

## An Unusual Metallic Foreign Body in the Right Ventricle

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### Abstract

Cardiac retained foreign bodies are very rare. We report the case of a man with an iron splinter migrated from the arm to the right ventricle by a venous pathway after a traumatic upper arm injury, occurred while working on a manhole. The presence of the metallic foreign body was accidentally discovered, twelve years later, during a cardiac magnetic resonance exam. Although very little, it caused a huge round-shaped artifact covering the entire right ventricle. Nevertheless the MR exam was immediately terminated as soon as the metal artifact was detected. A cardiac Computed Tomography confirmed the metallic nature. The magnetic exposure did not cause complications and a medical follow up was prescribed. Previous literature is reviewed.

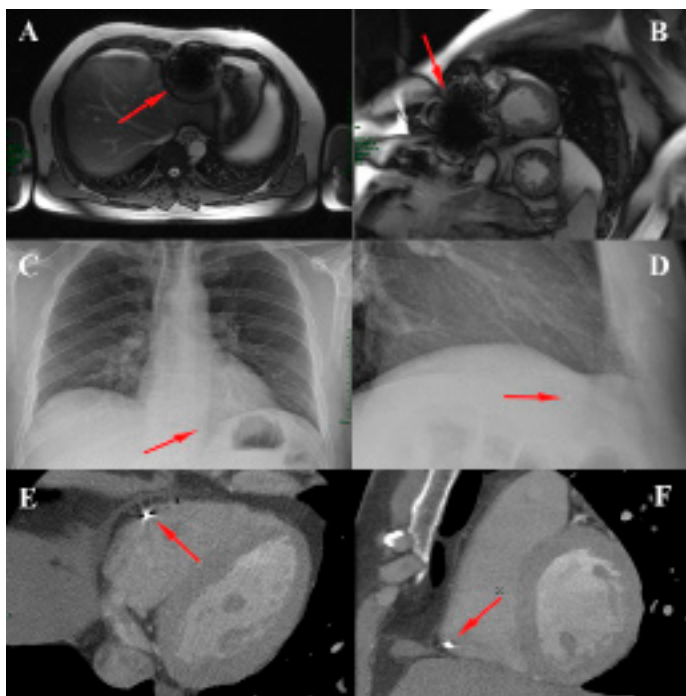
**Keywords:** cardiac mass, traumatic embolization, foreign body, imaging artifact

### CASE PRESENTATION

A 39-year-old man presented in the Emergency Department with acute chest pain; cardiac enzymes and electrocardiogram were normal. An echocardiographic exam showed a hypokinetic left ventricle with an ejection fraction of 42% (video). At computed tomography (CT) the coronary arteries were normal. A cardiac magnetic resonance was performed and the localizer sequences revealed a large round-shaped hypo-intense “mass” in the retrosternal space, concealing the right ventricle (RV), panel A-B. The characteristics were typical of an artifact due to a metallic foreign body. Previous chest X-ray and CT-scan were re-evaluated. The chest X-ray showed a 2x3 millimeter high-density object projected on the right ventricle, panel C-D. The CT scan demonstrated a hyper-dense body (1800 HU) in the RV inferolateral free wall, surrounded by a typical beam hardening

metal streak artifact, panel E-F. The CMR scan did not cause harm nor embolization of the foreign body.

The patient had never been shot, nor had a history of thoracic trauma or surgery. Eventually he remembered that 12 years before he had suffered a severe trauma to the right arm while working on a cast iron manhole and had never understood what had happened to a small splinter penetrated into the wound. A venous pathway seems the most likely mechanism to explain the migration of the metallic foreign body in the RV. Maybe the iron particle had ‘tentacles’ so it attached to the trabeculations of the RV wall. As the foreign body had presumably been present for 12 years, with a low risk of embolization and infection, surgical removal was not advised. Removal should be considered when large dimensions, mobility, shape irregularity or symptoms are present.



**Panel A-B:** Cardiac magnetic resonance images revealed a large round-shaped hypo-intense “mass” in the retrosternal space, concealing the right ventricle (RV)

**Panel C-D:** Chest X-ray antero-posterior and latero-lateral projectcons showed a 2x3 millimeter high-density object projected on the right ventricle.

**Panel E-F:** The CT scan demonstrated a hyper-dense body (1800 HU) in the RV inferolateral free wall, surrounded by a typical beam hardening metal streak artifact

### DISCUSSION

Unknown presence of a metallic foreign body (FB) may cause a serious danger in patients undergoing magnetic resonance imaging (MRI). In case of FB retained in the heart cavities there is a high risk of serious complications. Fortunately, this condition is very rare and quite always a consequence of a gun shot or a chest trauma, therefore their presence is already known or may be suspected before performing an MRI, during the anamnesis collection. Nowadays, FB are an increasing complication of invasive procedures, such as electrophysiological and hemodynamic studies or cardiac surgery.

Anecdotal case reports or short series of retained intracardiac FB have been described, especially in the left sided chambers after catheter invasive procedures [1]. We report the case of a very unusual FB embolized from a peripheral vein and entrapped in the right ventricle, unexpectedly discovered during a cardiac magnetic resonance (CMR) exam.

We describe a case of a peripheral venous embolized intracardiac cast iron foreign body after a traumatic upper arm injury occurred twelve years before, that object accidentally discovered during a CMR exam. Cardiac FB are rare and quite always a consequence of a gun shot or a severe chest trauma. Symbas [2] reviewed 201 patients reported from 1940 to 1988; bullets, needles, catheter fragments, shrapnel of mortars and mines were the most common cardiac FB. Nearly all the cardiac chambers can be involved although the right ventricle is the most common site (37.5%), followed by left ventricle (28.4%), pericardium (12.5%), right (9%), and left atrium (3.4%) [2]. More recently, the most common FB are those related to iatrogenic procedures, such as catheters and pacemaker electrodes.

However, traumatic embolization of a foreign body has been scantily described and cardiac entrapment of a metallic shrapnel, penetrated from a peripheral vein, has been only anecdotally reported in literature [3,

4]. From the right side of the heart, FB may migrate into the pulmonary artery, but most commonly remain entrapped in endocardial trabeculations and are encapsulated by fibrous tissue [2].

Transthoracic echocardiography provide useful first line imaging and measurements regarding the size, location, and mobility; transesophageal echocardiography may add informations [5] but CT scan has higher sensitivity and specificity [6].

In our case CMR was the first examination which revealed the suspicion of a FB. The huge artifact was typical of a metallic structure. The CT beam hardening artifact, and the Hounsfield Units, confirmed the metallic nature, although dimensions were overestimated on respect to the chest x-ray imaging.

Retained FB in the heart can lead to several complications, including thrombus formation, tricuspid valve insufficiency, pericardial effusion or tamponade, constrictive pericarditis, neurological manifestations secondary to cardio-embolic stroke, infections and arrhythmias [5,7,8].

Treatment strategies should be individualized. In case of complications or symptoms, surgical removal is mandatory. In asymptomatic patients the nature, location, dimensions and mobility of the FB could affect clinical decisions; according to the risk of infection, embolization, or erosion, surgery is indicated. [5].

Patients with the foreign bodies completely embedded in the myocardium or in the pericardial space usually can be followed without surgery as complications are not described. In asymptomatic patients, indication for surgery depends on dimensions, nature and location of the foreign body [2]. A conservative management may be preferred in case of diameter less than 5 mm, regular shape and presence of FB for a long time as entrapment by fibrous tissue may prevent complications [4]. In some cases endovascular retrieval may be attempted especially in cases of foreign objects lost during invasive procedures [9]. Multimodality imaging is of crucial importance to obtain all the information to support clinical decision-making. In our case the splinter had small dimensions, was fixed and was embedded in the right ventricle for 12 years; the risk of embolization and infection was low, therefore surgical removal was not indicated. The

dimension of the MR artifact are independent from the FB size, which is masked, and additional imaging techniques are necessary. Magnetic resonance risk is not necessarily dependant on the metallic FB dimension, and the exam is always controindicated. In our patient the magnetic fields did not cause a FB migration nor complications. Nevertheless the MR exam must be immediately terminated as soon as a metal artifact is detected.

### CONCLUSION

In conclusion this very rare case report highlights the risk of peripheral venous embolization after a severe injury. When a shrapnel of metallic material penetrates a vascular structure, a venous embolization is possible and the right ventricular trabeculations may entrap it. The strong magnetic field and gradients of CMR may be very dangerous in such cases, therefore we emphasize the importance of an accurate screening protocol for patients undergoing the exam. In particular, occupational and trauma history is mandatory as well as the review of previous Chest X-ray.

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