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CASE REPORT

Perioperative Hemodynamic Management of Refractory Hypotension in a Patient with Giant Hepatic Cysts Complicated by Compression of the Inferior Vena Cava

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Surgery is the treatment of choice for compression of the inferior vena cava (IVC) in patients with polycystic liver disease (PCLD). However, hemodynamic instability may develop after induction of anesthesia and during maintenance when compression of the IVC causes a decrease in venous return and may persist until reduction of the volume of the cysts or liver. Perioperative hypotension should be treated promptly by titration of anesthetic drugs, fluid therapy, transfusion, intravenous administration of a vasopressor, and postural modification depending on the etiology. However, regardless of the method(s) chosen, placement in the left lateral decubitus position is crucial for increasing venous return in patients with compression of the IVC. Herein, we report the case of a male patient with PCLD and compression of the IVC who developed refractory hypotension after induction of anesthesia. A dramatic improvement in his hemodynamic status was noted immediately after he was placed in the left lateral decubitus position. The patient's critical hemodynamic state was then able to be managed until his hepatic cysts were drained, and there were no sequelae.

Key words: Hepatic cysts, inferior vena cava compression, left lateral decubitus position, perioperative management

INTRODUCTION

Polycystic liver disease (PCLD) is an autosomal dominant genetic disorder characterized by progressive development of multiple parenchymal cysts in the liver and may also include renal cysts.[1,2] Clinically, the prevalence of PCLD has been estimated to be 0.001%,[1] which is relatively low in comparison with other liver diseases. Approximately 80% of patients with PCLD are clinically asymptomatic.[2,3] However, 3% of affected patients present with abdominal symptoms because of an increase in hepatic volume that leads to compression of surrounding structures.[1,2] PCLD presenting with giant hepatic cysts and compression of the inferior vena cava (IVC) is extremely rare, and only a few definitive case reports have been published.[4,5] Surgery, including drainage and liver transplantation, is usually the first choice of treatment for PCLD in symptomatic patients.[1,2] However, patients with compression of the IVC may become hemodynamically unstable after induction of anesthesia and during maintenance because of a decrease in venous return and a subsequent decrease in cardiac output. Ephedrine is regarded as the first-line treatment for intraoperative hypotension during general anesthesia. A reduction in the concentration or rate of infusion of anesthetic agents is often considered. Measures to maintain adequate hydration are generally used to increase the intravascular volume when hypotension occurs after induction of anesthesia. In addition to ephedrine, vasopressors such as norepinephrine and even epinephrine can be used a primary medical treatment for refractory hypotension if the patient is bradycardic. Calcium gluconate is another medication that can increase systemic vascular resistance. Further, the Trendelenburg position is widely used to increase venous return in patients with hypotension after induction of anesthesia and during maintenance.[6,7] Here, we report the

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case of a young male patient with PCLD and compression of the IVC who developed refractory hypotension after induction of anesthesia and could not be treated using any of the above-mentioned approaches. The patient's condition eventually improved when we placed him in the left lateral decubitus position (right-side up and left-side down), as the standard hypotensive resuscitation position for pregnant women, and the hepatic cysts compressing the IVC were successfully drained.

CASE REPORT

The patient in this case provided informed consent to anonymized reporting of clinical details. A 17-year-old male patient, with no relevant medical history or known allergies, presented with a 3-month history of intermittent abdominal pain and ileus. Abdominal computed tomography (CT) scans [Figures 1-3] revealed multiple marked hepatic cysts with partial compression of the IVC. There were a grandfather and two uncles with a similar hepatic disorder in the family history. While in hospital, he underwent a series of examinations, including genetic testing, routine hematology and biochemistry tests, a coagulation profile, and echocardiography, all of which were unremarkable. However, on the basis of abnormal DNA findings, he was diagnosed with PCLD. Surgical drainage and cystectomy of the liver were indicated because of his persistent abdominal symptoms. Propofol-based total intravenous anesthesia[8-15] was induced with intravenous fentanyl (2 mcg/kg) and 2% lidocaine (1.5 mg/kg). Subsequently, continuous infusion of propofol (Fresofol 1%) was delivered by Schneider's kinetic model of target-controlled infusion with the effect-site concentration (Ce) of 4.0 mcg/ml. When the patient lost his consciousness, 0.6 mg/kg of rocuronium was administered, followed by endotracheal intubation and administration of intravenous dexamethasone (5 mg) to prevent postoperative nausea and vomiting. Then, a right radial arterial line was inserted and two 18-gauge peripheral lines were placed bilaterally in the upper limbs for potential large-volume fluid infusion. He was placed in the supine position. However, refractory hypotension (heart rate, 102 beats/min; blood pressure, 65/43 mmHg) was noted after induction of anesthesia, for which hydration, reduction of the propofol infusion, administration of ephedrine 20 mg and calcium gluconate 1000 mg, and placement in the Trendelenburg position were ineffective. Thoracic and cardiac auscultation revealed clear breath sounds bilaterally and normal heart sounds with no murmurs. No skin rash was noted after induction of anesthesia or administration of prophylactic antibiotics. Arterial blood gas analysis revealed stable hemoglobin and electrolyte levels and a normal lactate level. After discussion among the

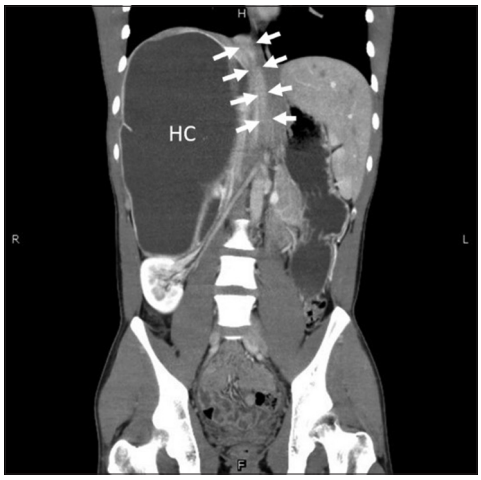

Figure 1: Coronal computed tomographic image showing giant hepatic cysts with partial compression of the inferior vena cava (arrows)

Figure 2: Axial computed tomographic image showing giant hepatic cysts with partial compression of the inferior vena cava (arrows)

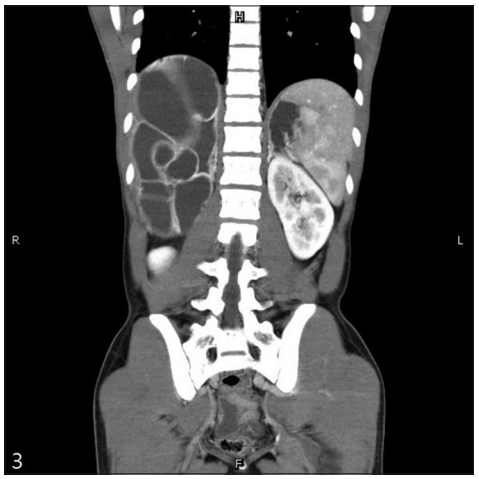

Figure 3: Coronal computed tomographic image showing multiple hepatic cysts with septations

members of the surgical team, it was agreed that the primary cause of his refractory hypotension was compression of the IVC followed by obstruction of venous return. Therefore, we placed the patient in the left lateral decubitus position, which is the standard hypotensive resuscitation position for pregnant women, in an attempt to reverse this catastrophic state. His vital signs improved markedly (heart rate, 80 beats/min; blood pressure, 92/50 mmHg) in the left lateral decubitus position without additional vasopressors. After drainage of the accumulated fluid (5300 mL) from the hepatic cysts, his vital signs progressively stabilized (heart rate, 64 beats/min; blood pressure, 116/60 mmHg). We successfully completed the laparoscopic procedure in 180 min. The patient recovered uneventfully and was discharged on postoperative day 5 in a stable condition.

DISCUSSION

Compression of the IVC, also referred to as IVC syndrome, is indicated by an intra-abdominal mass effect involving the IVC and causing hemodynamic instability, including production of a thrombus.[4,5,16] Surgical and anesthetic management of this syndrome is very difficult. Our existing knowledge indicates that perioperative hypotension should be treated promptly by titration of anesthetic drugs, fluid therapy, transfusion, intravenous administration of a vasopressor, and postural modification depending on the cause.[6,7] Nevertheless, the strategy used to increase venous return in the setting of compression of the IVC is crucial. The evidence with regard to the effects of different body positions on cardiac output is conflicting;[17] however, the left lateral decubitus position can decrease compression of the IVC and increase venous return and thus be a reasonable option for temporary relief from a critical hemodynamic state in a patient with increased abdominal pressure or a potentially obstructive mass close to the IVC. Modification of the operating table with a tilt to the left may be an alternative strategy. In a previous case report by Hutton *et al*.,[17] a patient with narrowing of the IVC developed profound asymmetric hemodynamic changes under general anesthesia in the right lateral decubitus position when compared with the left-sided position, implying that an immediate postural change could be a crucial approach to rapidly treating and differentially diagnosing intraoperative compression or obstruction of the IVC. Moreover, patients at high risk for compression of this vessel, such as pregnant women and patients with intra-abdominal neoplasms, should be carefully assessed.

The left lateral decubitus position is routinely used as a hypotensive resuscitation strategy to relieve compression of the IVC and increase venous return in pregnant women.[18] The same method can be used in patients with compression of the IVC caused by other conditions, such as hepatic or renal cysts, retroperitoneal tumors, or intra-abdominal malignancy. Although the best way to stabilize vital signs is removal of the source of the IVC compression, the left lateral decubitus position could be an effective measure to temporarily resolve this critical state after induction of anesthesia and during maintenance. Moreover, preoperative decompression procedures, such as sonographic-guided or CT-guided drainage, should be considered if compression of the IVC is noted. The present case highlights that the simple approach of patient positioning has a profound impact on hemodynamic stability. If we suspect that hemodynamic compromise has resulted from compressive forces of giant hepatic cysts generated in the supine position, we can confirm this suspicion and simultaneously resolve the problem by placing the patient in the lateral decubitus position.

CONCLUSION

Refractory hypotension after induction of anesthesia and during maintenance may develop if IVC compression causes a decrease in venous return. In addition to hydration, medication, and placement in the Trendelenburg position, the left lateral decubitus position may be considered for temporary relief of critical hypotension until removal of the source of IVC compression. In patients at high risk for compression of the IVC, such as pregnant women and patients with intra-abdominal neoplasms, postural change should be performed to differentially diagnose and rapidly treat IVC compression. Such an approach should be kept in mind if refractory hypotension is encountered intraoperatively.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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