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Comprehensive Management of Massive Transfusion in Postpartum Hemorrhage Patients

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Abstract:
Postpartum hemorrhage (PPH) is one of the leading causes of maternal morbidity and mortality worldwide. This condition can cause significant blood loss in a short period of time, requiring rapid and appropriate intervention to prevent fatal complications. A 30-year-old female patient came to the hospital with G0P1A0H1 and bleeding from the birth canal, currently 37–38 weeks pregnant. After examination, the patient was found to have suspected placenta previa accreta. During surgery, grade 3 placenta accreta was found to have infiltrated the urinary bladder, and a joint operation was performed with the urology department. Intraoperative bleeding was approximately 2000 cc, and during the operation, 4 units of whole blood, 2 units of PRC, 4 units of FFP, and 4 units of cryoprecipitate were administered. Intraoperative hemodynamics fluctuated. After the operation, the patient was transferred to the ICU for monitoring. Management of postpartum hemorrhage (PPH) is based on rapid diagnosis and immediate replacement of lost blood volume, as well as restoration of the blood's ability to carry oxygen. In addition, prompt medical and surgical measures to address the underlying cause of bleeding are essential to prevent further blood loss.

Keywords: Postpartum hemorrhage (PPH), Placenta accreta, Massive obstetric hemorrhage, Multidisciplinary management

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INTRODUCTION

Postpartum hemorrhage (PPH) is one of the leading causes of maternal morbidity and mortality worldwide. This condition can cause significant blood loss in a short period of time, requiring rapid and appropriate intervention to prevent fatal complications. Postpartum hemorrhage (PPH) continues to be the leading cause of maternal morbidity and mortality in most countries around the world (Anouilh et al., 2023; Bryant & B., 2022; Federspiel et al., 2023; Gonzalez-Brown & Schneider, 2020; Günaydın, 2022; Watkins & Stem, 2020; Zenebe et al., 2023).

Previous studies have documented various approaches to managing massive obstetric hemorrhage. Escobar et al. (2022) established comprehensive *FIGO* recommendations for PPH management, emphasizing the importance of early recognition and multidisciplinary intervention. Vlaar et al. (2021) developed clinical practice guidelines for transfusion strategies in bleeding critically ill adults, highlighting the critical role of balanced blood product administration. Additionally, Surbek et al. (2020) examined patient blood management principles in pregnancy and childbirth, demonstrating the need for evidence-based protocols. However, despite these advances, there remains a gap in the literature regarding real-world case management that integrates massive transfusion protocols with multidisciplinary surgical approaches, particularly in cases complicated by *placenta accreta* with bladder involvement.

The urgency of this research stems from the persistent high mortality rate associated with PPH, especially in cases involving *placenta accreta spectrum disorders*, which have shown a rising incidence globally due to increasing cesarean section rates. The novelty of this case report lies in its comprehensive documentation of a severe grade 3 *placenta accreta* with bladder infiltration requiring joint obstetric–urological management, combined with detailed monitoring of hemodynamic parameters and laboratory values throughout the massive transfusion process. This integrated approach provides valuable insights into the sequential decision-making process during critical hemorrhagic events.

Approximately 3% to 5% of obstetric patients experience postpartum hemorrhage. Postpartum hemorrhage accounts for approximately 25% of maternal deaths globally and contributes to 12% of maternal deaths in the United States each year. According to the American College of Obstetricians and Gynecologists, early postpartum hemorrhage is defined as a total blood loss of at least 1,000 mL or blood loss accompanied by symptoms and signs of hypovolemia within 24 hours after delivery, including blood loss during the delivery process.

One of the most used interventions in the management of severe postpartum hemorrhage is massive transfusion, which involves the administration of large volumes of blood products in a short period of time to replace lost blood volume and correct coagulation disorders. The objectives of this case report are threefold: first, to document the comprehensive management approach of massive transfusion in a case of severe PPH complicated by *placenta accreta percreta*; second, to demonstrate the importance of multidisciplinary collaboration and systematic laboratory monitoring in optimizing patient outcomes; and third, to provide practical clinical insights for healthcare professionals managing similar complex obstetric emergencies. The practical benefits include offering a template for establishing institutional massive transfusion protocols specific to obstetric hemorrhage, highlighting critical laboratory parameters that guide transfusion decisions, and demonstrating the importance of early ICU involvement in severe cases. Understanding the indications, benefits, and risks of massive transfusion in cases of postpartum hemorrhage is crucial for improving clinical outcomes and reducing maternal mortality rates.

METHOD

A 30-year-old female patient came to the hospital with G0P1A0H1 with bleeding from the birth canal, currently 37-38 weeks pregnant. After examination, the patient was found to have suspected placenta previa accreta. A complete laboratory examination was then performed and an emergency cesarean section was performed. Before the operation began, hematology values were 9.9 and platelets were 217,000/mm3. Coagulation factor examination found normal results.

During surgery, grade 3 placenta accreta was found to have infiltrated the urinary bladder, and a joint operation was performed with the urology department. Intraoperative bleeding was approximately 2000 cc, and during the operation, 4 units of whole blood, 2 units of PRC, 4 units of FFP, and 4 units of cryoprecipitate were administered. Intraoperative hemodynamics fluctuated. After the operation, the patient was transferred to the ICU for monitoring.

While in the ICU, the patient remained intubated with a blood pressure of 81/52 on norepinephrine and dobutamine support. While in the ICU, the patient underwent a complete blood count and received two bags of whole blood transfusion without crossmatching.

Laboratory results showed hemoglobin levels of 1.3 g/dL, hematocrit of 4%, and platelets of 42,000. The patient underwent further resuscitation with the administration of 2 more units of whole blood, 2 units of PRC, 4 units of FFP, and 1 bag of apheresis platelets, while being evaluated to find the source of bleeding elsewhere. Hemodynamics fluctuate in the ICU. After receiving fluids and blood, the patient's hemodynamics become relatively stable and inotropic support can be gradually reduced. Patients were also given anti-bleeding therapy, namely tranexamic acid and vitamin K.

Other laboratory parameters also showed albumin at 1.0, and a 25% albumin transfusion was administered. Coagulation factor tests were still within normal limits: PT 9.8 (control), APTT 28.7 (control), and INR 0.82. Electrolyte laboratory parameters were still within normal limits. Blood gas analysis revealed severe metabolic acidosis, with pH 7.13, PcO2 24, BE -16.6, HCO3 9.5, PaO2 177, and SaO2 99.2% dan lactat value 9,1.

The patient underwent hematological tests every 6 hours. After correction in the first 6 hours, Hb was 6.3 and platelets were 96,000. Currently, 2 units of whole blood and 1 unit of PRC have been administered, and 1 unit of PRC is planned to be administered. Hematological tests will be repeated 6 hours later. The Hb level was found to be 7.5. After a complete examination, no new source of bleeding was found, and the patient remains under close observation.

After 24 hours post-transfusion, Hb was 9.6 and platelets were 138,000. Blood pressure had begun to stabilize without inotropic support. Blood gas analysis has returned to normal with a pH of 7.41, PcO2 of 34, BE of -2.4, HCO3 of 22.1, PaO2 of 156, and SAO2 of 99%. The patient had also begun to be weaned off the ventilator and was extubated.

The patient remained in the ICU for 4 days for close monitoring of her condition after massive transfusion. Subsequently, the patient was transferred to the Obstetrics HCU room.

RESULT AND DISCUSSION

A 30-year-old female patient came to the hospital with G0P1A0H1 with bleeding from the birth canal, currently 37-38 weeks pregnant. After examination, the patient was found to have suspected placenta previa accreta. A complete laboratory examination was then performed and an emergency cesarean section was performed. Before the operation began, hematology values were 9.9 and platelets were 217,000/mm3. Coagulation factor examination found normal results.

Bleeding is the leading cause of death within the first hour after a patient arrives at a trauma center. More than 80 percent of deaths that occur in the operating room (OR) and nearly 50 percent of deaths within the first 24 hours after injury are caused by severe bleeding and coagulation disorders. Although only about 3 percent of civilian trauma patients receive massive blood transfusions (more than 10 units of red blood cells within 24 hours), this group of patients accounts for about 70 percent of the total blood transfusions administered at trauma centers.

During surgery, grade 3 placenta accreta was found to have infiltrated the urinary bladder, and a joint operation was performed with the urology department. Intraoperative bleeding was approximately 2000 cc, and during the operation, 4 units of whole blood, 2 units of PRC, 4 units of FFP, and 4 units of cryoprecipitate were administered. Intraoperative hemodynamics fluctuated. After the operation, the patient was transferred to the ICU for monitoring. While in the ICU, the patient remained intubated with a blood pressure of 81/52 on norepinephrine and dobutamine support. While in the ICU, the patient underwent a complete blood count and received two bags of whole blood transfusion without crossmatching.

Shock is a condition that occurs due to a decrease in tissue perfusion, resulting in an inability to meet the metabolic needs of organs and tissues in the body. This inadequate blood flow can be clinically recognized through the appearance of one or more signs, such as lactic acidosis, changes in mental status, oliguria, and tachycardia. Monitoring vital signs is very important in hemodynamic evaluation and rapid intervention. In healthy pregnant women and those who have recently given birth, cardiovascular compensatory mechanisms are able to maintain normal vital signs until significant blood loss occurs (usually more than 1000 ml). Therefore, changes in clinical signs and vital signs due to bleeding are usually only noticeable at a later stage, which can hinder the early detection of postpartum hemorrhage (PPH).

After the patient arrives in the ICU, basic laboratory tests must be performed immediately and repeated as needed, at least every hour. These tests include INR, aPTT, fibrinogen levels, hemoglobin or hematocrit, and platelet count. In addition, if available, on-site diagnostic tests such as thromboelastometry and rotational thromboelastography can also be performed.

Fluid therapy is one of the main methods used to treat patients experiencing shock, as it can increase blood flow in the microvasculature and increase cardiac output. However, in recent years, problems related to fluid overload in intensive care units (ICUs) have received increasing attention.

Laboratory results showed hemoglobin levels of 1.3 g/dL, hematocrit of 4%, and platelets of 42,000. The patient underwent further resuscitation with the administration of 2 more units of whole blood, 2 units of PRC, 4 units of FFP, and 1 bag of apheresis platelets, while being evaluated to find the source of bleeding elsewhere.

Massive transfusion protocol (MTP) is the main standard of care in managing hemorrhagic shock. MTP activation most often occurs due to traumatic injury, rupture of an abdominal aortic aneurysm, gastrointestinal bleeding, and obstetric bleeding. Although there is no formal agreed-upon definition of massive transfusion, the traditional definition referring to the administration of 10 units of red blood cells within 24 hours is still widely used in various healthcare centers.

Massive transfusion is generally defined as the administration of more than 10 units of packed red blood cells (PRBC) within a 24-hour period. During resuscitation of trauma patients with hemorrhagic shock, crystalloid solutions are often used, but currently rapid administration of blood products is more recommended. Additionally, balanced transfusion of PRBC, fresh frozen plasma (FFP), and platelets (PLT) has been shown to be effective in treating coagulopathy resulting from hemorrhagic shock. Several studies indicate that a ratio of PRBC, FFP, and PLT administration of 1:1:1 or higher can reduce mortality rates and improve therapeutic outcomes.

Massive transfusion is usually defined as the administration of more than 10 units of packed red blood cells (PRBC) within 24 hours. In the resuscitation of trauma patients with hemorrhagic shock, crystalloid solutions are often used, but it is now recommended to administer blood products rapidly. Additionally, transfusion with a balanced ratio of PRBC, fresh frozen plasma (FFP), and platelets (PLT) has been shown to improve coagulation disorders caused by hemorrhagic shock. Several studies indicate that administering PRBC, FFP, and PLT at a ratio of 1:1:1 or higher can reduce mortality rates and improve treatment outcomes.

Other laboratory parameters also showed albumin at 1.0, and a 25% albumin transfusion was administered. Coagulation factor tests were still within normal limits: PT 9.8 (control), APTT 28.7 (control), and INR 0.82. Electrolyte laboratory parameters were still within normal limits. Blood gas analysis revealed severe metabolic acidosis, with pH 7.13, PcO2 24, BE -16.6, HCO3 9.5, PaO2 177, and SaO2 99.2% dan lactat value 9,1.

Blood transfusion should be administered immediately after the source of bleeding has been successfully controlled, until sufficient levels are reached, namely hemoglobin (Hb) of at least 7 g/dL with hematocrit (Hct) ≥ 22% in healthy patients, and Hb ≥ 9 g/dL with Hct ≥ 27% in patients with heart disease. Additional parameters such as mixed venous oxygen saturation (SvO2) of at least 70%, normal base deficit (NBE) less than 4 meq/L, and lactate (LA) below 4 mmol/L in the absence of infection can also be used as indicators of therapeutic goal achievement.

The massive transfusion protocol (MTP) applied in cases of postpartum hemorrhage plays a role in accelerating the transfusion process. Most of these protocols are adapted from evidence in trauma management, with MTP activation criteria including an estimated replacement of 50% or more of blood volume within 2 hours, or ongoing bleeding after the administration of 4 units of red blood cells (RBC) in less than 2 hours (Furman et al., 2024; la Rosa, 2020; Meneses et al., 2020; Rijnhout et al., 2022; Tran et al., 2016). Although a 1:1:1 administration strategy is recommended, a recent systematic review suggests that a fresh frozen plasma (FFP) to RBC ratio of 1 or higher is associated with better clinical outcomes in patients. Currently, the American College of Obstetricians and Gynecologists recommends the use of MTP as part of a comprehensive postpartum hemorrhage management plan.

Hemodynamics fluctuate in the ICU. After receiving fluids and blood, the patient's hemodynamics become relatively stable and inotropic support can be gradually reduced. Patients were also given anti-bleeding therapy, namely tranexamic acid and vitamin K.

Intravenous administration of tranexamic acid at a dose of 1 gram (100 mg/ml) at an infusion rate of 1 ml per minute (administered over 10 minutes) can be repeated with a second dose of 1 gram if bleeding continues after 30 minutes or if bleeding recurs within 24 hours after the first dose is completed. Increased use of tranexamic acid in the management of postpartum hemorrhage (PPH) has the potential to reduce maternal mortality and have a positive impact on health equity, particularly for women in low- and middle-income countries.

Research on bleeding in critically ill patients faces challenges, mainly due to the variety of definitions used to describe massive and non-massive bleeding. Massive bleeding is conventionally defined as blood loss of more than 10 units in 24 hours or 4 units in 1 hour. Although difficult to treat, massive bleeding is usually easily recognized by medical personnel. However, a consistent definition for non-massive bleeding has yet to be established. Non-massive bleeding still has significant clinical implications, given the resources and blood products required for its management. Therefore, to develop effective evidence-based interventions to reduce resource use in non-massive bleeding, clear and consistent nomenclature standards are needed.

There are times when active and severe bleeding occurs, and blood transfusions are often necessary, even in large quantities, to save the patient's life. However, when the bleeding has stopped, unnecessary red blood cell transfusions should be avoided, and a more limited transfusion approach should be adopted. In this situation, intravenous iron infusion is considered more effective than oral supplementation in treating postpartum anemia.

CONCLUSION

Management of postpartum hemorrhage (PPH) is based on rapid diagnosis and immediate replacement of lost blood volume, as well as restoration of the blood's ability to carry oxygen. In addition, prompt medical and surgical measures to address the underlying cause of bleeding are essential to prevent further blood loss. This case demonstrates that successful management of massive obstetric hemorrhage requires a coordinated multidisciplinary approach, early activation of massive transfusion protocols with balanced blood component therapy, systematic monitoring of hemodynamic and laboratory parameters, and experienced intensive care support. The principles of trauma-based massive transfusion protocols can be successfully applied to obstetric hemorrhage, but require adaptation for the unique physiological challenges of the peripartum period. Healthcare institutions managing obstetric patients should establish clear protocols for early recognition and aggressive management of PPH, with emphasis on multidisciplinary team training and resource availability. Future research should focus on optimizing transfusion ratios specific to obstetric hemorrhage and identifying early predictors of severe PPH to enable preventive interventions.

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