Case Report

Delayed retroperitoneal hemorrhage during veno-venous extracorporeal membrane oxygenation: a case report

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Case: There are several reports of retroperitoneal hemorrhage induced by percutaneous femoral cannulation for extracorporeal membrane oxygenation (ECMO). However, there are no reports of delayed retroperitoneal hemorrhage, which develops a few days after ECMO initiation and is unrelated to the ECMO cannulation. Herein, we report a rare case of delayed retroperitoneal hemorrhage during veno-venous extracorporeal membrane oxygenation (VV-ECMO).

Outcome: A 54-year-old man was referred to our hospital because of severe acute respiratory distress syndrome. We initiated VV-ECMO. The patient had severe delirium and was confined to a long-term supine position to maintain circuit safety. On day 13, computed tomography unexpectedly revealed a large retroperitoneal hemorrhage spreading around the psoas muscle.

Conclusion: Delayed retroperitoneal hemorrhage can develop during VV-ECMO management a few days after its initiation. Anticoagulant use and forceful muscular strain could be risk factors of delayed retroperitoneal hemorrhage.

Key words: Anticoagulation, delirium, retroperitoneal hemorrhage, supine position, veno-venous extracorporeal membrane oxygenation

INTRODUCTION

VENO -venous extracorporeal membrane oxygenation (VV-ECMO) is an important salvage therapy for patients with severe acute respiratory distress syndrome (ARDS). Since the CESAR trial in 2009,[1] VV-ECMO has been established and widely used for the treatment of severe ARDS.[2] However, bleeding complications remain the leading cause of morbidity and mortality in patients treated with ECMO;[3] the main mechanisms include anticoagulation therapy, thrombocytopenia, and coagulation factor use.

Anticoagulation therapy is essential to maintain circuit safety in VV-ECMO. Hence, one of the greatest challenges of ECMO management is achieving and maintaining proper anticoagulation.

Spontaneous retroperitoneal hematoma (RPH), defined as bleeding into the retroperitoneal space without associated trauma or iatrogenic manipulation, is potentially fatal.[4] The known risk factors for spontaneous RPH are anticoagulation, antiplatelet therapy, and chronic renal failure.[5] Symptoms of RPH are non-specific and atypical. It appears to be difficult to diagnose RPH as, per reports, 10.1% of all RPH (with various origins) are misdiagnosed initially.[4]

Retroperitoneal hematoma could be induced by percutaneous femoral cannulation for ECMO,[6,7] which develops in a short time and is relatively easily diagnosed. Herein, we report a rare case of delayed RPH during VV-ECMO, which developed a few days after ECMO initiation and appeared to be unrelated to cannulation.

CASE

A 54 -year-old man was referred to our hospital because of respiratory failure. On admission, he was intubated

and sedated to Glasgow Coma Scale 3. His vital signs were as follows: respiratory rate, 22 breaths/min; blood pressure, 125/62 mmHg; heart rate, 84 b.p.m.; temperature, 38.7°C; peripheral capillary oxygen saturation, 90% (fraction of inspired oxygen [FiO_2], 1.0). Arterial blood gas analysis showed severe hypoxia (partial pressure of oxygen, 74.7 mmHg). Chest radiography and computed tomography (CT) revealed bilateral ground glass opacities. From these findings, the patient was diagnosed with severe ARDS.

However, high-pressure ventilation with high FiO_2 for 7 h did not improve his respiratory conditions; we decided to initiate VV-ECMO. The ECMO cannula was placed uneventfully. Heparin, as an anticoagulant, was given to maintain an activated partial thromboplastin time of 60–80 s. His clinical course is shown in Figure 1.

The patient had severe delirium caused by the ARDS itself. We attempted titration of several sedatives and analgesics to achieve an appropriate awake status. However, his
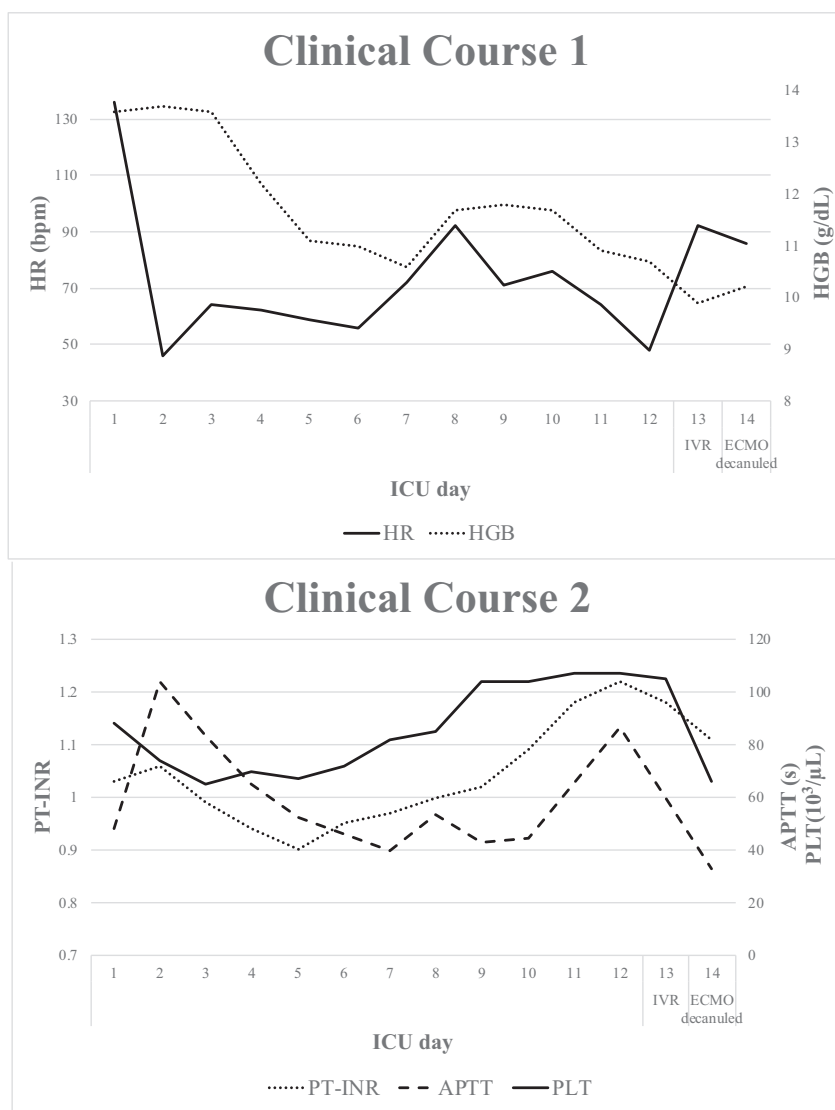

Fig. 1. Clinical course of a 54-year-old man who developed delayed retroperitoneal hemorrhage during veno-venous extracorporeal membrane oxygenation (ECMO) management. The heart rate (HR) was gradually increasing and anemia was progressing around day 13. A transfusion protocol, as a target hemoglobin of 10 g/dL before stopping the bleeding (i.e. embolization in the present case), was applied. Finally, the patient was given 14 U red blood cells and 6 U fresh-frozen plasma. We used activated partial thromboplastin time (APTT) as an indicator of coagulation instead of ACT. HGB, hemoglobin; PLT, platelet count; ICU, intensive care unit; IVR, interventional radiology; PT-INR, prothrombin time-international normalized ratio; ACT, activated coagulation time.

delirium was intractable. Thus, the patient was confined to a long-term supine position to protect the ECMO circuit.

On day 6, tracheotomy was carried out. Additionally, gastrointestinal endoscopy was carried out because of gradual anemia progression; gastric erosion was revealed. Whole-body CT on day 7 showed improvement of the bilateral opacities and no abnormal retroperitoneal findings (Fig. 2). As the respiratory condition gradually improved, VV-ECMO weaning was considered. On day 13, CT scanning for ARDS evaluation and screening of the whole body unexpectedly revealed a large RPH spreading around the psoas muscle and measuring 7×5 cm^2. We detected extravasation of the contrast medium on the 3rd to 4th lumbar artery on angiography (Fig. 3); they were embolized with gelatin sponges, and his hemostasis promptly stabilized. Red blood cells (14 units) and fresh-frozen plasma (6 units) were transfused, and anticoagulation was stopped. As there was no deterioration in the respiratory condition after transfusion, VV-ECMO was removed on day 14. The postoperative course progressed well, without rebleeding occurrence. On day 21, the mechanical ventilator was taken off. The patient became ambulatory and was discharged on day 54.

DISCUSSION

THE PRESENT CASE highlights that delayed RPH can develop during VV-ECMO management several days after ECMO initiation, and anticoagulation use and forceful muscular strain are presumed risk factors for delayed RPH.

First, delayed RPH can develop during VV-ECMO management several days after ECMO initiation. Spontaneous RPH is a rare disease that often develops in elderly patients, affecting only 0.001% of patients in the emergency department.[4,8] Its mortality rate is approximately 23%.[5] There are several reports on the relationship between RPHs and cannulation in ECMO. Extracorporeal membrane oxygenation requires a large-diameter catheter for sufficient flow and anticoagulants to prevent thrombosis formation in the circuit. Reports of RPH due to a difficult cannulation or mal-cannulation exist.[6,7] In cases of difficult cannulation and deranged coagulation status, RPH development occurred within 12 h after cannula replacement, whereas mal-cannulation resulted in ECMO termination within 7 h of initiation
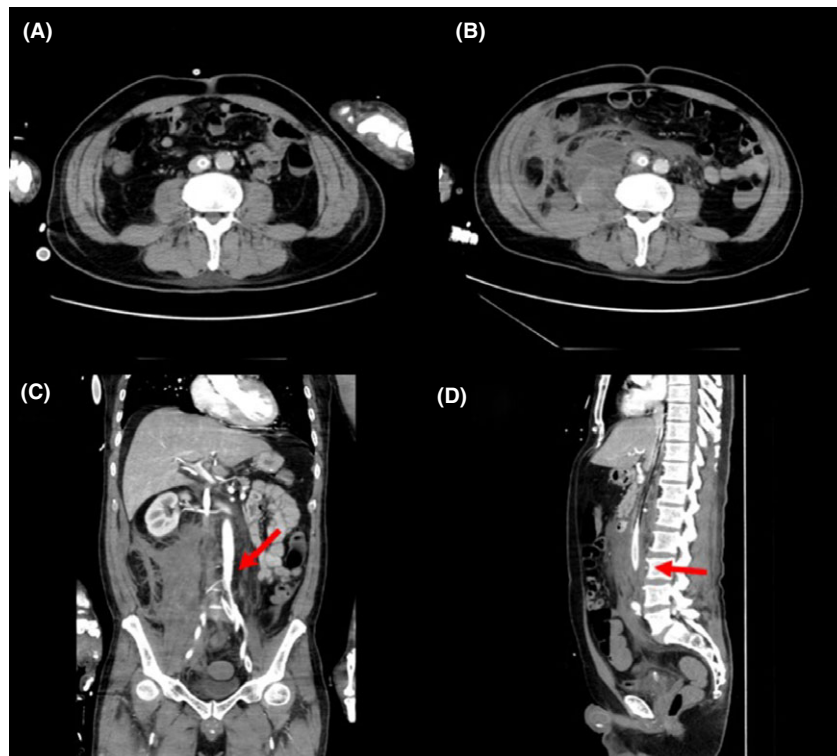

Fig. 2. Computed tomography scans showing (A) no retroperitoneal hematoma on day 7, and (B–D) retroperitoneal hematoma accompanied by extravasation of contrast medium (arrows) on day 13 of veno-venous extracorporeal membrane oxygenation management in a 54-year-old man.
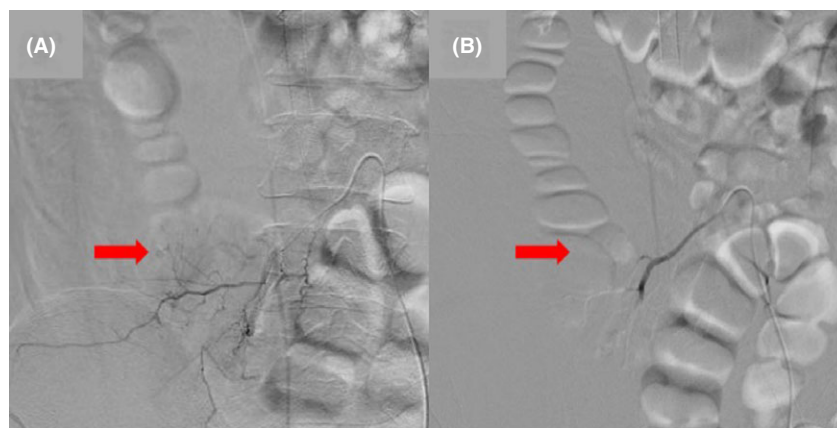
Fig. 3. Angiography images showing (A) extravasation of contrast medium (arrow) on the 3rd to 4th lumbar artery and (B) disappearance of the extravasation (arrow) after transcatheter arterial embolization. The patient was a 54-year-old man who developed delayed retroperitoneal hemorrhage during veno-venous extracorporeal membrane oxygenation management.

because of RPH. However, to our knowledge, there are no reports of delayed RPH during ECMO management. In this case, RPH occurred 13 days after VV-ECMO initiation. Computed tomography scanning on day 7 revealed no RPH. Hence, this RPH was not clearly associated with VV-ECMO cannulation.

Second, the risk factors of delayed RPH are presumed to be anticoagulant use and forceful muscular strain. Anticoagulation therapy is a known risk factor of spontaneous RPH.[4] As anticoagulation therapy is essential to maintain the circuit safety, the risk of spontaneous RPH inevitably increases during VV-ECMO management. However, the present case did not have relevant comorbidities/complications, and no medications that might cause bleeding, except heparin, were given. Yamamura *et al.*[9] reported that one possible mechanism of blood vessel rupture is long-term confinement in a supine position, which results in the compression of the posterior side of the involved muscle. Another possible mechanism is iliopsoas muscle strain during routine patient care, of which neither the nursing staff nor the patient was aware. In such cases, RPH occurred an average of 11 days from the start of confinement. Traditionally, patients who undergo ECMO are heavily sedated to prevent inadvertent cannula dislodgement. This in turn leads to an increased risk of immobility-associated complications. Currently, in keeping with the goal of early liberation from mechanical ventilation, many facilities are exploring an "awake ECMO" strategy.[10] An important benefit of being awake is that complications can be detected at an earlier stage. In this case, we attempted to adjust the analgesia and sedation to maintain an awake status during ECMO management. However, as the delirium was uncontrollable, the patient

was confined to a long-term supine position. Hence, RPH occurred on day 13.

During VV-ECMO, symptoms can be masked by the sedation and ventilator management, rendering the diagnosis of RPH even more difficult. In our case, we discovered the RPH during CT scanning for ARDS assessment on day 13. A review of the patient's chart and data indicated that his heart rate was significantly increasing and anemia was progressing. A large number of transfusions and embolizations were needed. The careful observation of patient's chart and data could have avoided the massive transfusion and embolization in this patient. Thus, medical staff engaging in ECMO management should consider delayed RPH when observing changing vital signs and anemia.

CONCLUSION

DELAYED RPH CAN develop during VV-ECMO management a few days after ECMO initiation. Anticoagulation use and forceful muscular strain could be risk factors for delayed RPH. Medical staff engaging in ECMO management should be aware of the possibility of delayed RPH development, symptoms of which are non-specific, atypical, and easily masked by sedation.

DISCLOSURES

Approval of the research protocol: N/A.
Informed consent: The patient provided consent for publication.
Registry and the registration no. of the study/trial: N/A.
Animal studies: N/A.
Conflict of interest: None.

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