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Restrictive blood transfusion protocol in liver resection patients reduces blood transfusions with no increase in patient morbidity

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Abstract

BACKGROUND: Management of anemia in surgical oncology patients remains one of the key quality components in overall care and cost. Continued reports demonstrate the effects of hospital transfusion, which has been demonstrated to lead to a longer length of stay, more complications, and possibly worse overall oncologic outcomes. The hypothesis for this study was that a dedicated restrictive transfusion protocol in patients undergoing hepatectomy would lead to less overall blood transfusion with no increase in overall morbidity.

METHODS: A cohort study was performed using our prospective database from January 2000 to June 2013. September 2011 served as the separation point for the date of operation criteria because this marked the implementation of more restrictive blood transfusion guidelines.

RESULTS: A total of 186 patients undergoing liver resection were reviewed. The restrictive blood transfusion guidelines reduced the percentage of patients that received blood from 31.0% before January 9, 2011 to 23.3% after this date ($P = .03$). The liver procedure that was most consistently associated with higher levels of transfusion was a right lobectomy (16%). Prior surgery and endoscopic stent were the 2 preoperative interventions associated with receiving blood. Patients who received blood before and after the restrictive period had similar predictive factors: major hepatectomies, higher intraoperative blood loss, lower preoperative hemoglobin level, older age, prior systemic chemotherapy, and lower preoperative nutritional parameters (all $P < .05$). Patients who received blood did not have worse overall progression-free survival or overall survival.

CONCLUSIONS: A restrictive blood transfusion protocol reduces the incidence of blood transfusions and the number of packed red blood cells transfused. Patients who require blood have similar preoperative and intraoperative factors that cannot be mitigated in oncology patients. Restrictive use of blood transfusions can reduce cost and does adversely affect patients undergoing liver resection.

Surgical oncology patients are at a high risk for presenting with related anemia preoperatively, and the perioperative management of their anemia is strongly related to patients' overall morbidity and mortality.[1–3] Specifically within the field of surgical oncology, procedures involving the liver are generally considered to be more

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complicated and carry a greater risk of bleeding that requires intervention.[4–6] Several studies have shown that managing anemia in these patients with allogeneic blood transfusions can negatively impact the patients' recovery even in the absence of procedural errors.[7–10] Although the cause has not been determined definitively, a physiological response known as "transfusion-related immunomodulation" has been proposed as the possible mechanism.[11]

The published literature makes a strong case that blood transfusions should be avoided whenever possible because of documented adverse effects. However, blood transfusions are inevitably required in some cases to reach an oxygen-carrying capacity in the patient that is adequate for tissue perfusion.[12] The challenge then becomes identifying which patients will be negatively impacted by receiving a transfusion and which patients will the transfusion benefit. Based on the theoretical relationship between blood transfusions and patient outcomes, we hypothesized that a dedicated restrictive blood transfusion protocol would reduce the overall number of transfusions without increasing patient morbidity.

Methods

After obtaining institutional review board approval, this prospective evaluation study of a restrictive blood transfusion protocol was conducted between January 2009 and June 2013. Written informed consent was obtained from all study participants. All the patients in this study underwent a surgical operation for the treatment of cancer of the liver. Patient data were divided according to 2 criteria: date of operation and administration of a blood transfusion. September 2011 served as the separation point for the date of operation criteria because this marked the implementation of more restrictive blood transfusion guidelines. Results from the data collected in each group were compared to determine if the transfusion protocol affected the overall frequency of blood transfusions, the value of the indicators for needing a transfusion, or the patients' outcomes.

Blood transfusion usage guidelines

The purpose was to provide guidance for the usage of blood components in a manner which optimizes patient care while judiciously utilizing limited resources and to provide the basis for prospective evaluation of blood transfusion practices.

Red blood cells. Hemodynamically stable patients were transfused at a hemoglobin level trigger of 7 g/dL, with a goal hemoglobin level of 7 to 9 g/dL. Level-1 evidence has shown such a "restrictive policy" is as effective as a more liberal strategy (transfusion for Hb <10 g/dL) in the critically ill patient. An exception to this policy is patients with evidence of myocardial ischemia.[13] Epoetin or darbepoetin was recommended for patients with chemotherapy-associated anemia at a Hb concentration that is approaching or has fallen below 10 g/dL. The target for therapy should be a hemoglobin level of 12 g/dL. Erythropoiesis-stimulating agents (ESAs) were discontinued if there was no evidence of response after 6 to 8 weeks. These agents are not recommended in patients with active malignancy who are not receiving chemotherapy or radiation therapy based on the Food and Drug Administration black box warning: "Use of ESAs increased the risk of death when administered to a target Hb of 12 g/dL in patients with active malignant disease receiving neither chemotherapy nor radiation therapy. ESAs are not indicated in this population".[14] Iron levels were monitored in patients on ESA therapy with replacement indicated in the setting of iron insufficiency.

Plasma. Plasma transfusion was indicated in the presence of coagulopathic bleeding or in the presence of an International Normalized Ratio greater than 2.0.[15] Fresh Frozen Plasma (FFP) transfusion was indicated for urgent warfarin reversal.[15] FFP administration was indicated in anticipation of an invasive procedure with significant risk of bleeding and an International Normalized Ratio greater than 1.5. If time allowed, vitamin K was used for reversal of warfarin to reduce FFP transfusion requirements.[15]

Platelets. Platelet count less than 50,000 in surgical patients in the presence of excessive bleeding was an indication for platelet transfusion,[15] as well as in anticipation of an invasive procedure with significant risk for bleeding.[16] Platelet transfusion was not indicated in surgical patients with normal platelet function and a platelet count greater than 100,000.[15] Platelet transfusion was indicated in patients with a platelet count lesser than 10,000.[16] Platelet transfusion was considered in the presence of massive transfusion when timely assessment of platelet count is not feasible.

Cryoprecipitate. Cryoprecipitate was administered in the setting of uremic bleeding or in patients with fibrinogen concentration less than 100 mg/dL and coagulopathic bleeding. Transfusion of cryoprecipitate was otherwise rarely indicated if the fibrinogen concentration was greater than 150 mg/dL.[15]

Surgical technique

All hepatic resection were completed using a thermal energy tissue sealing and cutting device in combination with vascular staplers for parenchymal transection. Extrahepatic vascular control was used on a selective basis. Total vascular inflow occlusion via the Pringle maneuver was not used in any patient. Both our open and laparoscopic surgical and anesthetic techniques have been described previously.[17–20] The surgical technique has been published previously, and in short, the abdomen is explored laparoscopically and the liver is mobilized and surveyed using laparoscopic ultrasonography. The line of transection is identified and marked with