Case Report

Inferior Vena Cava Obstruction and Shock

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Abstract

Shock is one of the most challenging life-threatening conditions with high mortality and morbidity; the outcomes are highly dependent on the early detection and management of the condition. Septic shock is the most common type of shock in the Intensive Care Unit. While not as common as other subsets of shock, obstructive shock is a significant subtype due to well defined mechanical and pathological causes, including tension pneumothorax, massive pulmonary embolism, and cardiac tamponade. We are presenting a patient with obstructive shock due to inferior vena cava obstruction secondary to extensive deep venous thrombosis. Chance of survival from obstructive shock in our patient was small; however, there was complete and immediate recovery after treatment of the obstruction on recognizing the affected vessels. This case alerts the practicing intensivist and the emergency medicine physician to consider occlusion of the great vessels other than the pulmonary artery or aorta as causes of obstructive shock.

Keywords: Combined septic, deep venous thrombosis, IVC filter complications, obstructive shock

INTRODUCTION

The most frequent shock presenting to the Intensive Care Unit is septic shock, which has the highest mortality rate compared to other forms of shock. Mortality reaches 40 percent but can be reduced with proper evaluation, sufficient fluid resuscitation, and early antibiotic administration. On the other hand, one of the least common shock subtypes is obstructive shock. We are presenting an obstructive shock secondary to complete occlusion of venous return without compression of the heart or involvement of the pulmonary vessels.

CASE REPORT

A 72-year-old Caucasian male patient who is a current smoker presented to the emergency department (ED) with dysuria, subjective fever, mild confusion, and dizziness. He denied shortness of breath or loss of consciousness. Two days earlier, the patient was in the ED for foley catheter removal that was placed for obstructive uropathy due to benign prostatic hyperplasia. Medical history was significant for stage II chronic kidney disease and multiple kidney stones status post lithotripsy. Surgical history was significant for a road traffic accident (RTA) 15 years ago requiring surgery and right hip osteoarthritis with avascular necrosis status post replacement.

He is a nonalcoholic and denied any illicit substance use. Physical examination revealed mild fever (100.1°F), tachycardia (111 bpm), hypotension (70/40 mmHg), and tachypnea (29 bpm). Cardiopulmonary and abdominal examination were unremarkable. Extremities showed bilateral edematous swelling, more so on the right leg. His initial arterial blood gases were normal with an inspired oxygen fraction of 28%. The leukocyte count was 15.9 × 10³/μL with 85% neutrophils and hemoglobin was 10.9 mg/dl. Other hematologic and coagulation parameters were within the normal range. Serum bicarbonate was 22 mEq/L, creatinine 3.4 mg/dl, blood urea nitrogen 39 mg/dl, lactic acid 3.2 mg/dl, whereas other serum chemistries and liver function tests were unremarkable. Urinalysis was positive for leukocyte esterase and a high white cell count. An electrocardiogram and serum troponin levels were normal.

Based off this presentation, septic shock was suspected. Therefore, blood cultures were ordered and broad spectrum antibiotics were initiated. He was then placed on a vena cava filter to prevent further embolization. Intravenous fluids were continued to maintain adequate perfusion. An ultrasound of the lower extremities showed no evidence of deep vein thrombosis. A computed tomography (CT) scan of the chest with contrast was obtained and showed occlusion of the inferior vena cava with effacement of the hepatic veins.

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Due to suspected pulmonary embolism, echocardiogram was performed and showed an ejection fraction of 60% with normal right ventricular ejection fraction and dimensions. Computed tomography (CT) pulmonary embolism protocol was negative. CT abdomen showed bilateral nonobstructive renal stones and some stranding suspicious for a small retroperitoneal hematoma.

Reevaluation of the patient presentation and history with his family confirmed that he had a RTA complicated with DVT on the right leg and treated with inferior vena cava (IVC) filter placement 15 years ago. In the absence of significant improvement with proper septic shock management and no significant sepsis source, obstructive shock secondary to IVC obstruction was entertained. Venography was performed to evaluate the patency of the IVC [Figure 1b]. There was almost complete occlusion of the IVC at the level of the filter. In addition, it showed filling defects were noted within the distal IVC and bilateral common and external iliac veins as well as the common femoral veins compatible with thrombus. Slight hypertrophy was noted of the collateral arising from the left common iliac vein suggestive of long-standing obstruction.

Mechanical thrombectomy was then performed [Figure 1c and d]. A total volume of approximately 350 mL thrombus was removed. Given the suspicion for retroperitoneal hematoma, he was not a candidate for catheter directed thrombolysis. After the removal of the clot, the patient did not require any intravenous pressors. The patient was started on unfractionated heparin after discussion with multiple radiologists and monitored closely. The stranding in the retroperitoneum was considered to be edema due to congestion. His hemoglobin did not drop, and he was discharged on Rivaroxaban with no recurrence of thrombosis for the following 3 months. Given the chronicity of his IVC filter, radiology, and vascular surgery recommended against endovascular removal, which means that he will be on anticoagulation for the rest of his life.

**Discussion**

Preventing pulmonary embolism formation from DVT is a priority in the acute and chronic setting. IVC filters effectively reduced the incidence of pulmonary embolism as well as optimizing the venous flow dynamic but simultaneously increased the incidence of DVT formation. We have reached a point where placing an IVC filter is a bedside procedure. Complications of surgery for filter placement limited their use initially, but now advancements have made it easy to place a filter under ultrasound guidance with little complications. In general, filters are used in patients with anticoagulation contraindication or even as a prophylaxis to pulmonary embolism formation in trauma patients. No mortality improvement was documented with IVC filter placement, but complications such as DVT and perforation are recorded in the literature. Direct thrombus extension can occur through the filter and can lead to recurrent pulmonary embolism or IVC obstruction which might lead to obstructive shock.

Shock in general is defined as a condition of organ hypoxia secondary to increased oxygen consumption, decreased oxygen delivery, or inadequate oxygen utilization. Shock can be due to sepsis, hypovolemia, or obstruction. It commonly presents with hypotension, other vital sign changes, or the presence of elevated serum lactate levels. The effects of shock are initially reversible but can rapidly become irreversible, resulting in multi-organ failure (MOF) and death. Thus, when a patient present with undifferentiated hypotension and/or is suspected of having shock, it is important that the clinician rapidly identify the etiology so that appropriate therapy can be administered to prevent MOF and death.

Obstructive shock is a medical emergency that occurs due to mechanical problems that averts diastolic filling resulting to decreased cardiac output, despite normal intravascular volume and myocardial function, there are physical effect can lead to obstruction during diastolic filling of the ventricles which is due to decrease return to the heart patient will present with shock symptoms. Symptoms and signs of obstructive shock vary depending on the extent of the damage and acuity, which include confusion, loss of ability to concentrate, unconsciousness, chest pain, shortness of breath, pale, light headedness, and it could present with resistant hypotensive status.

IVC obstruction secondary to IVC filter placement it does commonly happen, it could be acute or chronic, acute complete...
obstruction due to thrombosis which associated with collapse is an extremely rare complication. In contrast, more frequently happen is the chronic thrombosis resulting in the formation of collateral circulation through the abdominal wall veins. Therefore, symptoms are difficult to guide your diagnosis. However in our presentation, was complicated with obstructive shock which rarely reported. Management of obstructive shock secondary to IVC obstruction depends on how chronic the thrombosis and on other comorbidities. Most are treated with anticoagulation, catheter-directed thrombolytic therapy, or thrombectomy.\cite{12,13}

In our presentation, obstructive shock was most probably secondary to the impedance of venous return by the extensive thrombosis at the IVC. The lack of other etiologies of shock, infection, abnormal cardiac function (right or left), or significant neurologic deficit as well as the quick reversal of shock immediately after mechanical removal of the clot from the IVC all point to an obstructive etiology to shock. One might argue that the shock could have been secondary to an inflammatory reaction to thrombosis. That is a possibility and probably did contribute to the shock but that would not explain the complete and almost immediate reversal of shock and improvement in renal function.

**Conclusion**

With this case report, we seek to alert the practicing intensivist and the emergency medicine physician to consider occlusion of the great vessels other than the pulmonary artery or aorta as causes of obstructive shock. IVC obstruction should be considered in cases of undifferentiated shock. In addition, IVC filters should be removed once their indication has resolved. Furthermore, it may be helpful to consider performing a point of care ultrasound scan to evaluate all shock patients in ED to rule out the presence of an obstructive process.

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**Conflicts of interest**

There are no conflicts of interest.

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