

Percutaneous retrieval of an embolized gunshot bullet from right ventricle: a case report and review of literature

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Background

Gunshots embolizing to the heart is a rare occurrence. We report a case of percutaneous retrieval of a gunshot bullet from the right ventricle (RV) cavity of a 40-year-old lady. To the best of our knowledge, this is the first case to be reported with a right supraclavicular inlet of the bullet and successful percutaneous retrieval using a snare from the RV cavity.

Case summary

A 40-year-old female patient was referred to our cardiac centre from a general hospital with a gunshot injury 8 days prior. On arrival, she was haemodynamically stable, there was an inlet wound at the right supraclavicular area. Transthoracic echocardiography revealed the bullet in the RV cavity. Under conscious sedation, right femoral vein access succeeded to retrieve the shot from the RV to the groin. The bullet slipped out and resnared from the right internal iliac vein and came out safely from the right femoral vein through the 24-Fr sheath. The vein was closed using a figure of 8 suture. The patient discharged home after 2 days.

Discussion

Bullet emboli to the heart are rare, endovascular retrieval of a bullet from the right ventricular cavity is feasible and relatively safe; however, more research is required. Echocardiography during the procedure is strongly recommended to early detect any complications. Accurate use of available tools such as X-ray, echocardiography, computed tomography, and fluoroscopy is a must for precise diagnosis.

Keywords

Gunshot • Bullet • Snaring • Right ventricle • Case report

Learning points

- Retrieving a bullet from the heart in asymptomatic patients is controversial, no randomized trials comparing extracting the bullet vs. leaving it in place with conservative management.
- Endovascular retrieval of a bullet from the right ventricular cavity is feasible and relatively safe; however, the decision should be taken individually based on the available experience and resources in each place.

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Introduction

Gunshots from current weapons had rapid velocity often penetrating the heart causing extensive damage, but in certain circumstances depending on the speed and distance of the bullet, it may remain inside the heart. The management of haemodynamically stable patients with retained intracardiac bullets is still controversial. Some recommend leaving in place as the short-term follow-up reported no adverse effects.¹ However, Mishra et al.² reported the death of a 26-year-old man after >3 weeks of discharge with small pellet in the pericardium due to haemorrhagic effusion. We are publishing the percutaneous retrieval of a gunshot bullet from the right ventricle (RV) cavity of 40-year-old lady. To the best of our knowledge, this is the first case to be reported with a right supraclavicular inlet of the bullet and successful percutaneous retrieval using a snare from the RV cavity.

Timeline

Presentation	A 40-year-old female patient referred from a general hospital to our cardiac centre with a gunshot injury 8 days prior. On arrival, she was hemodynamically stable, the patient heart rate was 96 b.p.m., blood pressure was 110/70 mmHg, and respiratory rate was 17/min.
First hour	She presented at 12 p.m. where X-ray chest showed the bullet inside the cardiac shadow; transthoracic echocardiography (TTE) revealed the bullet inside the right ventricle (RV) cavity near the apex.
After 4 h	At 4 p.m., the patient was taken to the catheterization room after the decision made to try endovascular removal with TTE guidance and surgical backup.
After 6 h	At 6 p.m., the bullet was successfully extracted from RV through the right femoral vein. Transthoracic echocardiography showed no complications with intact tricuspid valve and subvalvular apparatus.
After 2 days	The patient discharged home.
After 1 month	The patient followed as an outpatient; she was stable with normal follow-up TTE

Case presentation

A 40-year-old female patient referred to our cardiac centre from a general hospital with a gunshot injury 8 days prior. There was no past medical history or comorbidities. Computed tomography (CT) of the chest revealed the bullet but reported wrongly outside the heart, a bedside transthoracic echocardiography (TTE) missed the bullet. The thoracic surgeon opened a lower sternotomy wound but failed to find the bullet, he closed the wound with two sternal sutures and referred the patient to our centre. On arrival, she was

haemodynamically stable, her heart rate was 96 b.p.m., blood pressure was 110/70 mmHg, and respiratory rate was 17/min. The ECG and blood markers including Troponin-T were normal. She told her husband shot her with a gun along the street while she was leaning forward. On examination, there was one wound above the medial third of the right clavicle presenting the bullet inlet. A chest X-ray showed the bullet inside the cardiac shadow near the lower border of the heart; there was no pneumothorax or clavicular fracture (Figure 1, left). A revised CT chest showed the bullet inside the RV (Figure 1, right). A detailed (TTE) revealed the bullet in the RV cavity near the apex in apical four-chamber view with posterior angulation (Figure 2, left). There was mild tricuspid regurgitation (TR), intact interventricular septum, and no pericardial effusion (Figure 2, right). After a prolonged discussion, we decided to try to retrieve the bullet percutaneously with surgical backup.

Under conscious sedation and TTE guidance, right femoral vein access using an E-sheath 16-Fr (Edward lifescience) was established; we bevelled the distal end of the sheath to allow for larger inflow. We selected this sheath as it is expandable to 24-Fr by an internal expansion of passing objects. An assembly made of tip deflectable catheter AGILISTM NXT steerable introducer (St Jude Abbott vascular) and telescoped with 5-Fr Judkins Right guide and single loop gooseneck 15 mm snare. We try to snare the bullet from the RV cavity beneath the tricuspid valve apparatus where we faced a lot of thin chordae and the moderator band. Transthoracic echocardiography showed an increase of TR from mild to moderately severe due to a traction of the assembly on the leaflets; however, there was no mechanical affection of the leaflets or subvalvular apparatus. The bullet was grasped from outer to inner to ensure the snare is free of any structures (Figure 3, left), then the bullet retrieved with careful manipulation of the Agilis catheter and counterclockwise rotation till it came to the right atrium. Once the bullet came out to the right atrium, the TR severity reduced back to mild. In the inferior vena cava, the whole assembly was tried to engage the 16-Fr sheath but failed so we pulled the entire system to the groin (Figure 3, right). The bullet slipped out and migrated up towards common iliac vein then down to the right internal iliac vein (Figure 4, left). To avoid this slippage, a figure of 8 suture should be taken proximal to the bullet site at the groin to prevent slippage of the bullet while manipulating to extract it. We selected a different assembly made by a 24-Fr sheath (Medtronic), guiding JR 5-Fr, 15 mm gooseneck snare through the right femoral vein, and in the left femoral vein 5-Fr JR guiding handling 15 mm gooseneck snare. The bullet was caught using both snares simultaneously (Figure 4, right) and manipulated to come out safely from the right femoral vein through the 24-Fr sheath (Figure 5, left), the vein was closed using a figure of 8 suture. The procedure was not associated or followed by any arrhythmia. The extracted snared bullet showed in (Figure 5, right), the removed bullet measured 12 mm length and 6 mm width. The patient discharged home after 2 days. After 1 month, the patient condition was reasonable, and the follow-up TTE revealed normal study with trace TR.

Discussion

The impact of this case study is to add an example of successful retrieval of bullets from the heart encouraging the specialist

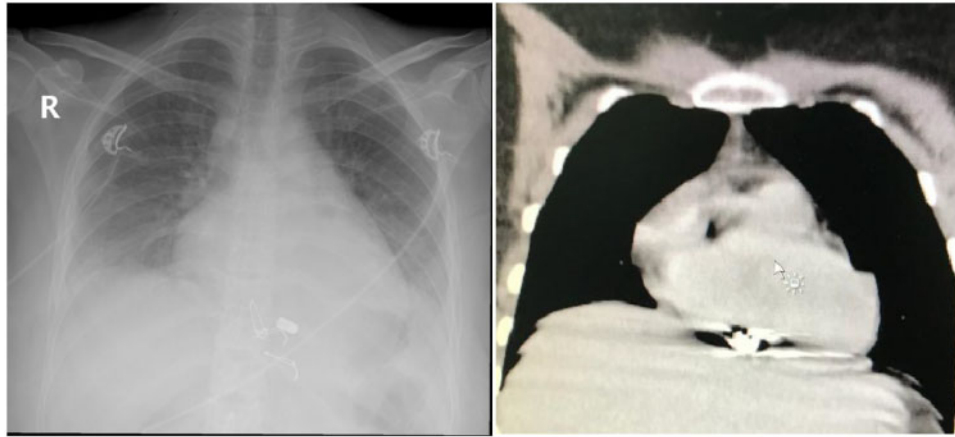


Figure 1 (Left) Gunshot bullet seen within the cardiac shadow, no pneumothorax or clavicular fracture, note the two lower sternotomy sutures after failed surgical retrieval. (Right) CT chest showing the bullet above the diaphragm in RV with artefacts around it.

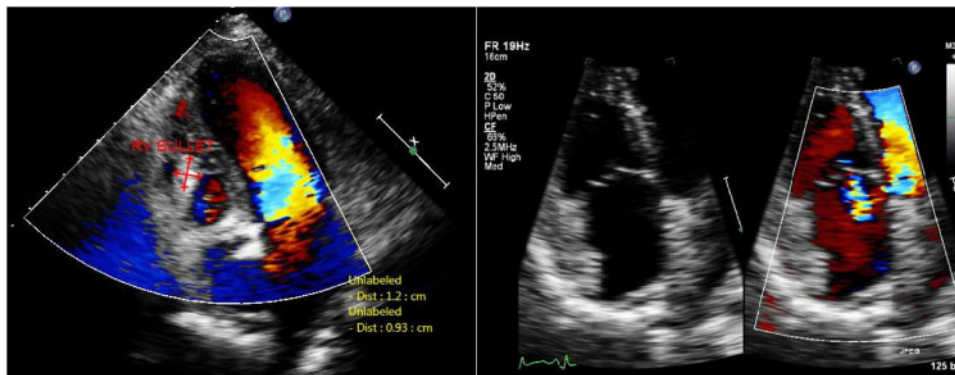


Figure 2 (Left) Apical four-chamber view with posterior angulation showing the bullet in the RV cavity. (Right) Four-chamber view showing mild tricuspid regurgitation, note the bullet did not appear in RV in regular four-chamber view.

interventional cardiologists to do it and avoid open heart surgery. The course of this bullet is rare; it was fired from a far distance, hits the clavicle then entered the right subclavian vein to the innominate vein to superior vena cava to the right atrium passing the tricuspid valve and settled in RV cavity. Cysne *et al.*³ reported a similar course of a bullet at 1982; he removed the bullet surgically. →Yoon *et al.*⁴ did a very lovely search about management of bullet emboli to the heart in the last 55 years; he demonstrated most of the bullets embolized to RV, 30 cases reported, 19 cases underwent surgical removal, 6 cases managed by observation, and 5 cases attempted a trial of endovascular removal. Three of the five cases failed, and the bullet removed surgically. Two cases had successful endovascular removal of a bullet from RV. One case was the first case report of endovascular intervention for venous bullet emboli to the RV at 1980 by Hartzler.⁵ The inlet was in the left neck; he used a biopptome via the internal jugular vein. The second case reported by Nazir *et al.*⁶ at

1992, the inlet was in the back; he used a balloon to retrieve the bullet. We present her a successful snare retrieval of a bullet from the RV. Alan Elison *et al.*⁷ concluded that there are no established guidelines about the management of migrating bullets. The mortality rate for a retained bullet is 6% associated with complication in 25% of cases; the mortality rate decreases to 1–2% if the bullet is removed.⁴ Carter *et al.*⁸ concluded that venous bullet emboli should be removed endovascularly whenever technically possible. In our centre, we reported a case of successful percutaneous removal of an air bullet partially embedded in the LV side of the interventricular septum, a thrombus was formed around the bullet, and the risk of embolism was present.⁹ We decided to extract the bullet rather than to leave in place. We think that with the availability of current endovascular techniques and equipment, extraction of bullet emboli to the heart is feasible and relatively safe. We recommend a quick referral of any stable patient with an embolized bullet to the heart to an expertise

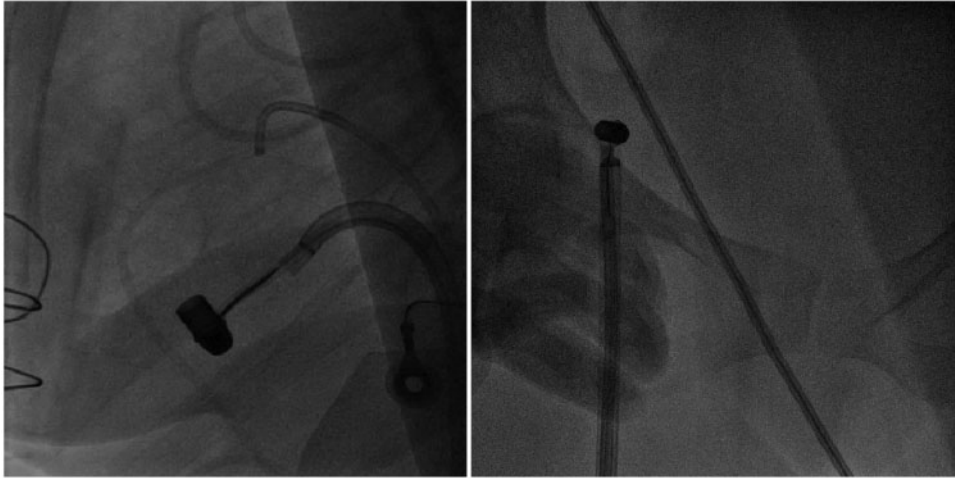


Figure 3 (Left) The bullet snared in the right ventricle. (Right) The snared bullet at the tip of 16-Fr sheath at the right groin.

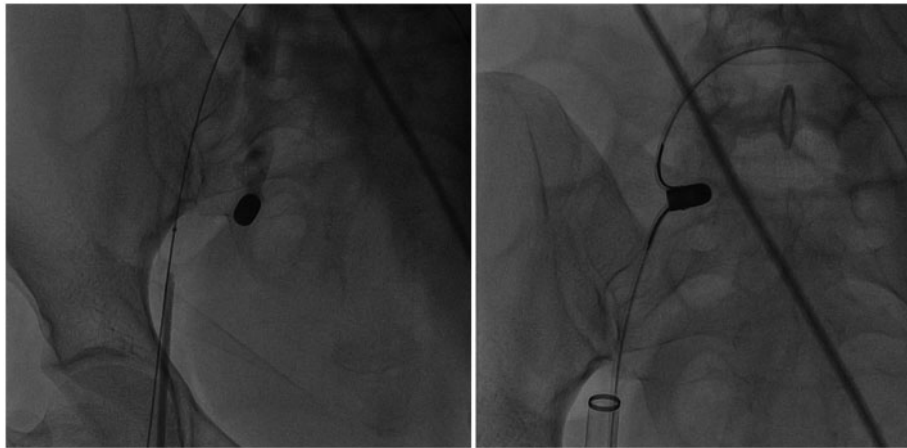


Figure 4 (Left) The bullet is dislodged from the snare, travel up to the right common iliac vein then went down to the right internal iliac vein. (Right) Both snares from both femoral veins are catching the bullet.

centre in endovascular intervention; an immediate trial for bullet retrieval is recommended. No randomized trials are comparing retrieving the bullet vs. leaving it in place with conservative management. Therefore, while trying to extract most of the cardiac bullets done in most of the cases, the evidence supporting retrieval in asymptomatic stable patients is not sufficient. The decision should be taken individually based on the available experience and resources in each place.

Conclusion

Bullet emboli to the heart are rare. Endovascular retrieval of a bullet from the RV cavity is feasible and relatively safe with sufficient resources and experience. Accurate use of available tools such as X-ray, echocardiography, CT, and fluoroscopy is a must for precise diagnosis and procedure guidance.

Lead author biography

Dr Hesham Abdo Naeim graduated from faculty of medicine, Al-Azhar University at December 1997. Granted M.Sc. degree in cardiovascular diseases at December 2002.

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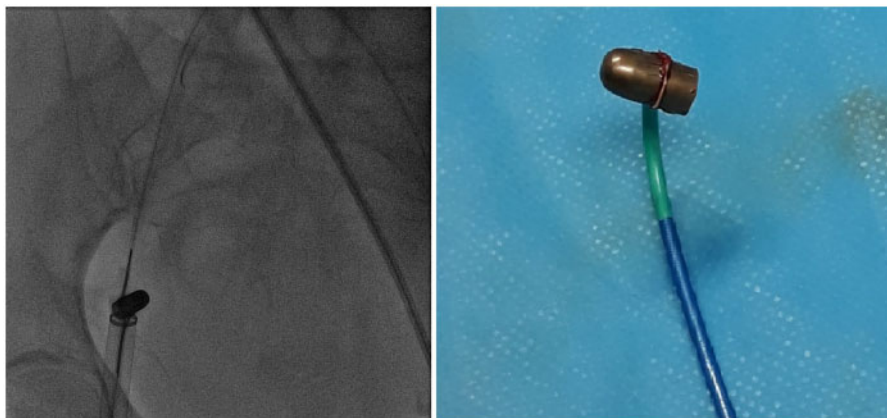


Figure 5 (Left) The bullet extracted through 24 sheath from the right femoral vein. (Right) Extracted snared bullet measured 12 mm length and 6 mm width.

Arabia from January 2007 till April 2013. Adult cardiology consultant in Madina cardiac center Saudi Arabia from June 2013 till now.

Supplementary material

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

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

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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