Blood Management: State of the Art

The Use of Red Blood Cells and FreshFrozen Plasma

WHITE PAPER

Safety and Complications of Transfusion

Blood transfusion is an integral part of medical and surgical practice, and its safety is now assumed. Although the transmission of virus-borne diseases - such as HIV and hepatitis – by blood transfusion are extraordinarily rare events, blood should be viewed as a potent drug that entails significant risk. The key complications are:

- **Hemolytic transfusion reactions.** These are almost always preventable and are due to failure of the safety procedures in the hospital or transfusion facility. A recent study documented 1:2000 error rate in blood transfusion processing. Ten per cent of patients with major hemolytic events die.
- **Transfusion-related acute lung injury (TRALI).** This “adult respiratory distress syndrome” may result from the transfusion of any plasma-containing blood product. It is the leading cause of death from transfusion and is fatal in up to 20% of cases. Up to 1:5000 transfusions may precipitate TRALI. Patients undergoing surgery appear to be at increased risk (2).
- **Transfusion-associated circulatory overload (TACO).** Blood transfused too quickly can precipitate congestive failure, particularly in the perioperative setting. TACO can occur at any age, although patients over 70 are particularly vulnerable. Up to 8% of orthopedic patients may have TACO (3).
- **Transfusion-related immunomodulation (TRIM)**. It is well established that allogeneic transfusions suppress a recipient’s immune system and that the suppression is dose-dependent. This may explain why multiple studies have demonstrated that transfusion is associated with adverse outcomes - perioperative infections, longer ICU and hospital stay, and perioperative mortality (4).

Red Cell Transfusion

For more than 40 years, the “golden rule” of Red Blood Cell (RBC) therapy was based on a 10 g/dL Hemoglobin or 30% Hematocrit “transfusion trigger.” We now know that there is no clinical

or physiologic basis for a similar hemoglobin/hematocrit-based trigger for all patients. RBC transfusion decisions should be based on patient-specific clinical parameters. RBC transfusion is appropriate when there is a need to promptly increase oxygen carrying capacity and to treat symptoms of anemia. However, hemoglobin levels of less than 8 g/dL are well tolerated by most patients. It is not appropriate to use RBC as a volume expander. A prospective, randomized clinical trial of intensive care patients found that those receiving RBC for hemoglobin values greater than 8g/dL did not fare better than those on a more restrictive transfusion protocol (5).

Consensus guidelines state that RBC should be used as follows:

- Transfuse for signs/symptoms of anemia and oxygen deprivation, not just volume-related signs/symptoms.
- In hemodynamically stable and normovolemic patients, transfusion may be appropriate at or below 7g/dL Hgb.

For patients with known or suspected coronary artery disease prior to revascularization and those with an oxygen extraction ratio greater than 60%, some experts believe that it may be appropriate to consider more liberal RBC transfusion.

For patients who are not actively bleeding but require an RBC transfusion, RBC should be transfused one unit at a time. After each transfusion, hemoglobin/hematocrit levels and clinical status should be checked to determine effectiveness (1).

Fresh Frozen Plasma (FFP)

FFP is plasma that is separated from whole blood and frozen within 8 hours of collection. It contains close to 100% of all clotting factors (1 unit/ ml), including Factors V and VIII, and fibrinogen. The volume is 200-250 ml/unit.

FFP is frequently transfused inappropriately. A coagulation deficiency should be documented prior to transfusion. Recognized indications include:

- microvascular bleeding in combination with a coagulation deficiency.
- invasive procedures with multiple coagulation factor deficiencies.
- disseminated intravascular coagulopathy.
- rapid reversal of warfarin in actively bleeding patients.
- thrombotic thrombocytopenic purpura.

FFP should not be used for volume expansion.

Tests that may be helpful in assessing the need for FFP are a prolonged PT and a prolonged R value on a thromboelastograph tracing. FFP carries the same risks for disease transmission as any other blood component. As it contains plasma, it can cause complications including allergic and anaphylactic transfusion reactions, transfusion-related acute lung injury and immune modulation.

The appropriate dose of FFP is 10-20 ml/kg. To raise coagulation levels to 20-30% may require 4-6 units of FFP, depending on the size of the individual.

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