Bullet embolus to the right ventricle following shotgun wound to the leg

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SUMMARY

Bullet embolism to the heart is a rare complication of gunshot trauma to the body and if not identified can have a severe impact on a patient's morbidity and mortality. This paper presents the case of a patient who sustained a shotgun wound to the leg 10 years prior to presenting with shortness of breath and localised chest pain. Routine chest radiograph for possible chest infection was reported normal apart from a small metallic artefact overlying the left side of the heart, which had the same appearance as the pellets from the gunshot wound in the leg. Following referral to our cardiothoracic surgeons, further investigations confirmed the presence of a pellet within the patient's right ventricle, which had embolised from the original injury site. The case was discussed globally to decide on the best management plan. To date, the patient has been successfully managed conservatively, with regular follow-up.

BACKGROUND

Bullet embolism to the heart is a rare entity. In the literature, there are few reported cases that have been successfully managed conservatively. Moreover, there is a lack of evidence-based guidelines regarding the best management of bullet embolism to the heart. We aim to review the literature on bullet embolism, discuss imaging modalities to locate the embolised missile and management options currently available. We focus on the conservative approach to management.

Our unique case highlights that after consideration of the risks and benefits of interventional procedures and surgery, a conservative approach is a successful and effective way of managing a retained cardiac missile.

CASE PRESENTATION

An active 29-year-old man presented to his general practitioner (GP) with shortness of breath and mild chest pain 10 years after receiving a shotgun wound to both thighs, suffered while being imprisoned in Iraq. On fleeing the country and entering the UK, the patient regularly visited a GP complaining of chronic leg pain and was subsequently referred to a pain clinic 4 years previously, when it was documented that the gunshot had damaged some branches of the femoral nerve although some of the quadriceps were still functioning (figure 1). It was concluded that surgical treatment to remove the individual pellets was impractical and did not guarantee a cure.

At the most recent presentation with shortness of breath and chest pain, the GP started treatment for a possible chest infection. The patient's symptoms

improved following treatment with antibiotics, but chest radiography incidentally found a pellet within the patient's right ventricle, which had embolised from the original injury site. The patient was referred to cardiothoracic surgery outpatients for further investigation (figures 2 and 3).

ECG revealed normal sinus rhythm. Transthoracic echocardiogram was not performed.

OUTCOME AND FOLLOW-UP

On follow up, the patient was no-longer dyspnoeic, but was adamant that the bullet could be felt inside the heart, which was supported by the patient being able to locate mild pain to the exact site of where the missile lay. However, this is a highly unusual phenomenon and is likely to be a psychological response to the patient becoming aware of the bullet that had embolised to his heart.

In reference to our case, it was decided that conservative management with regular follow-up was the most appropriate course of action in our patient. First, removal of the bullet embolus with percutaneous basket relocation was considered but deemed ineffective due to the minute size and it being in an inaccessible site. In addition, it was felt that there would be a high risk of dislodgement of the pellet, increasing the risk of pulmonary artery embolisation. As a result, surgery with right atriotomy/ventriculotomy was considered as an alternative method of extraction; however, this was not encouraged as the risk of morbidity and mortality during surgery would be greater than the risk of complications of the embolus. Furthermore, due to the young age of the patient it was felt that if major cardiac surgery were to be performed, it would increase the risk of mortality of future cardiac surgery for other age-related causes, such as coronary artery disease.

Although the patient is currently asymptomatic, surveillance with regular imaging will be performed to ensure that the embolised pellet remains in its original position and that further embolisation from his legs does not occur. Despite being highly unlikely, such an event could potentially alter the patient's current management plan.

DISCUSSION

Despite being a relatively rare event, retained cardiac missiles have been commonly recorded in English literature first occurring in 1803 by Davis,¹ who presented the case of a young boy who sustained a penetrating chest injury with a piece of wood, which subsequently embolised to his heart via the superior vena cava.

As a bullet enters soft tissue it can either penetrate through or remain within the tissue after

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Figure 1 x-Rays of the right thigh demonstrate shotgun pellets lying in soft tissues in the medial aspect of both thighs, but with no bone injury.

losing its kinetic energy.² Bullet emboli can either directly enter a vessel at the time of injury or gradually erode into the lumen by pulsating movement of the vessel against the foreign body.^{3 4} Once within the vessel factors such as gravity, weight, size and shape of the object determine the migration of the missile.

Venous embolism has a much rarer incidence (20%) than arterial embolism (80%)⁵ thus highlighting the uniqueness of this case. Arterial embolism commonly originates from the heart and great vessels being symptomatic in the majority of cases (80%) causing claudication and acute limb ischaemia.⁶ Venous embolism, however, is only symptomatic in a third of cases and may present with chest pain, dyspnoea and haemoptysis, with the source being the peripheral veins, vena cava or liver.⁶ The occurrence of these symptoms largely relies on the position of the emboli and whether it is infected.⁴

Radiological tests are the most appropriate investigations to use in suspected bullet embolism.⁷ X-ray of the injury site will demonstrate the extent of pellet spread and may indicate further investigation. If a patient were to present with symptoms of cardiac or lung involvement following the injury, a chest x-ray would be appropriate to search for evidence of embolism. If first-line basic investigations highlight the possibility of bullet embolism, further advanced radiological investigations should be performed.

(a)

(b)

Figure 2 The posteroanterior radiograph was reported normal except for a small metallic artefact overlying the left side of the heart, which is similar in appearance to the gunshot pellets in the thighs. It was felt that this was a 'stray' pellet, but further investigation was required. The patient denied any direct trauma to the chest and was subsequently referred to our cardiothoracic surgeons.

There is widespread controversy as to whether asymptomatic bullet emboli should be removed surgically to avoid future complications or whether conservative management should be followed.^{5 8} Owing to the limited evidence available there are no specific guidelines currently in place to assist this management dilemma.⁷ Historically, surgical extraction was the common practice as the rate of mortality was significantly less (17%) than patients treated conservatively (30%).⁹ However, since this study there has been evidence to suggest that conservative management can be as effective at improving morbidity and mortality in patients with retained cardiac missiles.⁷ Right-sided

Figure 3 CT of the thorax confirmed the presence of an 8×7 mm metallic artefact in the right ventricle. It was suspected that this had migrated intravascularly from the primary site in the patient's thigh and was caught in the region of the tricuspid subvalvular apparatus.

missiles have a significantly lower complication rate (24%) than left-sided missiles (43%), making conservative management appropriate in our case. It has been suggested that emboli are low risk if they are 'immobile, right-sided, smooth, small (<5 mm) or completely intramyocardial'.⁷

If removal is indicated it is important that the risk of complications is greater than the risk of morbidity and mortality of missile location and retrieval.⁷ Transjugular or transfemoral percutaneous basket relocation, for right-sided missiles is usually the first technique used to attempt removal due to being minimally invasive and avoiding surgical mortality risk.¹⁰ However, if this method fails or the procedure is more complicated then surgery with median sternotomy, cardiopulmonary bypass and right atriotomy/ventriculotomy is indicated.⁷

There are various methods of conservative treatment in asymptomatic retained cardiac missiles. Traditionally, this involves regular follow-up including taking a detailed history from the patient regarding chest pain, palpitations, dyspnoea and pyrexia, as these could indicate complications of the embolus.⁷ In addition, physical examination and regular radiological imaging should be performed to ensure the location of the missile remains in situ, as well as checking that additional emboli have not occurred from the site of injury. Some studies have recommended the use of anticoagulants and prophylactic antibiotics until fibrous encapsulation has occurred.¹¹

With reference to our intriguing case, the patient originally presented with shortness of breath and mild chest pain. Following a detailed history, clinical examination and investigations, it is unlikely that the symptoms were related to bullet embolism, suggesting that the embolism was simply an incidental finding.

Although asymptomatic, it is likely that the bullet embolised a long time after the original gunshot trauma. A chest radiograph performed in 2009 to investigate for a possible chest infection, was reported normal thus proving that embolisation had not occurred at this time. When the original insult occurred, it is highly probable that the bullet did not penetrate the vessel, but

remained in close proximity. With time, it is likely that the pellet eroded into the lumen by the movement of the vessel against the pellet and subsequently embolised to the heart via venous circulation.

Learning points

- ▶ It is important to suspect bullet emboli in any patient who has had an entry gunshot wound without an exit wound, and when radiological investigations show deviation of the missile from its original location or it is identified at an unexpected site.⁸ If one is vigilant and adheres to these points, the amount of missed cases will be reduced.
- ▶ Owing to the rarity of these cases, there is a lack of evidence-based guidelines to suggest appropriate management for these patients. The general consensus is that management should be individualised and thought through carefully by the patient's multidisciplinary team. If a patient is symptomatic or is at high risk of embolus-related complications, then removal should be performed. However, if the risks of surgery are too high then conservative management is best with regular follow-up.
- ▶ Further research into retained cardiac missiles is required in order to assist these key management decisions. There is a need for a way to differentiate high risk cases which would benefit from intervention, from low risk patients where conservative management would suffice. This would be most beneficial for those clinicians who have not previously encountered such a case, thus benefiting themselves as well as their patients.

Competing interests None.

Patient consent Obtained.

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