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Case Report

Fluid resuscitation dilemma: anticipating massive blood loss in hysterectomy

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Abstract

Massive bleeding during obstetric surgeries, such as hysterectomy, is a significant cause of maternal mortality and morbidity worldwide. In such cases, fluid resuscitation is imperative. However, intraoperative guidelines and fluid requirements cannot be universally standardized to accommodate every patient, surgical procedure, or condition. The debate between restrictive and liberal fluid resuscitation during massive intraoperative bleeding has persisted for a long time. Both approaches have been associated with side effects that impact patient morbidity and mortality. Despite the fact that there have been extensive studies on fluid and hemodynamic optimization, results remain inconsistent due to the varying definitions of "restrictive" and "liberal" fluid management and the differing monitoring protocols across studies. The present study describes a case of a 28-year-old woman in her third pregnancy who was scheduled to undergo a cesarean section and hysterectomy due to placenta accreta. The patient experienced significant intraoperative bleeding, prompting the administration of substantial intravenous fluids and blood products to maintain hemodynamic stability. She was closely monitored for signs of fluid overload. The resuscitation efforts proved successful, and the patient was discharged without complications.

Keywords

hysterectomy, fluid resuscitation, liberal fluid resuscitation, massive bleeding

Introduction

Massive bleeding during obstetric surgeries, such as hysterectomies, remains one of the leading causes of maternal mortality and morbidity worldwide. In such situations, fluid resuscitation is mandatory. However, the ideal formula for fluid management that fits every patient, surgery, or condition is unrealistic. One of the key challenges is the heterogeneity in the definitions and terminologies used to describe hypotension, tissue perfusion, and liberal/restrictive fluid management, leading to considerable variation in fluid administration in terms of selection, timing, and dosage of intravenous fluids.[1,2]

The debate over restrictive versus liberal fluid resuscitation during massive intraoperative bleeding continues. The liberal approach has been linked to complications such as tissue and pulmonary edema, coagulopathy, hyperchloremic acidosis, and transfusion-related diseases. Conversely, restrictive fluid administration is associated with tissue hypoxia, injury, and hypoxia-related acidosis. Intraoperative Mean Arterial Pressure (MAP) below 65 mmHg is correlated with myocardial and renal injury. The primary goal of fluid replacement is to maintain cardiac output while avoiding the adverse effects of fluid overload.[4,5]

Case presentation

A 28-year-old female patient, G3P2, who was 37 weeks pregnant, was scheduled to undergo a cesarean section and hyster-

ectomy. The decision for the elective hysterectomy was made in light of the findings from a prenatal ultrasound, which revealed the presence of placenta accreta. The placenta acretta index (PAS) score was 9 which indicates an invasive placenta to the bladder and surrounding organ with high vascularity and high risk of bleeding intraoperatively. The team decided it was best to do hysterectomy. The patient's pregnancy had been uneventful, with no history of chronic illnesses or previous surgery. Her pre-pregnancy weight was 58 kg, and her current weight was 70 kg, with a BMI of 27.34 kg/m^2. Preoperative blood tests were within normal limits.

Preoperatively, 1000 mL of crystalloid was administered. Spinal anesthesia was performed using 15 mg of 0.5% bupivacaine at the L3-L4 level, with a sensory block extending to T6. The decision was made to initiate spinal anesthesia in order to circumvent the potential adverse effects of general anesthesia on the infant. The anticipated duration of the surgical procedure was between two and three hours. In the event of hemodynamic instability or a prolonged surgical procedure, a transition to general anesthesia was deemed necessary. Hemodynamics were stable following spinal anesthesia and at the onset of surgery. Three peripheral intravenous lines were established, and arterial line monitoring was initiated for continuous hemodynamic surveillance, as shown in ***Fig. 1****.*

After the delivery of the infant, the hysterectomy was initiated. During the procedure, significant bleeding was encountered due to adhesions involving major arteries and veins. Additionally, a fourth-degree bladder rupture occurred during the hysterectomy due to bladder invasion of the placenta. Norepinephrine (0.1–0.3 mcg/kg/min) and dobutamine (5–15 mcg/kg/min) were administered to maintain mean arterial pressure (MAP) above 65 mmHg and systolic blood pressure above 90 mmHg. The assessment of urine output proved challenging due to the occurrence of bladder rupture. Hemodynamic monitoring was facilitated by the utilization of an arterial line and central venous pressure. Furthermore, complete blood counts and blood gas analyses were conducted at one-hour intervals throughout the surgical procedure.

General anesthesia was initiated during the hysterectomy, and the patient was intubated with rocuronium, ketamine, and fentanyl. Active bleeding continued for three hours, with a total estimated blood loss of 8000 mL. Crystalloid and colloid solutions were administered in a 3:1 ratio, along with six units of packed red blood cells (PRBC). Total fluids administered included 8000 mL of crystalloid (6000 mL of Ringer's lactate and 2000 mL of normal saline), 3000 mL of colloid, and 1200 mL of PRBC. The patient underwent a substantial fluid replacement, meticulously tailored to their hemodynamic status, with a target systolic blood pressure exceeding 90 mmHg. This procedure was facilitated by the use of an arterial line and a central venous pressure (CVP) exceeding 7 cm H_2O. Moreover, systematic evaluations to monitor periorbital and pulmonary edema were conducted at 30-minute intervals. After a total operating time of four hours, the surgical team successfully controlled the bleeding. The patient was transferred to the ICU while still intubated. Postoperative hemodynamics remained stable, and norepinephrine was titrated off after 36 hours.

During the first ICU hour, the patient developed rhonchi at the lung bases and mild periorbital edema, prompting the initiation of a furosemide infusion. After 24 hours, the lungs were clear, and the furosemide was discontinued. The patient also experienced severe metabolic acidosis, which resolved after four days. Extubation was performed on the second

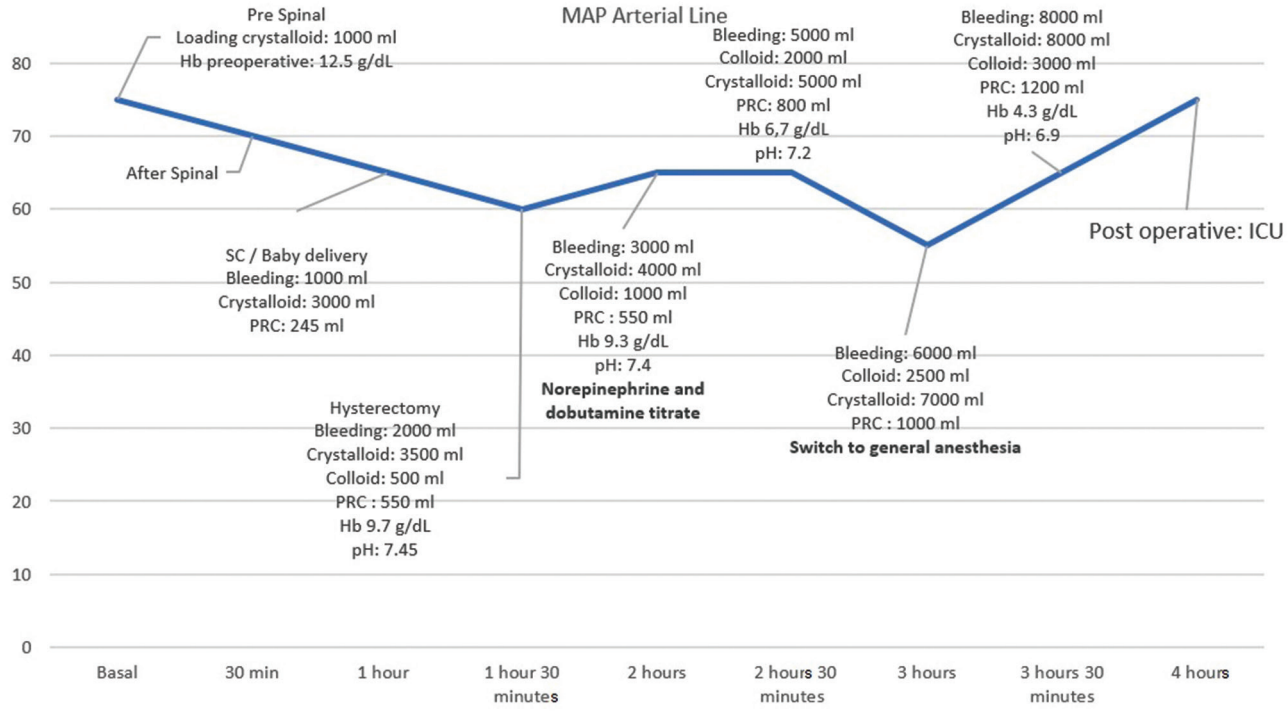

Figure 1. Intraoperative hemodynamic fluctuation.

postoperative day without complications. The patient was discharged from the intensive care unit (ICU) four days after surgery and sent home seven days postoperatively. Thirty days of follow-up showed no complication.

Discussion

The primary objective of fluid resuscitation is to restore and maintain tissue perfusion, electrolyte balance, and vascular volume, while avoiding adverse side effects. Fluid management entails more than merely replacing water and electrolytes; it involves optimizing cardiac output to vital organs to ensure adequate oxygen delivery to tissues. However, numerous studies on fluid and hemodynamic optimization have yielded conflicting results, largely due to differing interpretations of "restrictive" and "liberal" fluid approaches and variations in monitoring protocols. Currently, there is a shift toward a goal-directed approach with a moderately positive fluid balance.[2-4]

Massive bleeding during obstetric surgery is the leading cause of maternal mortality and morbidity. Pregnant women can tolerate blood loss of up to 1500 mL due to hemodilution and the increased cardiac output during pregnancy, often without significant drops in hemoglobin or clinical symptoms. Hemodilution can play a beneficial role by slowing the rate of red blood cell loss, allowing blood transfusions to catch up and maintain oxygen delivery (DO_2). This results in dilutional anemia, a relative reduction in hemoglobin concentration.[5-7]

The main concern with large fluid volumes is the risk of volume overload. A goal-directed approach with close hemodynamic monitoring allows anesthesiologists to guide fluid, vasopressor, or inotropic administration based on fluid responsiveness. Despite intensive monitoring, predicting or preventing volume overload remains challenging. Monitoring for signs of overload, especially in the first 24 hours, is crucial, enabling early de-resuscitation with albumin or diuretics to promote diuresis. In this patient, we monitored clinical signs of volume overload and used invasive arterial line monitoring and ultrasound (IVC distensibility index) to assess fluid status and responsiveness. Postoperative volume overload was identified after one hour and resolved within 24 hours with furosemide administration.

Liberal fluid resuscitation during massive intraoperative bleeding in maternal obstetric surgery offers several advantages over a restrictive approach. In cases of significant blood loss, liberal fluid administration helps maintain hemodynamic stability by rapidly restoring intravascular volume, thereby supporting cardiac output and tissue perfusion. This approach can be particularly beneficial in obstetric patients, who have increased blood volume and cardiac output during pregnancy, allowing them to better tolerate fluid shifts. Additionally, liberal resuscitation ensures that adequate circulating volume is available to compensate for the ongoing losses, which is crucial to prevent hypoperfusion and subsequent organ failure. By maintaining a higher fluid balance, liberal resuscitation helps prevent the development of hypotension, reduces the risk of ischemic injury to vital organs, and provides more time for blood transfusions to replace lost red blood cells. Although there is a risk of volume overload, careful monitoring of fluid responsiveness and hemodynamic parameters can mitigate these risks, making liberal fluid resuscitation a valuable strategy in the management of major hemorrhage during obstetric surgery.[8-11]

Conclusion

Liberal fluid management during massive intraoperative bleeding, particularly in major, high-risk surgeries such as hysterectomy, can still be employed to maintain cardiac output while allowing time for blood transfusion. This aggressive resuscitation strategy may benefit young, healthy patients with no comorbidities and normal cardiovascular and renal function. Close monitoring of side effects is crucial to prevent complications related to volume overload.

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Competing interests

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