



## Venous bullet embolism and subsequent endovascular retrieval – A case report and review of the literature

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### ABSTRACT

**INTRODUCTION:** Vascular bullet embolism is a rare phenomenon with fewer than 200 cases reported in the literature.

**PRESENTATION OF CASE:** A 22 year-old male presented with a gunshot wound to the right lower quadrant. Imaging demonstrated a bullet lodged in his left lower quadrant. Upon operative exploration, a single hole was found in the right external iliac vein without injury into the left lower quadrant. The bullet was found to have migrated intravascularly from the right external to the left common iliac vein, and was subsequently removed endovascularly.

**DISCUSSION:** Bullet embolism occurs infrequently, with arterial more common than venous. Arterial embolization usually requires emergency operative intervention due to ischemia. While venous embolization is often asymptomatic, removal of the bullet is recommended to avoid delayed complications when possible.

**CONCLUSION:** Venous bullet emboli should be removed endovascularly whenever technically possible.

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### 1. Introduction

Vascular bullet embolism is a rare but often severe complication in trauma. The diagnosis must be considered when the radiographic location of a retained bullet changes during serial imaging or does not correlate with expected trajectory. Arterial is more common than venous bullet embolization, and retrograde venous embolization is least common.<sup>1</sup> Bullet embolism often causes a diagnostic and therapeutic dilemma due to the infrequent incidence and reporting of the condition. We report a case of retrograde venous bullet embolization successfully managed with percutaneous angiographic bullet extraction.

### 2. Presentation of case

A previously healthy 22 year-old male was brought to our emergency department after suffering a gunshot wound to the right lower quadrant. Upon arrival, his pulse was 75 beats per minute, with systolic blood pressure of 140 mmHg. Examination revealed a well-developed male in some distress, and with significant tenderness in the right lower quadrant at the site of a single small caliber entrance wound. There was no evidence of gross peritonitis. After full examination, FAST ultrasound exam revealed fluid in Morrison's pouch. CT of the

abdomen and pelvis showed high density fluid in the pelvis, tracking along the left and right paracolic gutters to the upper abdomen. Also seen was a metallic foreign body in the left sacral ala.

The patient was taken to the operating room, where laparotomy with packing was performed. Exploration revealed clot in the pelvis as well as a tangential wound to the terminal ileum, which was repaired primarily. Also seen was a retroperitoneal hematoma of the right iliac fossa. After obtaining proximal and distal control of the right iliac vessels, the hematoma was explored, which revealed a single small hole in the anterior surface of the external iliac vein. No second hole was identified, and the injury was repaired primarily with pledgeted suture without narrowing of the vein. Exploration of the left iliac fossa, believed to contain the bullet, revealed no bleeding and no hematoma. Upon further review of the imaging, the bullet appeared to be lodged within the left common iliac vein. The retroperitoneum and abdomen were closed.

Postoperatively, abdominal plain films again showed the bullet lodged in the left iliac fossa. The patient was taken to angiography, where the left external femoral vein was accessed and venography confirmed the bullet to be within the left external iliac vein. The vein was serially dilated, and a snare device was used to successfully remove the bullet percutaneously.

The patient recovered well from surgery. He was kept on coumadin for six weeks, and was last seen three months postoperatively, at which point bilateral venous ultrasound confirmed normal venous flow (Figs. 1 and 2).

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Fig. 1. Axial CT showing mesenteric air in RLQ and foreign body in LLQ.

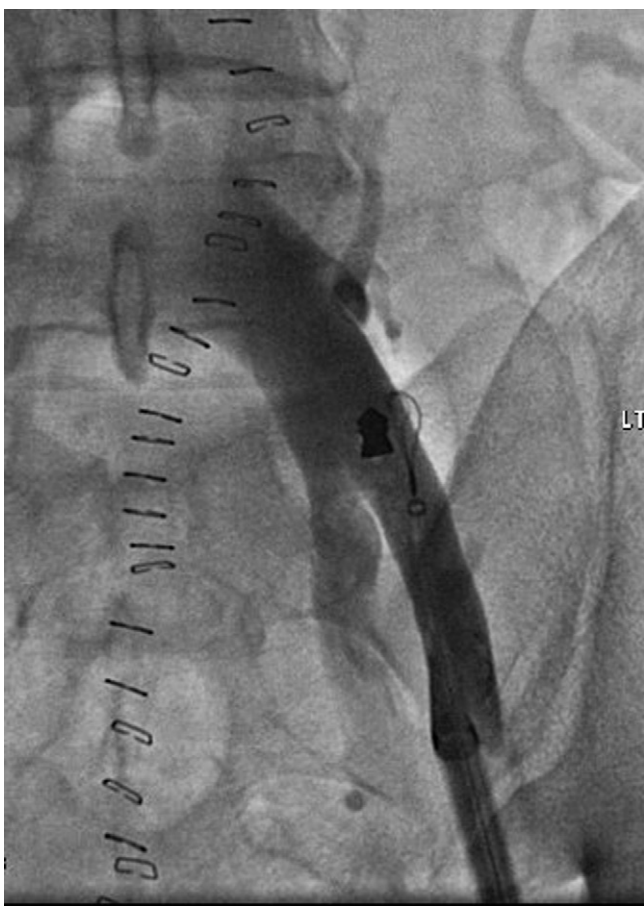


Fig. 2. Percutaneous angiographic bullet retrieval using snare device.

### 3. Discussion

Bullet embolization occurs most commonly when a small caliber, low velocity bullet penetrates only one wall of a vessel, coming to rest within the vessel. The first case was reported by Davis in 1834, and describes venous embolization of a wooden projectile to the right ventricle. Incidence of bullet embolization is very low, with fewer than 200 cases reported. With the exception of an institutional series of 28 cases presented by Mattox et al. in 1979,<sup>2</sup> almost all cases are presented as single case reports. Overall, approximately 75% of reported cases are arterial, embolizing to the periphery and 25% are venous, usually embolizing centrally to the heart or pulmonary artery.

Retrograde venous embolism, where the bullet migrates peripherally, is extremely rare, with only 14 cases presented in the literature.<sup>1</sup>

The treatment of bullet embolization depends on the location of the bullet and in part depends on the presence or absence of symptoms. Arterial embolization occurs most often to the lower extremities, more commonly to the left side than the right. Due to resulting ischemia, most arterial emboli cause immediate symptoms needing emergency operative intervention.<sup>2</sup>

Venous bullet embolization, however, is asymptomatic in approximately 70% of cases, which has historically led to debate over the need for removal.<sup>1</sup> In a case report and review of the literature, Shannon et al. cite many delayed complications of venous bullet embolism, including delayed embolization to the heart or pulmonary vasculature, arrhythmia, valvular dysfunction, organ damage, and sepsis. Because 25% of patients will suffer eventual morbidity from venous embolization, the authors recommend mandatory extraction in the acute setting.<sup>3</sup>

While most authors agree on the mandatory removal of peripheral venous bullet emboli, controversy remains on the removal of bullets which embolize to the pulmonary artery. Historically, surgical removal has been advocated. In a 1976 report by Stephenson et al., reviewing 17 such cases, all deaths occurred in patients who did not undergo surgical embolectomy, and were due to thrombosis, sepsis, vascular occlusion with infarction, and erosion into the airway. However, all of the deaths occurred before 1942.<sup>4</sup> In a more recent study, Kortbeek et al. reported a series of 32 cases of bullet embolism to the pulmonary artery, 14 of which were managed non-operatively. None of the non-operatively managed patients for whom follow-up data were available suffered an adverse effect from the embolus.<sup>5</sup> Thus, the substantial risk of operative intervention on the pulmonary artery and even endovascular intervention within the artery must be weighed carefully against the risk of long-term embolus related complications. Some authors recommend pulmonary embolectomy in asymptomatic patients only if the bullet is accessible via an endovascular approach.<sup>6</sup>

Before 1980, extraction of venous bullet embolism required open surgery. In cases where a surgical approach is required, preoperative and intraoperative localization of the bullet by fluoroscopy is essential to recognize the frequent occurrence of bullet migration between preoperative imaging and the time of surgery.<sup>1,2,7</sup>

The first report of endovascular retrieval of bullet in 1980 by Hartzler et al. describes retrieval of a bullet from the right ventricle using a snare device.<sup>8</sup> This was perfected by Sclafani et al. in 1991, who recommended the addition of balloon occlusion of the proximal vein to prevent procedure-related central embolization. While the number of reported cases remains small, recent publications report growing use and success of endovascular retrieval.<sup>6</sup>

### 4. Conclusion

Vascular bullet embolism is rare and is associated with significant morbidity and mortality. We report a successful case of percutaneous endovascular retrieval of a bullet which had migrated in a retrograde fashion to the left external iliac vein. We support the removal of asymptomatic venous bullet emboli using an endovascular approach whenever possible.

### Conflict of interest statement

The authors report no conflicts of interest.

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None.

**Ethical approval**

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

**Author contributions**

Dr. Cullen Carter – acquisition of data, drafting the article, final approval of the version submitted. Dr. Joaquim Havens, Dr. William Robinson, Dr. Matthew Menard, and Dr. Jonathan Gates – acquisition of data, critically revising article for intellectual content, and final approval of the draft to be submitted.

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