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Case Report

Arterial missile embolism following penetrating chest trauma: a case report

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ABSTRACT

Missile embolism is a rare but potentially serious complication of penetrating trauma that occurs when a projectile enters the vascular system and migrates within the circulation. Although described in military literature, civilian reports remain limited. A 25-year-old male presented following a gunshot wound to the left chest and arm. He was haemodynamically stable on arrival. Initial radiography demonstrated a bullet in the posterior mediastinum with a small haemothorax. Extended focussed assessment with sonography for trauma revealed a small pericardial effusion. Computed tomography performed shortly thereafter demonstrated migration of the projectile to the level of the aortic bifurcation, consistent with arterial missile embolism. The patient was transferred for cardiothoracic evaluation due to a suspected cardiac injury, which was managed non-operatively. Following transfer back to our institution, angiography confirmed the bullet lodged at the aortic bifurcation. Endovascular retrieval was attempted but was unsuccessful due to projectile deformation. Open arteriotomy was subsequently performed allowing successful bullet removal and arterial repair with a vein patch. The patient recovered postoperatively and was discharged after several days. Missile embolism is an uncommon but important diagnosis following penetrating trauma. Early imaging and high index of suspicion are critical, particularly when projectile location is incongruent with the expected wound trajectory. Multidisciplinary management is essential to optimize outcomes.

Keywords: Missile embolism, Penetrating trauma, Gunshot wound, Arterial embolism

INTRODUCTION

Missile embolism is a rare but clinically significant entity seen in penetrating trauma, occurring when a projectile enters the vascular system and migrates within the circulation.[1] Even though this phenomenon is uncommon, the complications thereof can be severe. While majority of the literature available originates from military settings, there is a paucity of data surrounding this in civilian trauma.

We present a case of arterial missile embolism following a gunshot wound with a rapid projectile migration identified in the patient's initial diagnostic workup.

CASE REPORT

A 25-year-old male presented at Chris Hani Baragwanath Academic Hospital following a gunshot wound (GSW) sustained during a robbery.

On arrival at the emergency department (ED) the patient was haemodynamically stable and alert, with a haemoglobin of 8.8 g/dl and a lactate of 3.7 mmol/l on the arterial blood gas analysis. Clinical examination demonstrated a through-and-through GSW to the left arm, with medial and lateral wounds, as well as a single wound on the left chest at the level of the sixth intercostal space. A full body anterior-posterior and lateral low-dose x-ray (LODOX) demonstrated a left distal comminuted humerus

fracture and the presence of a bullet in the posterior mediastinum with an associated small haemothorax (Figures 1 and 2).

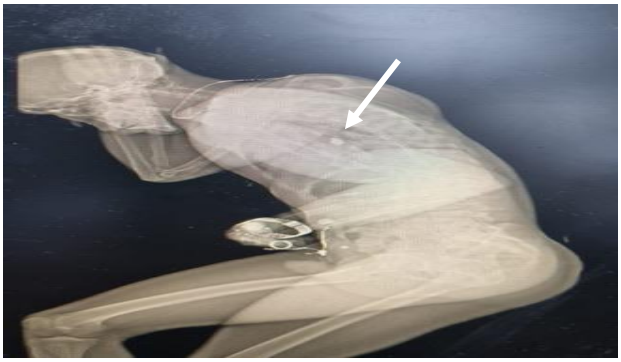

Figure 1: Lateral view of LODOX on arrival.

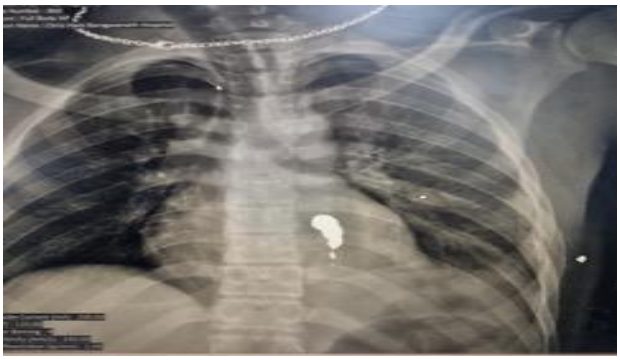

Figure 2: AP view of the plain film radiograph done in trauma unit.

An extended focused assessment with sonography for trauma (E-FAST) showed a 12 mm pericardial effusion and a small left haemothorax. No neurovascular deficit was noted in the injured arm. As the patient remained haemodynamically stable, a CT pulmonary angiogram (CTPA) and left upper limb angiography was planned. Additionally, a 12-lead ECG was performed and was unremarkable, however, the troponin T level was elevated at 181 ng/l (normal level <14 ng/l). A left-sided intercostal drain (ICD) was inserted which drained 400 ml of blood. An above-elbow back slab was applied by the orthopaedic team for the comminuted distal humerus fracture. Bilateral lower-limb pulses were present with equal differential pressures.

On CT imaging, the scanogram demonstrated the presence of the bullet within the abdomen, therefore, a CT abdomen was included in the study. This demonstrated a left sixth rib fracture as well as a left haemothorax. Notably, a left lung laceration was identified, extending from the lateral aspect of the lung to the infra-hilar region adjacent to the left atrium. Findings suggestive of cardiac injury were present, including left-sided pericardial thickening with surrounding air locules and a pericardial effusion measuring 10 mm. On CT of the abdomen the bullet was now localized at the level of the aortic bifurcation, consistent with a suspected missile embolus (Figure 3).

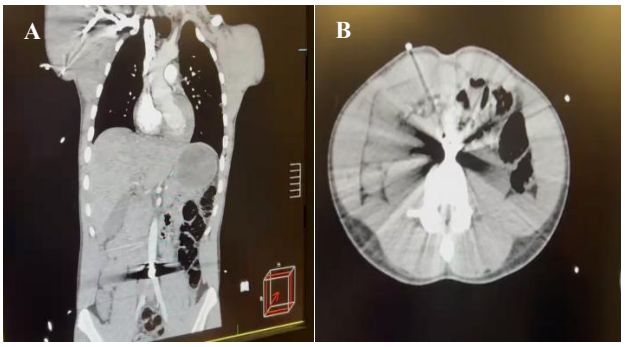

Figure 3 (A and B): Axial and coronal views of CT abdomen, illustrating the bullet at the bifurcation of the aorta.

Due to the concern for a complex cardiac gunshot injury, the patient was transferred to the cardiothoracic team at a nearby quaternary hospital. An echocardiogram demonstrated resolution of the pericardial effusion and normal cardiac function. His repeat troponin decreased to 90ng/l and the decision was made to manage the cardiac injury non-operatively.

The patient was transferred back to our facility after 48 hours, at which point a repeat X-ray showed no further migration of the bullet and no deterioration in his clinical condition.

The vascular surgery team subsequently performed an on table angiogram demonstrating the bullet at the aortic bifurcation (Figure 4).

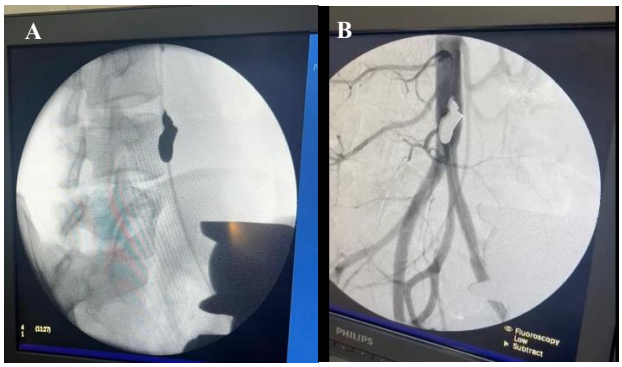

Figure 4 (A and B): AP and lateral views: digital subtraction angiograph of on table angiogram, demonstrating the bullet lodged by the aortic bifurcation, at L4 lumbar vertebral body.

An attempt was made to remove the bullet endovascularly, however, due to the size and deformation of the projectile, it could not be moved beyond the external iliac artery (Figure 5). An arteriotomy was performed. The bullet was bullet was removed, the area of intimal damage resected and the artery was repaired with a vein patch (Figure 6).

The patient's recovery was unremarkable and he was discharged a few days later.

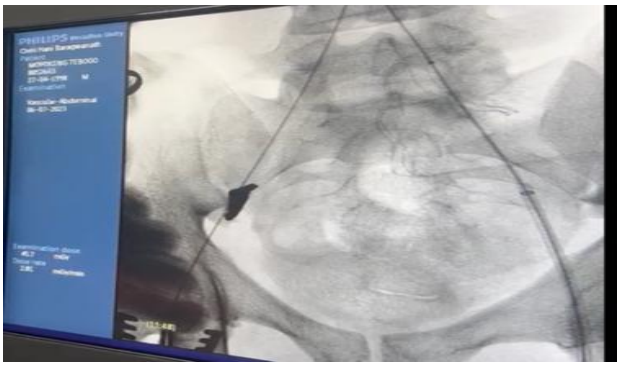

Figure 5: Bullet is seen in the right external iliac artery upon endovascular removal attempt.

Figure 6: Vein patch used to close the arteriotomy.

DISCUSSION

Missile embolus is a rare but complex entity associated with penetrating trauma injuries.[1] The reported incidence is low, with rates of approximately 0.3% reported during the Vietnam War and more recently up to 1.1% in military conflicts in Afghanistan and Iraq.[1-3] Most data originate from military research, and there is a paucity of evidence regarding civilian missile injuries, with literature largely limited to isolated case reports and retrospective reviews. As a result, establishing comprehensive guidelines remains challenging.[1,2]

The first description of missile embolus dates back to 1834 when on autopsy of a 10-year-old boy revealed a wooden fragment that had embolize to his heart after he accidentally shot himself in the chest with a homemade firearm.[4]

Several factors determine the probability of a missile or bullet embolizing, including the proximity of major vessels to the injury site, the kinetic energy of the projectile and its size. Smaller, low-velocity projectiles, such as shotgun pellets and 22 caliber bullets, have a higher likelihood of embolizing due to their size and reduced kinetic energy.[1]

Intravascular missile emboli are broadly classified as venous or arterial, with arterial emboli accounting for majority of reported cases.[1] Venous emboli migrate proximally, while arterial emboli travel distally within the systemic circulation.[4,5]

There are conflicting statistics regarding the prevalence of arterial versus venous missile emboli. Both types may lead to potentially devastating and life-threatening complications, however, arterial ME are more likely to become symptomatic. Reported complications include distal limb ischemia, myocardial infarction, cerebrovascular accident, cardiac valve injury, and dysrhythmias.[5]

Current recommendation suggest that arterial missile emboli should be removed as soon as possible, to reduce the risk of distal emboli or ischaemia. Arterial emboli are associated with a higher complication rate than venous emboli (74% versus 14%).[5] Endovascular retrieval is generally preferred over open due to its less invasive nature and slightly higher reported success rate (63% versus 57%).[5]

Lu et al proposed a management algorithm based on anatomical location of the missile. A high index of suspicion is essential. Certain clinical features should raise suspicion, including incongruent number of bullet wounds, absence of expected tissue injury along the bullet trajectory, or a mismatch between the suspected trajectory and location of the projectile.[1]

The diagnosis of missile embolism should be confirmed with imaging. Initial evaluation typically begins with plain radiograph, followed by computed tomography (CT), which often is confirmatory. In cases where an intracardiac missile is suspected, then transoesophageal echocardiogram is recommended.[1]

Definitive management depends on the anatomical location of the missile, including the intra-pericardial space, the right-sided circulation or the left-sided circulation.[1] Currently the lack of strong evidence predisposes us to publication bias and more robust evidence is needed to ensure that this entity can be better described and managed in the future.[5]

In the present case, the bullet migrated rapidly during the patient's initial workup, within approximately 30 minutes of presentation. Additionally, the patient did not develop any complications related to the missile embolus, such as lower limb ischaemia. Although the bullet seems to have entered the left atrium before embolizing distally, the patient remained haemodynamically stable. The pericardial effusion resolved spontaneously and the troponin level demonstrated a downward trend.

This case contributes to the limited body of literature describing arterial missile embolism in civilian trauma and

highlights the dynamic migration of a projectile during early imaging evaluation.

CONCLUSION

Missile embolism is a rare but important complication of penetrating trauma. This case underscores the importance of a high index of suspicion for missile embolism in patients with incongruent gunshot wound findings or an unexpected projectile location on imaging. Given the rarity of this condition and the limited availability of clinical guidelines, each case is should be assessed independently with a multidisciplinary team to offer the best patient outcome and minimise complications.

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