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Case Report

Peripheral Venous Bullet Embolization To The Heart – A Case Study

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Abstract

A bullet embolism is a rare complication following penetrating gunshot injury which can present challenges in diagnosis and management. If the projectile has been unsuccessfully removed or remains left in situ, there is a risk that the missile may have gained access to the vascular system from where the flow of blood migrates the foreign body to any number of large vascular beds. Arterial embolization is more common and is often accompanied with symptoms associated with end-organ damage and peripheral ischemia. Venous embolization is less common with few, or no symptoms reported, unless vascular injury, pulmonary embolism or oedema related venous flow obstruction is experienced which may require urgent attention. We present the incidental findings of a bullet within the right ventricle following a gunshot injury to the right upper thigh eleven years prior. To our knowledge, this is the first reported incidence identified in the United Kingdom.

Case Presentation

A 37 year old Middle Eastern male with a previous history of a single gunshot wound to the right thigh was referred to their local hospital for chronic, intense pain localized to the right scapula upon exertion. A chest X-ray showed a bright foreign body in the shape of a bullet within the cardiac silhouette. Following the X-ray, the patient reported being shot in the upper right thigh while residing in the Middle East prior to relocating to the United Kingdom. The patient explained that during attempts to surgically remove the bullet from the upper right thigh, he was advised that the bullet was surgically irretrievable, and an extensive arteriovenous repair was performed. The patient was referred to a tertiary cardiothoracic centre for further investigations where Computed Tomography (CT) of the chest cavity was performed, confirming a bullet shaped object lying against the interventricular septum within the right ventricle (RV), anteromedial to the septal leaflet of the tricuspid valve (Figure 1). A routine coronary angiogram to exclude the presence of coronary artery disease was carried out as part of the surgical work-up. This angiogram showed no evidence of coronary artery obstruction and a bullet shaped structure within the cardiac silhouette could be seen in numerous angiographic planes (Figure 2). Clinical examination was unremarkable except for a mildly raised jugular venous pressure so a transthoracic echocardiogram (TTE) was requested to exclude significant tricuspid regurgitation (TR), RV flow obstruction and pulmonary hypertension (Figure 3). The TTE identified a bright, echogenic structure adjacent to the RV moderator band with minimal TR on colour flow Doppler and an estimated pulmonary artery systolic pressure of 21mmHg indicating no significant valve abnormality and no evidence of pulmonary hypertension. No evidence of thrombus was seen during the TTE. Following a discussion of treatment options, the patient elected for conservative management over surgical retrieval and routine annual TTE is performed at their local department.

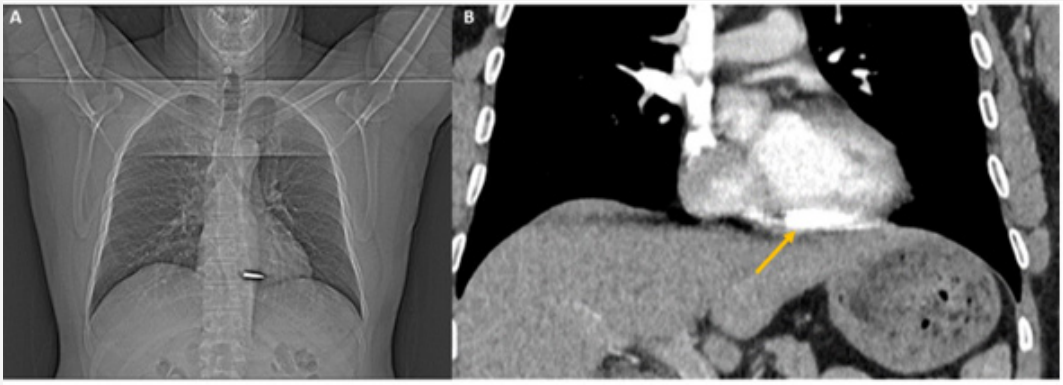

Figure 1: Showing a scout view using computed tomography illustrating the location of the projectile with no evidence of free fluid (Image A) and coronal slice through the chest cavity and heart showing a bright bullet shaped object highlighted by the yellow arrow within the right ventricular cavity (image B).

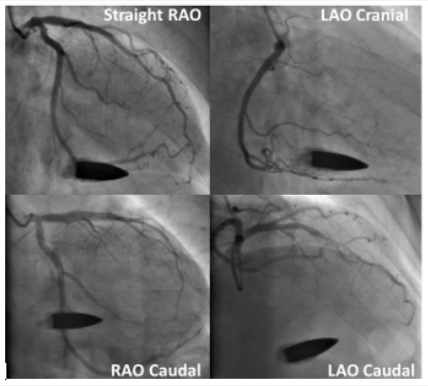

Figure 2: Various coronary angiographic views (labelled) with no evidence of flow limiting disease coronary disease. The bullet projectile is clearly seen within all the angiographic planes. There is also dense material seen around the base of the bullet which may be consistent with fibrous myocardial tissue. RAO = Right anterior oblique. LAO = Left anterior oblique.

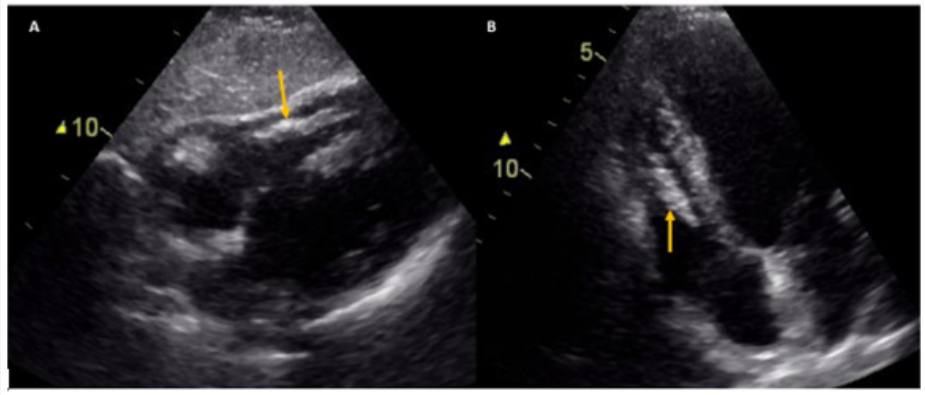

Figure 3: An echo bright linear structure (the bullet within the right ventricle adjacent to the interventricular septum (yellow arrows) seen clearly within the subcostal view (image A) and modified apical four chamber view (image B). No evidence of tricuspid valve dysfunction was reported.

Discussion

A venous bullet embolism occurs when a low velocity projectile penetrates a prominent vascular structure and enters the blood stream [1,2]. This phenomenon is rare as a typical high velocity projectile is more likely to induce extensive vascular trauma, obliterating the vasculature rather than the foreign body merely impaling the vessel. The incidence of this phenomenon has been reported to be as low as 0.3% in a review of 7500 bullet wounds during the Vietnam conflict [3], with an up-to-date search retrieving around 300 cases of "bullet embolism" in PUBMED. Intravascular venous embolization as seen within the reported case typically occurs in the direction of blood flow until the projectile

either obstructs venous return or terminates in the right heart or pulmonary artery [4]. Venous bullet embolization is more likely to terminate below the tricuspid valve due to the RV being a complex trabeculated, crescent shaped structure containing chordae tendinea which provides numerous regions where a foreign body can become anchored in position [1]. It has been reported that venous foreign body migration usually occurs immediately following the incidence of trauma with the majority of cases being hemodynamically stable and therefore reporting no symptoms [5]. In this particular case, it is likely that the bullet entered the femoral vein with venous return advancing the bullet up the inferior Vena Cava where it became lodged within the tricuspid chordal apparatus located within the RV. It has been reported that X-ray is a useful initial screening tool used to provide an approximate location of any bullet or fragment [4], as seen by angiography under the guidance of fluoroscopy. The ability to precisely locate the bullet within the RV cavity using CT and to evaluate the presence of tricuspid valve insufficiency and exclude RV hemodynamic obstruction in real time using TTE were the major benefits of these two imaging modalities in this scenario. Magnetic resonance imaging (MRI) is contraindicated in these specific patients due to the risk of significant tissue damage caused by the strong magnetic fields induced by the MRI scanner [6]. Suspicion should arise of a bullet embolism if the number of bullet entry wounds surpasses the number of exit wounds and initial radiological investigations do not recover all bullet fragments [7]. As venous bullet embolisms are typically asymptomatic, there is a small risk of fatality with a higher likelihood of complications such as infection, thrombosis and hemorrhage [8, 9]. Management of this condition needs to be tailored specifically to the patient's condition with endovascular retrieval, surgical thoracotomy, or conservative approaches all viable options [4]. At present, there is a distinct lack of evidence to provide guidance for the management of a bullet embolism.

Conclusion

Bullet embolism is a rare yet potentially serious phenomenon following a gunshot wound, no examples have been reported in the United Kingdom possibly due to strict firearm legislations. A venous embolism secondary to a projectile is uncommon and often asymptomatic though the risk of vascular injury, thrombus formation and infection remain. A multi-imaging approach was useful in this particular case to identify the location, assess RV and tricuspid valve function to overall guide management. At present while various techniques are available to facilitate the removal of the bullet, there is no current evidence based guidelines available to manage a bullet embolism.

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Conflict of Interest

No conflict of interest.

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