Massive Transfusion for Hemorrhagic Shock

What Every Critical Care Nurse Needs to Know

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KEYWORDS

• Massive transfusion • Red blood cell transfusion • Coagulopathy
• Hemorrhagic shock

KEY POINTS

- Protocol-driven therapy in massive transfusion benefits patients by:
  - Individualized approach to resuscitation.
  - Avoidance of iatrogenic coagulopathy by limiting crystalloid volumes.
  - Early administration of packed red blood cells (PRBCs).
  - Administering PRBCs with fresh frozen plasma and platelets in a 1:1:1 ratio.

HISTORY

Transfusions in the past were completed using whole blood until the development of blood component therapy in the 1980s. The advantages to blood component therapy are the storage time for each component individually is longer and resources are saved by administering only the portion of the blood that was required.[1]

Since the creation of blood component therapy, a patient with hypovolemia would receive packed red blood cells (PRBCs) and crystalloids, resulting in coagulopathies, and require additional blood components such as platelets (PLT) and fresh frozen plasma (FFP).

INTRODUCTION

Up until recently, the resuscitation for patients with hypovolemia, whether due to surgical losses or trauma, has been the early and aggressive administration of large amounts of crystalloid solutions. The use of high-volume crystalloid support is associated with increased hemorrhage and lower survival rates.[2–4] Recent studies indicate a survival benefit to protocol-driven transfusion strategies with specific ratios of

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PRBCs, FFP, and PLT. Protocol-driven therapy in massive transfusion also reduces intensive care unit and hospital lengths of stay, decreased ventilator-dependent days, and overall patient care costs.[5,6]

Massive transfusion is defined as complete replacement of a patient's blood volume or approximately 10 units of PRBCs within a 24-hour period or one red blood cells (RBC) volume in 24 hours for a pediatric patient.[7] This article reviews the most recent understanding and recommendations in massive transfusion along with the unintended consequences in the management of patients with profound hemorrhage.

Although the focus of this journal series is "critical care nursing in the operating room," research on massive transfusion and the resulting protocols has been derived from research studies not only in the surgical setting but also in the field of trauma medicine, most specifically in the military battlefields. The research referenced in this article is not exclusive to the operating room environment, but rather the entire realm of critical care.

TREATMENT

The primary goal of resuscitation is restoration of cellular perfusion. A 2-pronged approach should be used when caring for a patient in hemorrhagic hypovolemic shock. Initially, aggressive efforts should be made to stop blood loss, which in the surgical and trauma settings can pose a challenge. Second, replacing fluid volume deficits, oxygen-carrying capacity, and coagulation factors should be addressed.

IDEAL RATIO/FLUID RESUSCITATION

The approach to volume resuscitation is individualized based on the clinical condition of the patient, anticipated further hemorrhagic losses (or achievement of hemostasis), and comorbidities. Crystalloid intravenous (IV) fluids are used initially in resuscitation. IV fluid administration should be guided by evidence of adequate end-organ perfusion such as adequate urine output for weight and lactate less than 2.0. It is a fine balance maintaining the need for tissue perfusion and the risk of worsening bleeding through excess pressure on hemostatic clots and the induction of coagulopathy.

In general, for adult trauma patients with bleeding and without brain injury, a systolic blood pressure between 80 and 100 mm Hg is considered reasonable until bleeding has been controlled.[8,9] In trauma patients with a concomitant traumatic brain injury, a cerebral perfusion pressure of at least 60 mm Hg should be maintained to avoid cerebral hypoperfusion. Cerebral hypoperfusion in the setting of brain trauma is associated with a significant worsening in outcomes and must be avoided.[10]

TRANSFUSION AND MASSIVE TRANSFUSION

Packed Red Blood Cells

In contrast to crystalloid IV resuscitation, fluid replacement with PRBCs provides volume, osmotic pressure, and oxygen-carrying capacity. Transfusion is indicated to maintain a hemoglobin level between 7 and 9 g/dL. Type-specific blood should be administered if available. However, if type-specific blood is not available, type O RhD-negative PRBCs are recommended, especially for the parturient, to prevent development of anti-D antibodies.

PRBCs are prepared by removing most of the plasma from citrated whole blood. Actual changes depend on the state of hydration and the rate of bleeding. Because most of the plasma has been removed, PRBCs cause fewer transfusion and allergic reactions than whole blood does.[11] A general rule of thumb is that a single unit of