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Case Reports

Acute Bowel Ischemia Associated with Left Ventricular Thrombus and Arteriovenous Extracorporeal Membrane Oxygenation

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Abstract: Indications for extra corporeal membrane oxygenation (ECMO) have expanded in recent years, and it has become an invaluable tool in the care of adult patients in severe cardiogenic shock or respiratory failure. Understanding the physiologic effect of ECMO has also further developed, allowing for improvements in the management of the potential morbidities associated with this technology. Here, we present a case of acute bowel ischemia that developed while the patient was on central venoarterial ECMO. **Keywords:** extra corporeal membrane oxygenation (ECMO), left ventricle thrombus, acute bowel ischemia, cardiogenic shock. *J Extra Corpor Technol. 2018;50:58–60*

OVERVIEW

The use of extra corporeal membrane oxygenation (ECMO) has expanded to become an essential tool in the management of adult patients with cardiogenic shock or respiratory failure (1). The technology has improved significantly with advances such as less invasive cannula options and a better understanding of the physiologic effects of ECMO (2). This experience has allowed for improvements in the management of potential associated morbidities (3–6). Here, we present a case of acute bowel ischemia that developed while a patient was on central venoarterial (VA) ECMO.

DESCRIPTION

A Thirty-three-year-old female (height 155 cm, weight 35.4 kg, body surface area [BSA] 1.23 by Mosteller) with a history of hypothyroidism, hypercholesterolemia, anemia, anorexia and a new onset 2-month history of fatigue, shortness of breath, leukopenia, and erythema nodosum presented to the emergency department with worsening shortness of breath. She was not recently pregnant and did not have any history of kidney problems, cardiac arrhythmia, or coagulopathy. Her new complaints were undergoing extensive work-up as an outpatient. While in the emergency department, she suffered a sudden cardiac arrest with the return of spontaneous circulation after 4 minutes of advanced cardiac life support. She was found to have hemoglobin of 5.3 and required maximum dosing of norepinephrine. Subsequent echocardiogram (ECHO) revealed biventricular dilation with markedly depressed function; no intracardiac thrombus was seen at that time. She was taken emergently to the operating room and placed on central VA ECMO. The arterial cannulation was via a 10-mm Hemashield graft (Maquet-Getinge–Atrium USA, Hudson, NH) to which the custom perfusion system (Medtronic, Minneapolis, MN) was directly attached and placed to the anterolateral ascending aorta. Venous cannulation was via a 32 French right-angled dual lumen tip (DLP) (Medtronic) venous cannula in the right atrium. The patient was systemically heparinized before cannulation with 3,000 units of heparin and maintained on a continuous infusion of 10 units/kg/h, which was adjusted to a goal partial thromboplastin time of 60–80. This cannulation strategy was chosen to enable appropriate cannula size to achieve maximal support. The ECMO heparin-bonded circuit (Medtronic) with the CentriMag pump (Thoratec,

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Pleasanton, CA) and oxygenator (Quadrox, Maquet-Getinge, Wayne, NJ) were closely monitored by perfusion staff. Flows were generally maintained at 3.6–4 L/min. On postoperative day (POD) 1, she developed compartment syndrome of her left leg requiring four compartment fasciotomy. On POD 3, she developed critical limb ischemia which required iliofemoral balloon catheter thrombectomy. An unusual organized fibrinous thrombus was retrieved from her left common iliac artery. No clot was evident in the ECMO circuit during her course, and there were no technical circuit problems. Daily serial ECHOs did not clearly demonstrate intracardiac clot, although there were some exam limitations because of the cannula placement. She was intermittently thrombocytopenic requiring platelet infusion. Her cardiac function while initially depressed became hyperdynamic with an ejection fraction of 70%. Subsequently, on POD 7, she developed an acutely worsening lactic acidosis concerning for mesenteric ischemia. Computed Tomography Angiogram was therefore obtained demonstrating occlusion of her superior mesenteric and celiac arteries, with a filling defect extending into the aorta. She was emergently taken to the operating room for superior mesenteric, celiac, and aortic thrombectomy through a retroperitoneal abdominal incision. The same quality thrombus was again retrieved (Figure 1). Before thrombectomy, her small intestine was pale and her large intestine had patchy areas of ischemia without frank necrosis. Intestinal perfusion immediately improved with thrombectomy. Six hours later, ongoing bleeding was noticed in her surgical drains, for which she returned to the operating room. During this second look, both the small and large intestines appeared viable with no areas of necrosis. Pathological evaluation of the clot revealed a predominance of fibrinous material. The patient subsequently had a prolonged intensive care course, but clinically improved. She was ultimately weaned from ECMO support and decannulated 24 days after initial placement.

Figure 1. Filamentous clot cast recovered from the aorta and the superior mesenteric artery during surgical exploration.

COMMENT

With the advent and gradual adoption of extracorporeal cardiopulmonary resuscitation (ECPR) extracorporeal support of patients has proven an effective alternative for the support of adult patients in cardiogenic shock, following cardiac arrest or failure to wean from cardiopulmonary bypass, with survival rates ranging between 30% and 40% (7–9). Whether being used as a bridge to transplantation or placement of a ventricular assist device or weaned as cardiac function returns, evidence continues to accumulate due to its ever increasing role in resuscitation (10). Intracardiac thrombus may develop as a result of a non-ejecting or poorly contracting left ventricle during cardiac arrest, as has been known for many years in human pathological specimens (11) and recently documented in animal models (12). In our case, the colorless and fibrinous quality, as well as the size of the clot retrieved, suggested a cardiac origin (11–15) which potentially formed during her initial resuscitation in the emergency department (9–11). Clot may also develop while on ECMO due to ventricular distension and stasis, decreased blood flow in the ventricle, or increased afterload from the arterial cannula (3–5). Intracardiac clot can be challenging to identify on routine ECHO (13); thus, suspicion must remain when clinically appropriate. Anticoagulation may prevent clot in the ECMO circuit, but may not halt the development of intracardiac thrombus (16). Having a high suspicion for the development of thrombus led to an appropriate intervention for this patient. Timely surgical intervention allowed for the recovery of perfusion before bowel necrosis, avoiding the need for resection and further morbidity.

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