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Original Research

Prehospital Transfusion for Gastrointestinal Bleeding

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A B S T R A C T

Objective: Gastrointestinal (GI) bleeding is a common medical emergency with significant morbidity and mortality. Many patients are coagulopathic, which may perpetuate bleeding. Remote damage control resuscitation, including early correction of coagulopathy and anemia, may benefit exsanguinating patients with GI bleeding.

Methods: We conducted a retrospective review of patients with acute GI bleeding who received packed red blood cells (pRBC) and/or plasma during transportation to our institution between 2010 and 2014. A comparison group of patients who were not transfused en route was selected, and demographics, outcomes, and response to resuscitation were compared.

Results: A total of 112 patients with GI bleeding received pRBC (82%, n = 92 pRBC, mean 1.7 ± 0.9 units), plasma (62%, n = 69, mean 1.7 ± 0.8 units) or both (44%, n = 49) en-route. The comparison group comprised 49 patients transported by helicopter who were not transfused en-route. Demographics, crystalloid resuscitation, transfusion prior to transfer, rate of intervention, ICU days, length of stay, and mortality were similar between groups. Patients transfused en route had a significant increase in hemoglobin from 8.3 ± 2.2 to 8.9 ± 2.1 ($P = .03$) and decrease in INR from 2.0 ± 1.0 to 1.6 ± 1.4 ($P = .01$), whereas those not transfused en route experienced stable hemoglobin (8.7 ± 2.8 to 9.4 ± 2.5; $P = .21$) and INR values (1.9 ± 1.0 to 1.6 ± 1.4; $P = .32$). Both groups had a significant improvement in hemodynamic parameters with resuscitation.

Conclusion: Prehospital damage control resuscitation with pRBC and/or plasma resulted in the improvement of hemodynamic instability, coagulopathy and anemia in patients with acute GI bleeding. Almost all patients required additional inpatient interventions and/or transfusions, suggesting that prehospital transfusion is being utilized for appropriately selected patients.

Patients presenting with acute gastrointestinal (GI) hemorrhage experience significant morbidity and mortality.[1-3] Notably, many patients with GI bleeding are coagulopathic at presentation, and those with coagulopathy have been shown to have an increased risk of mortality and rebleeding.[4-6] Early hemostatic resuscitation with blood products, including plasma, is instrumental in correcting acidosis and coagulopathy and decreases mortality in hemorrhaging trauma patients.[7,8] The importance of a balanced transfusion protocol (approximately equal parts packed red blood cells [PRBCs], plasma, and platelets) in optimizing outcomes for massively transfused trauma patients has been shown.[9-13] Initiating transfusion in the prehospital setting has been shown to improve selected outcomes in trauma patients suffering from hemorrhagic shock.[14,15] Data on the use of blood products for medical bleeding in the prehospital setting are limited, and we are not aware of any institutional protocols specific for this purpose. Current institutional prehospital transfusion protocols are largely based on military practice and were therefore designed for trauma patients. Whether these same protocols are applicable to nontrauma hemorrhaging patients is unknown. Nontrauma patients account for the majority of prehospital

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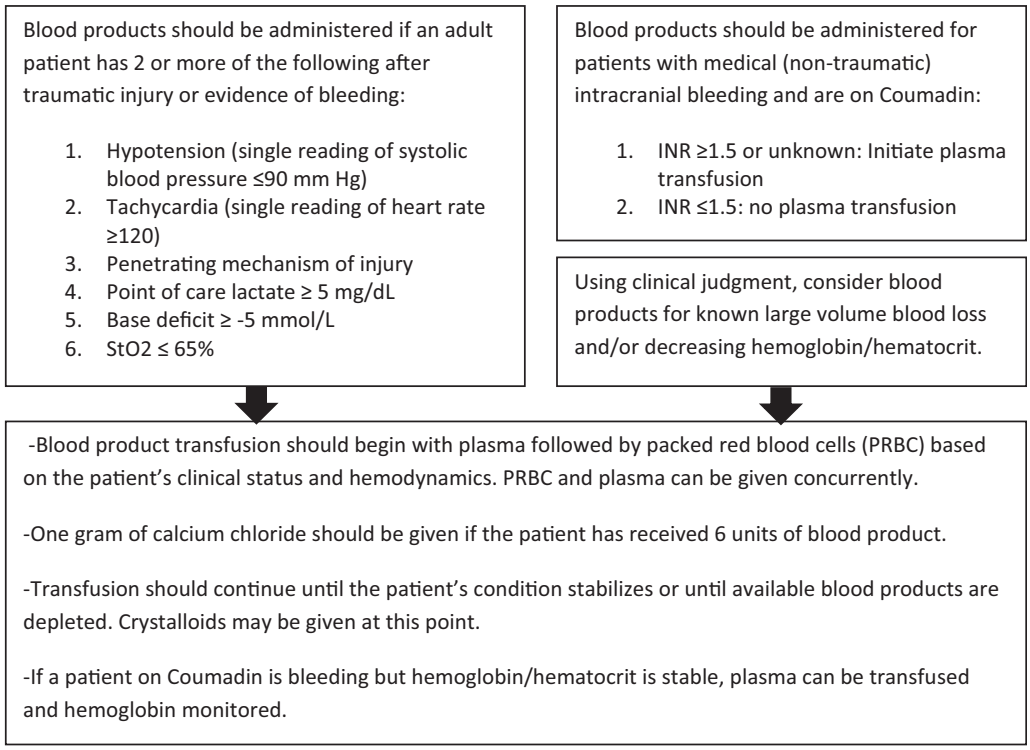

Figure 1. Current institutional prehospital blood transfusion guidelines.

transfusions by our institution's critical care transport team and differ in many ways from the population of trauma patients we serve. We have previously described the use of transfusion for medical bleeding by our air medical transport teams, including a subset of patients with GI bleeding, and we sought to further examine treatment and outcomes in this group.[16]

We have previously shown improvement in severe anemia after prehospital transfusion of PRBCs in patients transported for hemorrhage, including a subset of GI bleed patients.[17] Although initial civilian remote damage control resuscitation was limited to PRBC transfusion, we have incorporated thawed plasma as part of the prehospital critical care resuscitation protocol in order to treat coagulopathy as early as possible. As a result of this evolution in our protocol, we also aimed to determine whether plasma in combination with PRBCs is beneficial to patients with exsanguinating GI bleeding, hypothesizing that hemodynamics, coagulopathy, and anemia will improve.

Materials and Methods

After obtaining approval from the institutional review board, we conducted a retrospective review of our institution's prospectively maintained transport database. Our rural tertiary care center is the only large tertiary hospital within 60 miles of 30 referring centers. Patients transported to our institution by critical care air or ground transport for the management of presumed acute GI bleeding between January 2010 and February 2014 were identified. GI bleeding was defined as hematochezia, melena, or hematemesis either by patient report or witnessed by referring providers or prehospital providers.

Our institution began a program for prehospital PRBC transfusion in 1988 and incorporated prehospital plasma transfusion in 2009.[17,18] Our air medical transport teams currently carry 3 units of O negative PRBCs and 3 units of A positive thawed plasma. These teams sometimes are required to travel by ground rather than air because of inclement weather. Transfusion is initiated according to our institutional critical care transport guideline (Fig. 1). Hemodynamic instability is defined in the protocol as systolic blood pressure $\leq$ 90 mm Hg and/or heart rate $\geq$ 120 beats/min. Our institution's transport teams document an indication for transfusion in the transport records and provide a description of the patient's clinical presentation. A performance improvement (PI) review is performed on every single transport by the clinical nurse specialist and medical director. Any discrepancies are discussed at monthly flight team meetings, and either protocol changes or education is completed. Flight teams also have the capability to check point-of-care laboratory values using the Abbott i-STAT 1 (Abbott Laboratories, Abbott Park, IL).

Additional data were collected from the electronic medical record and transport database. We compared demographics, transfusion volumes, laboratory values, hospital course, and outcomes for adult patients who received transfusions of PRBCs and/or plasma during transportation by our flight crews with those who were transported by visiting helicopters (which do not carry PRBCs or plasma) during the same time period. Patients transported to other institutions or by basic life support crews were excluded as were prisoners and pregnant patients. Laboratory values before and after transfer (within 6 hours of arrival) were compared. The bicarbonate level was used as a surrogate measure for acidosis because only a handful of patients had an arterial or venous blood gas obtained before or during transfer. Anticoagulation was considered to include warfarin, clopidogrel, therapeutic dosing of low–molecular-weight heparin, and rivaroxaban but excluded aspirin.

Normally distributed data are reported as the mean with standard deviation and compared using the Student 2-tailed *t* test. Non-normally distributed data are reported as the median with interquartile range (IQR) and compared using the Mann-Whitney *U* test. Categoric variables were compared using the Fisher exact text. JMP version 10.0 (SAS Institute, Inc., Cary, NC) was used for statistical analysis. A P value $< .05$ was considered significant.