

Transfusion Medicine and Coagulation Management in Organ Transplantation

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KEYWORDS

- ROTEM • Thromboelastography • Transfusion • Blood conservation
- Organ transplantation • Coagulopathy

KEY POINTS

- Blood product conservation has become increasingly important in organ transplantation.
- Improved outcomes are seen with less blood transfusion.
- New methods of assessing and managing coagulopathy have yielded significant reductions in transfused products.
- Rotational thromboelastometry is increasingly used to aid in management of coagulopathy.

INTRODUCTION

The discussion of blood product use and transfusion medicine, particularly for surgical patients, is one that is constantly evolving. High-acuity patients requiring transfusion in and out of the operating room continue to present significant challenges to clinicians. As anesthesiologists, we make decisions and initiate transfusion therapy in dynamic clinical scenarios. The need to conserve available blood products and also avoid significant transfusion-related comorbidities must be taken into consideration when caring for these patients. Anesthesiologists routinely see increasingly older patients presenting for more and more complex surgical procedures. In high-income countries such as the United States and Western Europe, patients over the age of 65 receive more than 75% of blood transfusions.¹ Increased blood product administration is associated with a variety of potential complications, from increased durations of stay and increased infection risk, to even increased mortality in a variety of surgical patients, especially liver transplant and cardiac/pulmonary cases.²⁻⁹ These risks are

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in addition to the usual concerns associated with transfusion including mismatch, transfusion-associated graft-versus-host disease, transfusion-related acute lung injury, transfusion-associated circulatory overload, transmission of infectious disease, and immunomodulation. Given the impact of end-stage organ failure, these complications can have a particularly pronounced effect in the transplant population. The need to reassess transfusion strategies is, therefore, very real, and, as anesthesiologists, our intraoperative decision making plays a key role. Efforts to curtail blood product use in the surgical patient have been met with success.^{10,11} In the United States, a steady decrease in the number of transfused red cell units as well as the number of donated units has been seen for several years. Although we are to be lauded for reducing the overall number of transfused units, the decrease in donated units raises concerns about the ability of blood supply to withstand critical need in mass casualty situations.¹² Nevertheless, the decrease in supply makes judicious use of products ever more important. Overall trends in blood product use have shifted toward more conservative use of products as well as targeted, factor-specific replacement, especially in the management of more complex coagulopathies. Developments in point-of-care testing have helped in this effort.^{13–15} Blood product supplies are finite, and the increasing numbers of patients among the organ transplant population with extensive transfusion histories can present challenges in finding suitable blood products for cases with significant anticipated blood loss. This, along with many of the aforementioned concerns, renders making efficient use ever more important in current and future practice.¹⁶

HEMORRHAGE

Identifying patients at high perioperative risk for significant hemorrhage is key to successful management. In liver transplantation, several factors have been identified as increasing the likelihood of transfusion. Contrary to what is often presumed, studies have yielded equivocal findings with respect to use of coagulation tests preoperatively to determine patients at risk for surgical bleeding.¹⁷ Often, coagulopathy as reflected in conventional laboratory testing is not a predictor for severe intraoperative bleeding in the liver transplant population. This has much to do with the complex balance between procoagulants and anticoagulants in patients with end-stage liver disease. Severity of disease (as defined by the United Network for Organ Sharing status as well as Model for End-stage Liver Disease scores), preoperative hemoglobin level, operative time, surgical approach, level of surgical expertise, and degree of portal hypertension can all portend severe hemorrhage during the intraoperative course. In cardiac surgery, advanced age, higher complexity procedures, and low preoperative hemoglobin have been identified as higher risk for bleeding and transfusion.¹⁸ For any type of transplant procedure, extensive history of prior surgeries leading to distorted anatomy and adhesions may, in itself, increase the risk for bleeding.

Historically, protocol-based management of severe hemorrhage has been the most widely practiced; most of these protocols are derived from management of trauma patients. Massive transfusion has often been defined as greater than 6 units of packed red blood cells (PRBC). In complicated thoracic organ and abdominal organ transplantation (particularly the liver), it is not unheard of to encounter hemorrhage that requires transfusion that is orders of magnitude greater than this. This can lead to what is known as the “lethal triad” that results from massive hemorrhage and transfusion: the progressive development of coagulopathy, metabolic acidosis, and core hypothermia.¹⁹ Despite the assumption that whole blood may be the most sensible choice for transfusion in the setting of massive hemorrhage, component therapy remains

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