CASE REPORT

Paradoxical embolism through PFO leading to stroke in a gunshot victim with IVC injury

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Abstract

A 23-year-old man presented to the emergency department with multiple gunshot wounds to the chest and abdomen, and was taken to the operating room emergently for exploratory laparotomy due to hemodynamic instability. The patient underwent inferior vena cava (IVC), bowel and ureter repair during the procedure, requiring massive amounts of blood products. The patient transferred to the surgical intensive care unit with a routine post-operative course for approximately the next 7 days before presenting with signs of stroke. The patient was diagnosed with deep vein thrombosis in IVC at the repair site on a follow-up venogram. Upon further work-up with echocardiography, the patient was determined to have a patent foramen ovale (PFO), with paradoxical embolism as the most likely cause of the stroke. We present this unusual case of a GSW leading to stroke due to embolism from a venous source through a PFO.

INTRODUCTION

Traumatic injury to the inferior vena cava (IVC) presents in most cases as a very severe condition, with a high mortality and risk of complication, 70% in some cases [1, 2]. Injury can cause a deep venous thrombosis (DVT) due to venous stasis, which can lead to venothromboembolism (VTE) from the IVC. VTE is an uncommon sequela but occurs in similar rates after repair or ligation of the vessel [3]. Complications of IVC injury can be more severe when patients also present with cardiac structural defects, such as a patent foramen ovale (PFO), which can allow for venous system clots to embolize to the arterial circulation. A PFO lends a very high risk to developing cryptogenic stroke, with the defect being the cause in almost a third of strokes [4]. Numerous cases of bullet embolism in the venous and arterial systems, as well as cryptogenic stroke due to a PFO, have been noted in the literature [5, 6]. However, no cases describing paradoxical embolism through a PFO from an IVC thrombus after trauma with IVC repair have been reported at this time [4–6].

OBJECTIVE

We present the case of a gunshot victim who later presented with evidence of DVT leading to stroke from paradoxical embolism through a PFO in the hospital.

CASE PRESENTATION

A 23-year-old male presented to the emergency department with multiple gunshots (left chest near the axilla, medial aspect of the left arm near the axilla, abdomen to the right of midline and right back lateral to the spine). The patient was alert and talking but confused; Glasgow Coma Score 14 and Focused Assessment with Sonography for Trauma (FAST) was negative. His blood pressure was 94/54, pulse was 91, and both were rapidly falling. Hemoglobin of 10.8 g/dL and hematocrit of 33.5% were recorded in his initial labs. Additionally, the patient’s lactate was 4.3, and his pH was 7.24 with HCO₃⁻ of 20. A left chest tube was placed due to decreased breath sounds on the left,
and the patient received three units of packed red blood cells (PRBCs) in the trauma bay due hemodynamic instability. A right subclavian cordis was also placed at this time. The patient was then taken to the operating room emergently for a trauma exploratory laparotomy. Ballistic injuries in the right colon and small bowel were noted and laparotomy pads were packed in the abdomen to achieve temporary hemostasis. A right hemicolectomy was performed with the two ends initially left in discontinuity. Upon mobilization and removal of the right colon, active hemorrhage from IVC inferior to the renal veins was observed. Several 1 cm rents were noticed in the IVC, and the vessel was compressed with sponge sticks to control bleeding and the injuries were repaired primarily. The patient was satisfactorily stable post-IVC repair. The right ureter also was transected and urology assisted in performing a ureteral repair with ureteroureterostomy. The ileocolostomy anastomosis was then performed in stapled fashion, and a separate small bowel resection with anastomosis was also performed in stapled fashion for an additional small bowel injury. Once the bowel anastomoses were finished, the IVC was inspected and appeared hemostatic overall. A drain was placed adjacent to the ureteral repair and the abdomen was irrigated and closed. Overall estimated blood loss for the procedure was 2000 mL; 2000 mL of crystalloid, 5 units of PRBCs, 6 units of fresh frozen plasma and 500 mL of albumin were transfused during the surgery. The patient was then taken to the surgical intensive care unit (SICU) and remained intubated. The patient underwent a venogram post-operatively which revealed a stricture of the IVC secondary to repair, as well as a thrombus on the right side of the IVC below the renal veins. A heparin drip was also started for anticoagulation at this time. Approximately 7 days after the initial operation, the patient was then noted to have neurologic deficits on SICU rounds, with left-sided hemiplegia and concerns for infarcts and stroke. Magnetic resonance imaging (MRI) of the brain without contrast was performed and showed suspicious gyral hyperintensities involving the right posterior frontal lobe and right anterior parietal lobe superiorly suggestive of ischemic injury or infarction. Because the patient was a young, otherwise healthy male at the time of his injury, the etiology for the stroke was not clear initially. The patient had a prolonged hospital course, but ultimately was discharged to an acute rehabilitation facility. The patient over the next 6 months complained of weakness and neuropathy in his right leg and left arm, due to nerve damage from the gunshot wounds (GSW) and sequel from the stroke, respectively.

CONCLUSION

IVC injury is a life-threatening situation, especially when coupled with the increased likelihood of multiple concurrent associated injuries and developing other post-operative complications/conditions after repair [7]. Particularly, patients with known cardiac defects such as a PFO should be regularly monitored due to increased incidence of paradoxical embolism in these patients [4]. Anticoagulation therapy along with rapid recognition and treatment of stroke in these patients is essential to long-term survival of these patients. While rare, especially compared to bullet embolism in GSW patients, an embolus from a venous repair after GSW should be considered when a patient presents with a cardiac structural defect and clinical signs of stroke.

CONFLICT OF INTEREST STATEMENT

None declared.

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