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No Absolute Futility Predictor for Transfusions in Trauma Surgery: Case Report of a Successful Resuscitation with 218 Units Blood Products

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ABSTRACT

Increasing units of blood transfused during trauma surgery are associated with increasing mortality. Recommendations for considering further transfusions futile commonly range from 40-75 units. We report a trauma patient who received 218 units of blood products intraoperative and 230 within 24 hours and survived to live an active life.

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Introduction

Massive blood transfusion generally means the replacement of 10 or more units of red cells in 24 hours, although smaller numbers of units may qualify when rate of transfusion is included [1]. The identification of a patient needing a massive blood transfusion generally triggers clinical practice guidelines to control the bleeding, determine best transfusion products, and facilitate their availability [2]. These guidelines often include ways to determine whether continued transfusions are futile and should be stopped due to high mortality rates with massive transfusions and the limited availability of blood products [3].

A 2018 study of outcomes versus amount of blood transfused at one trauma center concluded that 40 units of packed red blood cells may constitute a threshold at which survival rates begin to decrease and futility can be considered [4]. A 1998 report on the upper limit to massive blood transfusion after severe trauma, however, had concluded that discontinuation of short-term care cannot be justified at less than 68 units [5]. A more recent study of 3523 patients receiving massive transfusions during trauma surgery found a 50 percent mortality rate after 50 units of red cells transfused, and 80 percent mortality after 75 units. Although the authors report a patient who survived after receiving 129 units of erythrocytes, they concluded that the high rate of complications after 50 units may inform decisions about the futility of giving more blood products [6].

We report a patient who received 218 units of blood products during trauma surgery, 230 units during the first 24 hours, and has survived 5 years since, now living an active and fulfilling life. This extends the reported upper limit of survivable blood transfusions during trauma surgery. This manuscript adheres to the applicable Enhancing the Quality of and Transparency of Health Research (EQUATOR) guideline. Health Insurance Portability and Accountability Act (HIPAA) authorization was obtained in writing from this patient for this report.

Case Description

A 56-year-old man, previously in good health, fell overboard from a recreational outboard motor boat and was struck by the propeller. It made 13 identifiable slices in his left abdomen and pelvis causing evisceration and injury to small and large bowel, spine, retroperitoneum, pelvic bones, iliac arteries and veins and sacral vessels. An emergency medicine physician was coincidentally on scene, helped extract him from the water, and started resuscitation.

Aeromedical Emergency Medical Services transported him to a Level 1 trauma center where he directly entered an operating room. Arriving approximately one hour after the accident he was conscious and moaning. His initial blood pressure was 55/30 and pulse 130. Initial arterial pH was 6.80 with a pCO2 of 58 and base deficit of 20.7. Arterial lactate was 16.3 mmol/l.

A central venous catheter and three peripheral catheters were placed. Blood pressure measurements, transesophageal monitoring and thromboelastography guided fluid resuscitation. He underwent damage control laparotomy, with hemorrhage control via temporary vascular occlusion, ligation, packing and pelvic debridement and stabilization. He received 218 units of blood products during surgery. These included 109 units packed red blood cells, 66 fresh frozen plasma, 36 platelets and 7 cryoprecipitate. These units amounted to 31,200 ml packed red blood cells, 15,400 ml fresh frozen and 2,300 ml platelets. In addition, the patient received 4000 ml crystalloids and 1000 ml 5 percent albumin. Lowest systolic pressure during the surgery was 40. Due to continued blood loss he received a total of 230 units of blood products during the first 24 hours.

This case occurred during a weekday afternoon, when abundant clinical resources were available, including adequate surgical, anesthesia and blood bank personnel. Discussions among care team members remained hopeful throughout the case that bleeding could be controlled. At no point did the patient sustain a cardiac arrest.

After 22 days, the patient was discharged from the hospital to a rehabilitation center, tolerating a regular diet and ambulating with assistive devices and pain controlled by oral medications. He required multiple surgeries over the next two years to debride wounds, close an abdominal defect with a flap graft, and receive a total hip replacement. He has required no additional procedures during the past two years.

Discussion

Hemorrhage causes 30-40 percent of trauma mortality [7]. Up to 5% of civilian trauma patients may receive a massive transfusion, a difficult burden for institutional and regional blood banks, which typically have only 100-200 units on hand. Individuals cannot survive without adequate blood volume to support perfusion and enough hemoglobin to transport oxygen, which generally means maintaining a mean arterial pressure greater than 60 mmHg and hemoglobin oncentration of 6 g/ml. Replacement of lost blood with banked blood during trauma surgery can achieve both goals. Many difficulties though limit the amounts of blood products that can be transfused, from product side effects to the ability to transfuse large volumes quickly.

Futility with massive blood transfusions is a controversial concept, and particularly difficult to determine during trauma surgery because the decision must be made under time pressure and many factors, such as type of trauma, may affect the clinical outcome [8, 9]. Futility is generally a determination made about an individual patient, often based on whether the patient may die despite further treatment or is unlikely to lead to a meaningful life.

Shortages of available blood products are increasingly common now, making societal considerations of how to distribute blood supplies an issue [10]. Physicians have both a duty to a bleeding patient to transfuse enough blood to replace what is lost and a duty to support access to care for all people. Using available blood units for one patient may lead to postponement or cancellation of surgeries and treatments for others that require blood availability or transfusion, thereby harming them. This ethical conflict is another aspect of futility, the point at which transfusions should be stopped.

Markers of potential futility for massive blood transfusions may include needing more than 75 units of blood, a peak blood lactate concentration greater than 10mmol/l and an arterial blood pH less than 7.00.3. This patient demonstrates that these markers are guides and not absolutes. Other factors to consider include age, absence of traumatic brain injury, ability to improve physiologic functioning and absence of cardiac arrest. Survival with a meaningful life can occur after greater volumes of transfused blood and with worse chemical markers than commonly reported. This case adds to the base of information available in determining the right course.

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