Gosavi S, Tyroch AH, Mukherjee D. Cardiac Trauma. Angiology. 2016 Jul 11;67(10):896–901. http://dx.doi.org/10.1177/0003319715627954

2. Mandal AK, Sanusi M. Penetrating chest wounds: 24 years experience. World J Surg 2001 Sep;25(9):1145–9. http://dx.doi.org/10.1007/BF03215862

3. Lundy JB, Johnson EK, Seery JM, Pham T, Frizzi JD, Chasen AB. Conservative Management of Retained Cardiac Missiles: Case Report and Literature Review. Journal of Surgical Education 2009 Jul;66(4):228–35. http://dx.doi.org/10.1016/j.jsurg.2009.04.002

4. Symbas PN, Picone AL, Hatcher CR, Vlasis-Hale SE. Cardiac missiles. A review of the literature and personal experience. Ann Surg. 1990 May;211(5):639-47; discussion 647-8. PMID: 2187422; PMCID: PMC1358242.

5. Navsaria PH, Nicol AJ. Missile in the heart. Injury Extra. 2005 Jan;36(1):4–5. http://dx.doi.org/10.1016/j.injury.2004.07.035

6. Muñoz CA, Quitian JG, García A, Ordoñez CA, Buchelli VR. Videothoracoscopic approach to the extraction of a cardiac retainer missile. Trauma Case Reports. 2021 Jun;33:100489. http://dx.doi.org/10.1016/j.tcr.2021.100489

7. Volpe MA, Paredes JEM, Redigolo LC, Sanchez ISM, Lanichek F, Silveira LZD. Heart Injury with Projectile Lodged Inside the Heart. Braz J Cardiovasc Surg. 2018;33(3). http://dx.doi.org/10.21470/1678-9741-2018-0012

8. Santos ECL, Tchaick RM, Ferraz DL de M, Oliveira JPS de P, Figueira FAM dos S, Lima GA da FCA. Embolization by Bullet Dislodged from the Heart. Braz J Cardiovasc Surg. 2017; http://dx.doi.org/10.21470/1678-9741-2017-0115

9. Billeter AT, Druen D, Franklin GA, Smith JW, Wrightson W, Richardson JD. Video-assisted thoracoscopy as an important tool for trauma surgeons: a systematic review. Langenbecks Arch Surg. 2013 Apr;398(4):515-23. https://www.ncbi.nlm.nih.gov/books/NBK132652/

10. Ahmed N, Jones D. Video-assisted thoracic surgery: state of the art in trauma care. Injury [2004 May;35(5):479–89. http://dx.doi.org/10.1016/S0020-1383(03)00289-4

11. Lodhia JV, Konstantinidis K, Papagiannopoulos K. Video-assisted thoracoscopic surgery in trauma: pros and cons. J Thorac Dis. 2019 Apr;11(4):1662–7. http://dx.doi.org/10.21037/jtd.2019.03.55

12. Mishra B, Joshi MK, Kumar S, Kumar A, Gupta A, Rattan A, et al. Innocuous cardiac gunshot that proved fatal: A bitter lesson learned. Chinese Journal of Traumatology [Internet]. 2017 Apr;20(2):122–4. http://dx.doi.org/10.1016/j.cjtee.2016.05.006