

# An assessment of the necessity of transfusion during pancreatoduodenectomy

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**Introduction.** Perioperative transfusion of packed red blood cells (PRBC) has been associated with negative side effects. We hypothesized that a majority of transfusions in our series of patients who underwent pancreaticoduodenectomy (PD) were unnecessary. A retrospective analysis was performed to determine whether transfusions were indicated based on pre-determined criteria, and the impact of perioperative transfusions on postoperative outcomes was assessed.

**Methods.** Our prospectively maintained database was queried for patients who underwent PD between 2004 and 2011. 200 patients were divided into Cohort 1 (no transfusion) and Cohort 2 (transfusion). Rates of various graded 90-day postoperative complications were compared. Categorical values were compared according to the Common Terminology Criteria for Adverse Events. All cases involving intraoperative blood transfusion were reviewed for associated blood loss, intraoperative vital signs, urine output, hemoglobin values, and presence or absence of EKG changes to determine whether the transfusion was indicated based on these criteria.

**Results.** There were 164 patients (82%) in Cohort 1 (no transfusion) and 36 patients (18%) in Cohort 2 (transfused). Both groups had similar demographics. Patients in Cohort 2 had lesser median preoperative values of hemoglobin (12.3 vs 13.1,  $P = .002$ ), a greater incidence of vein resection (33% vs 16%,  $P = .021$ ), longer operative times (518 vs 440 minutes,  $P < .0001$ ), a greater estimated blood loss (850 vs 300 mL,  $P < .001$ ), and greater intraoperative fluid resuscitation (6,550 vs 5,300 mL,  $P = .002$ ). Ninety-day mortality was similar between the 2 groups (3% vs 1%,  $P = .328$ ). Patients in Cohort 2 (transfused) had increased rates of delayed gastric emptying (36% vs 20%,  $P = .031$ ), wound infection (28% vs 7%,  $P = .031$ ), pulmonary complications (6% vs 0%,  $P = .032$ ), and urinary retention (6% vs 0%,  $P = .032$ ). A greater incidence of any complication of grade II severity (67% vs 35%,  $P = .0005$ ) or grade III severity (36% vs 17%,  $P = .010$ ) was also noted in Cohort 2. Of the 33 intraoperative transfusions, 15 (46%) did not meet any of the predetermined criteria: intraoperative hypotension ( $< 90/60$  mmHg), tachycardia ( $> 110$  beats per minute), low urine output ( $< 10$  mL/hour), decreased oxygen saturation ( $< 95\%$ ), excessive blood loss ( $> 1,000$  mL), EKG changes, and low hemoglobin ( $< 7.0$  g/dL).

**Conclusion.** Perioperative transfusions among patients with PD were associated with increased rates of various postoperative complications. A substantive portion (~46%) of perioperative transfusions in this patient population did not meet predetermined criteria, indicating a potential opportunity for improved blood product use. Further prospective studies are required to determine whether the implementation of these criteria may have a positive impact on perioperative outcomes. (Surgery 2013;154:504-11.)

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PERIOPERATIVE PACKED RED BLOOD CELL (PRBC) transfusions have been associated with numerous negative effects, ranging from increased postoperative

complication rates to lengthier hospital admissions. Among the cancer patient population, adverse oncologic outcomes have also been noted with decreased disease-free and overall survival.<sup>1-5</sup> Limiting perioperative transfusions is therefore recommended. Several studies have previously defined criteria to assess the appropriateness of PRBC transfusions.<sup>6-9</sup> These criteria include hemoglobin and hematocrit values, estimated blood loss (EBL), low urine output, and signs or symptoms of cardiovascular or cerebrovascular insufficiency. When these criteria were used, reported rates of

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inappropriate or unnecessary transfusions were as great as 57% in some studies.<sup>8</sup> Although various guidelines for perioperative transfusions exist, including the American Society of Anesthesiologists practice guidelines on perioperative transfusions,<sup>10</sup> they generally are not applied. This study analyzes the transfusion practices among 200 cases of pancreatoduodenectomy (PD) to determine whether transfusions were indicated based on predetermined criteria and also assesses the impact of perioperative transfusions on postoperative outcomes. We hypothesized that a majority of transfusions in our patients with PD occurred in the absence of predetermined criteria and may have contributed to increased postoperative complication rates.

## METHODS

With appropriate Institutional Review Board approval, we queried our prospectively maintained database to identify 200 consecutive patients who underwent PD at a single institution between 2004 and 2011. Retrospective review of these cases identified 164 patients who did not require perioperative transfusions of PRBCs (Cohort 1) and 36 who did (Cohort 2).

Baseline demographics and clinical characteristics were obtained from the medical chart. Medical history of hypertension, chronic pancreatitis, coronary artery disease, myocardial infarction, or chronic obstructive pulmonary disease was recorded. Obesity was defined as a body mass index greater than or equal to 30 kg/m<sup>2</sup>. Tobacco use was recorded as no previous smoking history, previous smoker, or current smoker. The American Society of Anesthesiologists classification score was obtained from the anesthesia record. Operative time, defined as the time from incision to application of the final wound dressing, was obtained from the anesthesia record, along with intraoperative EBL and administration of intravenous fluids.

Perioperative transfusion was defined as any patient who received blood within 48 hours of the operation (preoperative), during the operation (intraoperative), or after the operation before discharge (postoperative). Anesthesia and transfusion records for the 33 patients transfused intraoperatively were reviewed for massive blood loss (>1,000 mL), intraoperative hemoglobin <7 g/dL, hypotension (systolic  $\leq$ 90 mmHg or diastolic  $\leq$ 60 mmHg for at least 5 minutes), tachycardia ( $\geq$ 110 beats per minute for at least 5 minutes), oxygen saturation ( $\leq$ 95% for at least 5 minutes), urine output ( $\leq$ 10 mL/hour during any hour of the operation), or any EKG changes from normal sinus rhythm. Although the decision to transfuse the

patient was based on clinical judgment on the part of the anesthesiologist or surgeon or both, for the purposes of this study, we applied the aforementioned signs of hemodynamic instability or end-organ compromise and if one or more of the aforementioned criteria were met, the PBRC transfusion was considered indicated based on the predetermined criteria. If none of these criteria was met, the transfusion was deemed not indicated.

Rates of various 90-day postoperative complications between the 2 cohorts were compared. Operative mortality was defined as any death within 90 days of surgery. All complications were recorded using specific and standardized definitions. Complications were graded in severity using the Common Terminology Criteria for Adverse Events (v4.0) (Grade 1–5) unless otherwise stated herein. We graded pancreatic fistula by using the International Study Group of Pancreatic Fistula definition and delayed gastric emptying by using the International Study Group of Pancreatic Surgery definition.<sup>11,12</sup> For these complications, grades A, B, and C were converted to 1–3 to calculate median complication severity scores.

A trained data analyst under the supervision of the surgeon entered the data into an Institutional Review Board–approved prospective database. Groups were compared by use of the  $\chi^2$ -Fisher exact test for categorical variables and the Wilcoxon test for continuous variables (median, interquartile range). All data were confirmed with source documents and the accuracy of the data entered into the electronic database was reviewed.

## RESULTS

Both groups had similar demographics and clinical characteristics (Table I). There were 164 patients in Cohort 1 (not transfused) and 36 patients in Cohort 2 (transfused). Units of PRBC ranged from 1 to 21 units perioperatively with a median of 2 units. No difference in the prevalence of comorbidities such as hypertension, chronic pancreatitis, and history of myocardial infarction, chronic obstructive pulmonary disease (COPD), obesity, or tobacco use, was noted between the two groups (Table II) and indications for surgery were similar between the two groups (Table III). Patients in Cohort 2 had lesser median values of perioperative hemoglobin (12.3 vs 13.1,  $P = .002$ ; Table III), a greater incidence of vein resection (33% vs 16%,  $P = .021$ ), longer operative times (518 vs 440 minutes,  $P < .0001$ ), a greater EBL (850 vs 300 mL,  $P < .001$ ), and greater volume of intraoperative fluid resuscitation (6,550 vs 5,300 mL,  $P = .002$ ) (Table IV).

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