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Ischemic Colitis in a Patient on Venovenous Extracorporeal Membrane Oxygenation (VV-ECMO) Treatment: An Emerging Complication?

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Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Patient: Male, 48-year-old
Final Diagnosis: Ischemic colitis
Symptoms: Hematochezia
Medication: —
Clinical Procedure: Colonoscopy
Specialty: Critical Care Medicine • Gastroenterology and Hepatology

Objective: Rare co-existance of disease or pathology

Background: There have been few reports of colonic ischemia in patients receiving venovenous extracorporeal membrane oxygenation (VV-ECMO) treatment, and all patients died during the same hospitalization.

Case Report: A 48-year-old man was admitted with acute respiratory failure secondary to multifocal pneumonia and required VV-ECMO treatment. He developed abdominal distention and colon dilatation and was subsequently found to have ischemic colitis. He was able to recover from critical illness and ischemic colitis with supportive treatment including colonic decompression.

Conclusions: Ischemic colitis is associated with mortality in patients receiving ECMO treatment. The understanding of the pathophysiology is still evolving and requires further research to improve patient outcomes.

MeSH Keywords: Colonic Diseases • Critical Illness • Extracorporeal Circulation • Ischemia

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/923374

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Background

Venovenous extracorporeal membrane oxygenation (VV-ECMO) is one of the treatment modalities for respiratory failure due to pulmonary disease such as acute respiratory distress syndrome (ARDS) in the absence of cardiac compromise [1]. It provides complete respiratory support in critically ill patients who are unable to breathe on their own due to severe lung disease. In contrast to ventilator-induced lung injury and subsequent mortality associated with mechanical ventilation use in ARDS, VV-ECMO treatment was more successful in such patients, especially in younger age groups, even those that are unresponsive initially to mechanical ventilation [2]. As VV-ECMO is usually reserved for severely ill patients, its mortality rate remains high given the severity of the patient's underlying illness that prompts its use in the first place. Two landmark trials evaluating VV-ECMO in ARDS identified significant bleeding, thrombocytopenia, ventilator-associated pneumonia, cardiac arrhythmias, and cardiac arrest as major complications, but did not report the occurrence of colonic ischemia [3,4]. There is emerging but scarce evidence that ischemic colitis can occur in patients treated with VV-ECMO. To the best of our knowledge, only 3 such cases have been reported in the literature, all of whom subsequently died [5,6]. We present a rare case of a patient receiving VV-ECMO treatment who developed ischemic colitis with subsequent recovery with non-surgical management.

Case Report

A 48-year-old man with a history of hypertension and dyslipidemia presented with dyspnea and was subsequently admitted with hypoxic respiratory failure secondary to multifocal pneumonia and severe ARDS. He was initially put on mechanical ventilation, along with fluid resuscitation, vasopressors, and broad-spectrum antibiotics for treatment of septic shock. Despite ventilatory support following ARDSNet standards, nebulized Epoprostenol treatments, and trials of prone positioning, the patient had progressive clinical decline (partial pressure of arterial oxygen to fraction of inspired oxygen ratio was 79 with positive end-expiratory pressure of 15 cmH_2O), and required initiation of VV-ECMO on day 3 of admission. He had multiple episodes of hypotension over the next 5 days, requiring intermittent norepinephrine therapy. During the sixth day of VV-ECMO treatment, the extracorporeal membrane oxygenation (ECMO) flow rate was found to be decreased. On exam, the abdomen was distended, with active bowel sounds. It was suspected that abdominal compartment syndrome may be compromising VV-ECMO flow rate. An abdominal x-ray was done, which showed colonic dilation (Figure 1). The next day, the patient passed bright red blood in the rectal tube. Lab results showed hemoglobin 12.1 g/dl to 9.8 g/dL, which had decreased from a baseline of 12.1 g/dL since admission, a white cell count of 24 000 mm^3, with normal platelet count, renal function, electrolytes, prothrombin time, and lactate levels. A computed tomography angiogram of the abdomen revealed wall thickening without active gastrointestinal hemorrhage in parts of the right and left colon, along with patent mesenteric blood supply (Figures 2, 3). The anticoagulation with heparin drip was stopped. The Gastroenterology (GI) Service was consulted for colonic decompression and to evaluate hematochezia. Colonoscopy showed colonic findings consistent with ischemic colitis in the ascending colon and hepatic flexure (Figure 4), as well as in the descending colon (Figure 5), which was confirmed by biopsy (Figure 6). VV-ECMO flow rates improved

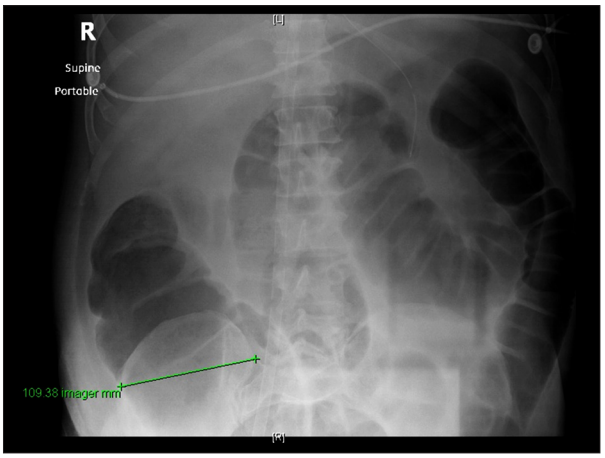

Figure 1. Abdomen X-ray shows colon dilation with cecal diameter about 10.9 cm.

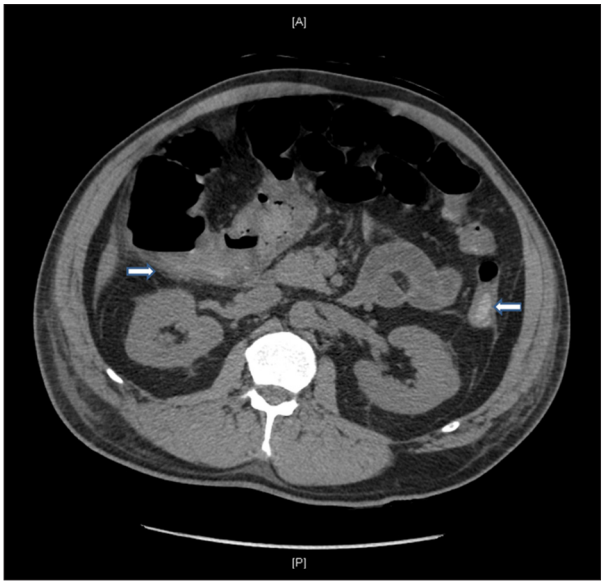

Figure 2. CT abdomen. Thickening and paracolonic fat stranding of proximal colon, hyperdensity in right hepatic flexure lumen consistent with blood (right arrow). Descending colonic wall thickening (left arrow).

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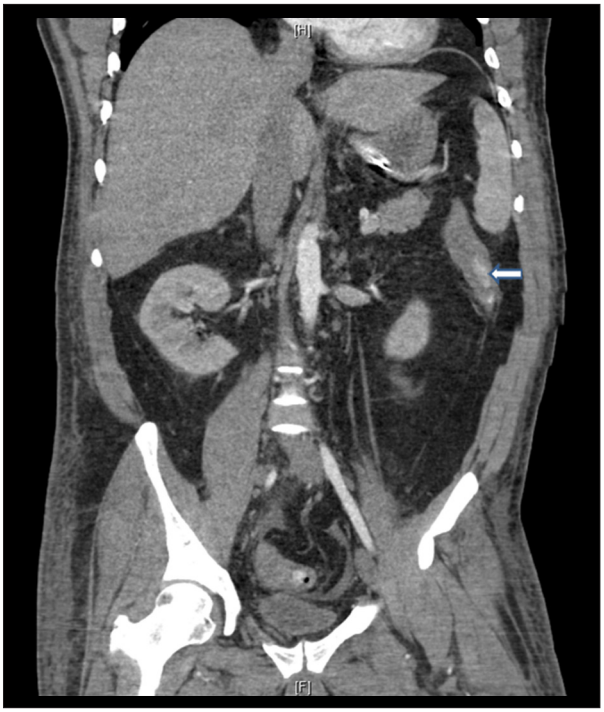

Figure 3. CT abdomen. Thickening of descending colon wall with hyperdense material in lumen, consistent with blood (arrow).

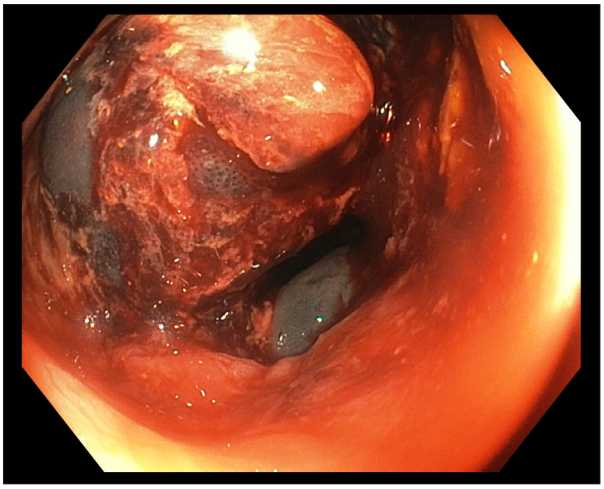

Figure 4. Colonoscopy showing congested, friable, necrotic and ulcerated mucosa, with hemorrhage in the ascending colon/hepatic flexure.

after colonic decompression. Bowel rest and nasogastric decompression were initiated, while hemodynamic support and antibiotics were continued. The patient's hemoglobin remained stable and the hematochezia resolved. He was given a course of high-dose steroids, weaned from VV-ECMO after 8 days of treatment, extubated 2 days later, and gradually recovered to baseline. Infectious workup results remained negative and antibiotics were stopped after a 2-week course. An outpatient

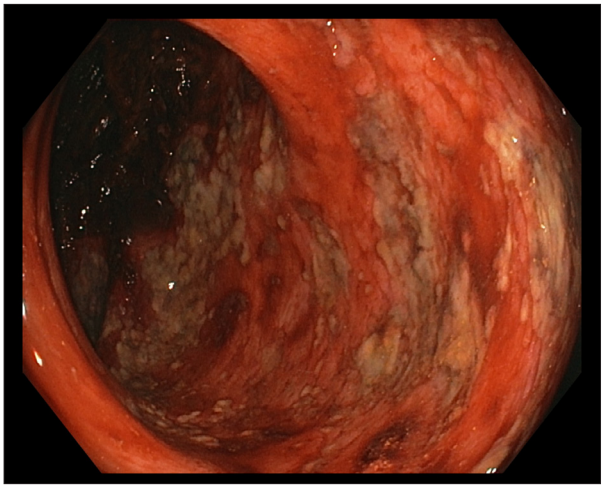

Figure 5. Colonoscopy showing erythema, congestion, necrotic and ulcerated mucosa, with areas of bleeding in the descending colon.

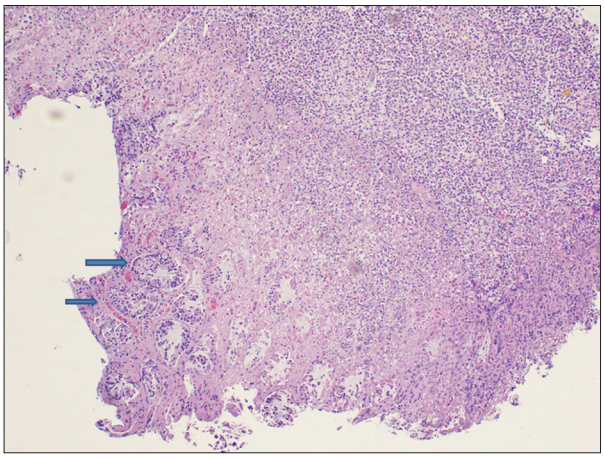

Figure 6. Colon biopsy showing loss of superficial crypts, preservation of base crypts (arrows), and voluminous inflammatory exudate.

colonoscopy was done 6 weeks later, which showed near resolution of injury due to the colon ischemia (Figures 7, 8).

Discussion

Gastrointestinal hemorrhage is a common complication associated with ECMO treatment [7]. Older age, coagulation disorders due to multiple etiologies, and systemic disease all seem to alter blood flow with ECMO treatment, and these are considered to be risk factors for GI bleeding and are associated with increased mortality [8,9]. Most cases of GI hemorrhage in patients on ECMO are due to an upper-GI source of bleeding [10,11].

Ischemic colitis is a common cause of lower-GI bleeding and is found in up to 24% of patients hospitalized due to

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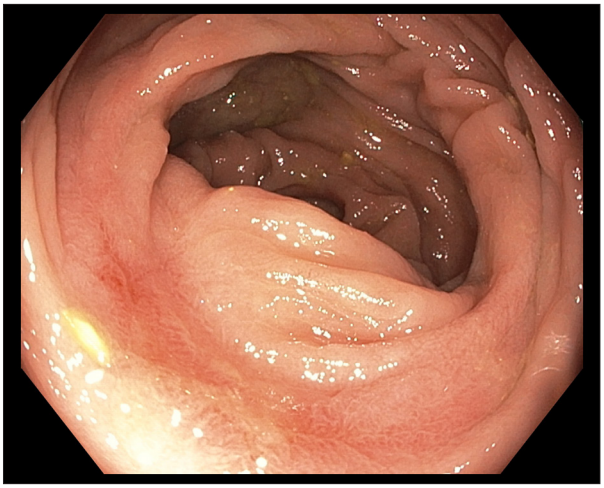

Figure 7. Image from splenic flexure during follow-up colonoscopy shows near resolution of inflammation and ulceration associated with resolving injury due to past colonic ischemia.

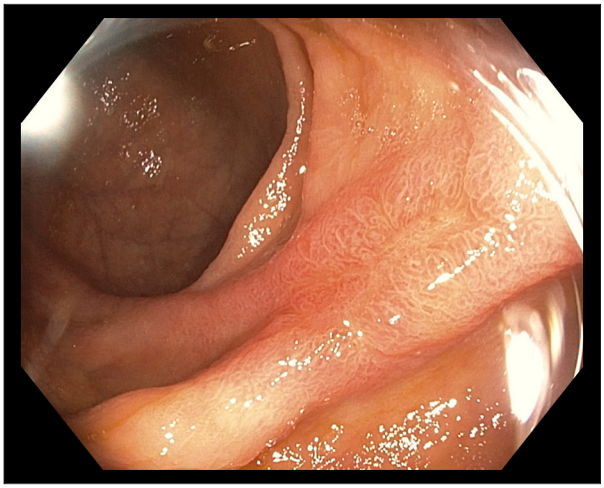

Figure 8. Image from ascending colon during follow-up colonoscopy shows near resolution of inflammation and ulceration associated with resolving injury due to past colonic ischemia.

hematochezia [12]. Colonic mucosal injury causes abdominal pain and can lead to ulceration and hemorrhage, and it can progress to involve the entire colonic wall with worsening ischemia. The differential diagnosis of the appearance of colonic ischemia includes infectious or inflammatory colitis or, less likely, malignancy. Colonoscopy is the most accurate method to diagnose ischemic colitis through direct visualization of the nature and extent of colonic mucosal injury, as well as confirmation of diagnosis through histological evaluation of a biopsy taken from the affected areas during the procedure. The risk of complications including perforation during colonoscopy in patients ultimately diagnosed with colonic ischemia is not higher than in those without colonic mucosal injury [13].

Hemodynamic derangements and thrombosis are known complications of VV-ECMO [8] that might predispose such patients to colonic ischemia, but the exact pathophysiology needs further investigation. An ECMO flow to cardiac output fraction of 0.6 is considered optimal for adequate blood oxygenation via VV-ECMO. Cardiac output is sometimes reduced to achieve this goal. This can decrease tissue perfusion and increase the risk of bowel ischemia [14]. All forms of ECMO treatments can be complicated by development of abdominal compartment syndrome (ACS) [15]. ACS can compromise ECMO flow rates and is associated with high mortality, even after decompressive laparotomy is attempted. ACS is one the etiologies of decreased perfusion and subsequent ischemia of the colon. Fortunately, in our patient, ECMO flow rates and other clinical parameters improved after colonic decompression and continued medical management.

The largest study evaluating GI bleeding in patients on ECMO treatment reported colonic ischemia in 3 patients [10]. A Canadian study of 80 patients receiving ECMO reported that 2 patients developed ischemic colitis [16]. The demographics of the patients, type of ECMO treatment used, and the risk factors or outcomes of colonic ischemia were not reported in either study. To date, 3 cases of ischemic colitis have been found in 2 of the studies that evaluated patients who received only VV-ECMO [5,6]. All of the patients were in their 70s and had respiratory failure due to various etiologies. One of the patients underwent total colectomy while another had partial colectomy, but eventually all patients died from different complications during the same admission. The duration of VV-ECMO before development of ischemic colitis and risk factors for colonic ischemia were not reported. Our patient was from a much younger age group and recovered with conservative management, making this a unique case.

Conclusions

Ischemic colitis is a common etiology of hematochezia requiring hospitalization. Colonic ischemia is rarely reported in patients receiving ECMO treatment and is associated with mortality in such patients. To the best of our knowledge, this is the fourth case of colonic ischemia reported in patients receiving VV-ECMO specifically. The pathophysiology is likely related to VV-ECMO-related hemodynamic changes and coagulopathy, as well as the patient's underlying critical illness, but requires further investigation to elucidate the cause and improve outcomes in such patients.

Conflict of interest

None.

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