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Clinical Study

The effect of blood transfusion on short-term, perioperative outcomes in elective spine surgery

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ABSTRACT

Studies in various surgical procedures have shown that transfusion of red blood cells (RBC) increases the risk of postoperative morbidity and mortality. Impact of blood transfusion in patients undergoing spine surgery is not well-described. We assessed the impact of intra and postoperative transfusion on postoperative morbidity and mortality in patients undergoing elective spine surgery. We used the American College of Surgeons' National Surgical Quality Improvement Program to identify a retrospective cohort of 36,901 adult patients who underwent elective spine surgery between 2006 and 2011. Patients who received intra or postoperative transfusion (n = 3262) were matched to those who did not using propensity scores. Logistic regression predicted adverse postoperative outcomes. We conducted sensitivity analysis in a subset of patients in whom the number of intraoperatively transfused units of RBC or whole blood was known. Upon matching, preoperative hematocrit, length of surgery, and percentage of spinal fusion surgery were not significantly different between transfused and non-transfused patients. After matching, transfusion remained adversely associated with prolonged length of stay (LOS) in hospital (odds ratio [OR] 2.6, 95% confidence interval [CI] 2.3–2.9), postoperative complications (OR 1.6, 95% CI 1.4–1.9), and an increased 30 day return to operation room (OR 1.7, 95% CI 1.3–2.2). Transfusion of even one unit of blood intraoperatively was associated with prolonged LOS (OR 2.0, 95% CI 1.5–2.6) and minor complications (OR 2.4, 95% CI 1.3–4.3). Therefore, transfusion of RBC or whole blood, even a single unit, increased LOS and postoperative morbidity in patients undergoing elective spine surgery, independent of preoperative hematocrit level and patient comorbidities.

1. Introduction

Transfusion of red blood cells (RBC) or whole blood is predictive of poor postoperative outcomes in various surgical procedures and is expensive [1,2]. Spinal surgery can be associated with significant blood loss, which may necessitate transfusion. However, there have been no comprehensive studies in the literature to characterize any association between transfusion and perioperative morbidity and mortality in patients undergoing spine surgery to our knowledge [3–5].

We used the American College of Surgeon's National Surgical Quality Improvement Program (NSQIP), a large, prospective, multi-institutional database, to assess the impact of intra and postoperative transfusion on 30 day morbidity and mortality of patients who underwent elective spinal surgery.

2. Methods

2.1. Database

Patients who underwent spine surgery from 2006 to 2011 were identified in the American College of Surgeons' NSQIP. Definition of variables, sampling strategy, design and further detailed description of NSQIP database have been described elsewhere [6,7].

2.2. Patients

Initially, 41,945 adult patients who underwent spine surgery were identified, using Current Procedural Terminology codes

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(American Medical Association, Chicago, IL, USA). We excluded patients who received preoperative transfusion or who had an unknown preoperative transfusion status (n = 185), had unknown preoperative hematocrit (n = 3,894), had surgery performed as an emergency (n = 945), or were under 18 years of age (n = 20). Our final patient population was composed of 24,470 patients who were operated on by a neurological surgeon and 12,431 by an orthopedic surgeon, for a total of 36,901 patients.

2.3. RBC transfusion status

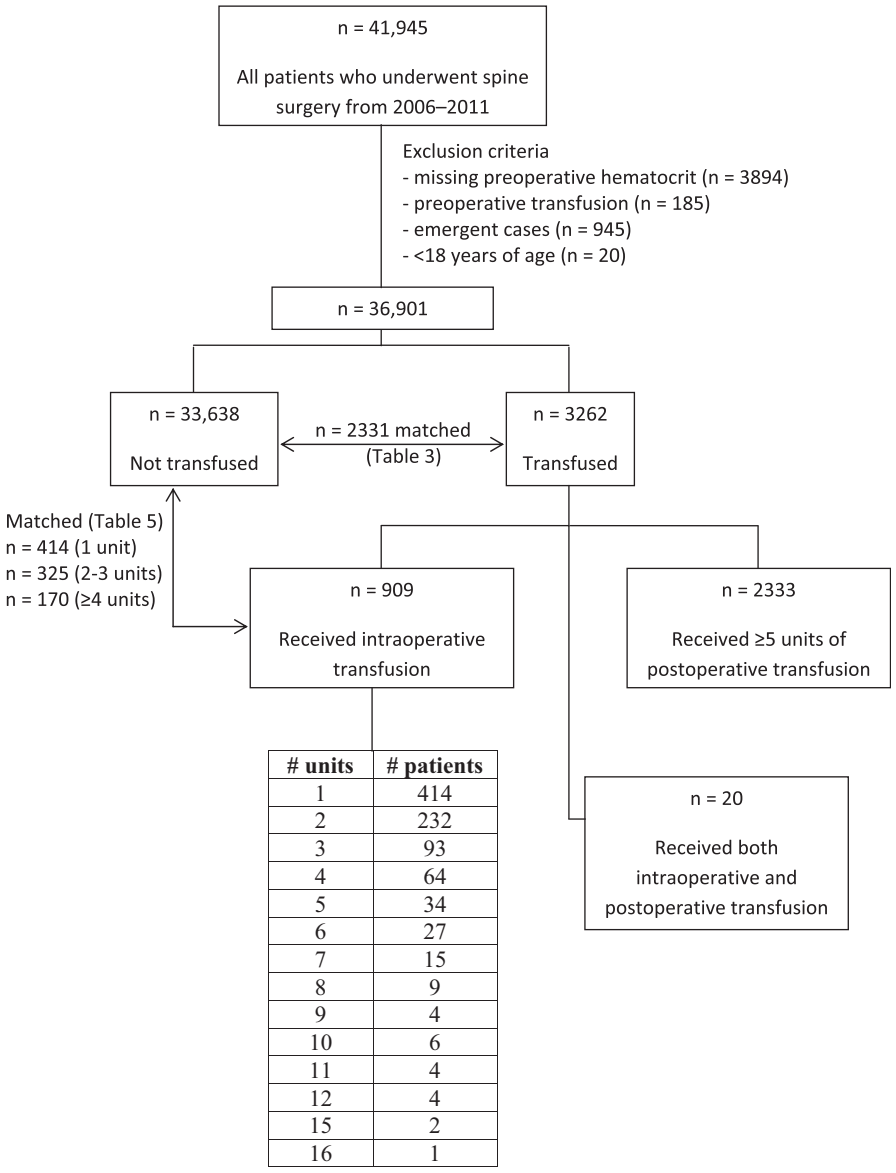
A total of 3,262 patients received at least one unit of packed RBC (pRBC) or whole blood during or after surgery; 33,638 patients were not transfused. Figure 1 demonstrates the flowchart of patient selection.

2.4. Covariates

Demographic variables, preoperative laboratory values and comorbid conditions available in NSQIP were analyzed among the patients in the two subgroups of transfused or non-transfused (Table 1).

2.5. Outcomes

We examined the following postoperative outcomes measures: prolonged length of stay (LOS), defined as length of hospitalization greater than 75% of the patients in our target population, which was 4 days; minor complications within 30 days postoperatively, including superficial surgical site infection, urinary tract infection, deep venous thrombosis or thrombophlebitis; major complications within 30 days postoperatively including deep incision surgical site infection, organ or deep space surgical site infection, wound disruption, pneumonia, unplanned intubation, pulmonary embolism, >48 hour postoperative ventilator-assisted respiration, progressive renal insufficiency, acute renal failure, cardiovascular accident with neurological deficit, coma of >24 hours, peripheral nerve injury, cardiac arrest requiring cardiopulmonary resuscitation, myocardial infarction, graft, prosthesis or flap failure, sepsis, septic shock; unplanned return to the operating room within



# units	# patients
1	414
2	232
3	93
4	64
5	34
6	27
7	15
8	9
9	4
10	6
11	4
12	4
15	2
16	1

Fig. 1. Flow chart showing patient selection methodology.