A 24-year-old African American male presented to the Emergency Department with a gunshot wound to the right mid-abdomen. The patient was in marked distress, and was showing signs of hemodynamic instability with marked hypotension and tachycardia; he was therefore taken to the operating room for immediate laparotomy. He was found to have a large right retroperitoneal hematoma with injury to the inferior vena cava (IVC); this was repaired during the operation. Several lumbar accessory veins originating from the IVC were clipped during the primary IVC repair. Following surgery, he was transferred to the intensive care unit in stable condition.

CT of the chest, abdomen, and pelvis with contrast was performed immediately following laparotomy. CT of the abdomen revealed several metallic densities adjacent to the infrarenal IVC consistent with both surgical clips and bullet fragments (Fig. 1). His initial chest X-ray before surgery demonstrated a metallic density overlying the left hemithorax [Fig. 2]. No thoracic entry wound was present on physical examination, and no diaphragmatic injury was identified during laparotomy.

Figure 1. 24-year-old African American male with missile pulmonary embolus. Abdominal transverse CT on admission. The black arrow in the figure illustrates the position of the metallic densities found adjacent to the infrarenal IVC.

A contrast chest CT demonstrated a 1.6-cm metallic density consistent with a large bullet fragment located in the posterior lower-lobe branch of the left pulmonary artery. There appeared to be flow distal to the bullet, suggesting a nonocclusive embolus.
Since the patient maintained adequate oxygenation while being treated in the hospital for his abdominal wound, no attempt at embolectomy was pursued. The patient recovered uneventfully, and on followup CT weeks later the bullet was again visualized in the same lower-lobe branch of the left pulmonary artery (Figs. 3 and 4); it had demonstrated no evidence of migration.

Discussion

Missile emboli are the result of penetrating projectile wounds that enter the vasculature and are subsequently carried to smaller vessels, where they occlude blood flow and cause infarction of tissue. Due to the traumatic and often random nature of projectile entry into the human body, missile emboli have been described in the literature in most major arterial systems as well as in the venous system (1, 2). Although rare, missile emboli should be considered when a patient presents with penetrating projectile trauma accompanied by certain radiographic characteristics (1).

The IVC and the iliac veins are common sites from which projectiles enter the vasculature and threaten to produce missile emboli. Although the most likely outcome in this situation is a missile pulmonary embolus, this is not the result of every such event—there are numerous reports in the literature of these projectiles lodging in the right ventricle before reaching the pulmonary circulation (3), and also of retrograde flow of the missile from its vascular entry point to smaller-caliber systemic veins (4). Additionally, paradoxical bullet emboli have been reported in the literature which, analogous to other paradoxical emboli, bypass the pulmonary circuit and directly enter the systemic arterial circulation via a defect such as a patent foramen ovale (5, 6).

Missile pulmonary emboli may present clinically with many of the same vital findings that one would suspect following a thromboembolic pulmonary embolism, including tachycardia, tachypnea, and hypoxemia. Approximately
two-thirds of patients are asymptomatic (7); those that do display symptoms usually complain of dyspnea and chest pain, with hemoptysis sometimes noted as well (1, 8, 9). Treatment decisions are often predicated on whether or not the patient is symptomatic: in a symptomatic patient, embolectomy is often pursued, whereas in an asymptomatic patient, some still advocate embolectomy (1, 10), while others promote more conservative measures such as supportive care (6, 11, 12).

In general, an abdominal gunshot wound can be challenging for a radiologist to assess in the emergent environment. Due to its relative rarity, the possibility of a missile pulmonary embolism is not given much consideration when evaluating trauma CTs for complications such as viscus perforating injuries or free bleeding into the peritoneal/retroperitoneal spaces. Nevertheless, this possibility should not be ignored; although the embolus can sometimes be benign, it can often contribute significant morbidity to the primary insult. In addition to infarction of pulmonary tissue, other potential sequelae of missile pulmonary emboli include infection (gangrene and sepsis have both been reported) as well as erosion through the arterial wall and subsequent hemorrhage (2, 8). Prompt diagnosis is therefore paramount in correctly assessing the situation and allowing for consideration of treatment options such as emergent surgical embolectomy.

Due to the potential for significant morbidity and mortality, a radiologist must therefore have a high degree of suspicion for missile pulmonary embolism in any gunshot trauma if there is no exit wound and also no bullet found in the projectile tract, but evidence of metallic fragments exists on initial chest x-ray (1, 2)—particularly when there are signs of injury to the IVC or other large abdominal/pelvic veins. As was the situation with our patient presented here, small bullet fragments near and around the IVC or another large vein can also aid in this diagnosis, and in cases in which the situation is dire, such considerations could potentially make a significant impact on patient recovery.

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