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Clinical Study

Risk of infectious complications associated with blood transfusion in elective spinal surgery—a propensity score matched analysis

So Kato, MD[a,*], Hirotaka Chikuda, MD, PhD[a], Junichi Ohya, MD[a], Takeshi Oichi, MD[a], Hiroki Matsui, MPH[b], Kiyohide Fushimi, MD, PhD[c], Katsushi Takeshita, MD, PhD[a], Sakae Tanaka, MD, PhD[a], Hideo Yasunaga, MD, PhD[b]

[a]*Department of Orthopaedic Surgery, Sensory and Motor System Medicine, Surgical Sciences, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8655, Japan*

[b]*Department of Clinical Epidemiology and Health Economics, School of Public Health, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan*

[c]*Department of Health Policy and Informatics, Tokyo Medical and Dental University Graduate School, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8519, Japan*

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Abstract

BACKGROUND CONTEXT: Although the negative aspects of blood transfusion are increasingly recognized, less is known about transfusion-related risks in spinal surgery.

PURPOSE: This study was designed to determine whether perioperative allogeneic blood transfusion is associated with increased risk of infectious complications after elective spinal surgery.

STUDY DESIGN: A retrospective cohort study with propensity score matched analysis was carried out.

PATIENT SAMPLE: Data of patients with spinal canal stenosis and spondylolisthesis who underwent elective lumbar surgeries (decompression or fusion) were obtained from the Diagnosis Procedure Combination database, a nationwide administrative inpatient database in Japan.

OUTCOME MEASURES: Clinical outcomes included in-hospital death and the occurrence of infectious complications (surgical site infection [SSI], respiratory tract infection, urinary tract infection, and sepsis).

METHODS: Patients' clinical information, including sex, age, type of hospital, preoperative comorbidities, duration of anesthesia, cell saver use, and volume of allogeneic blood transfused, were investigated. Patients transfused with >840 mL (6 units) were excluded. Propensity scores for receiving transfusion were calculated, with one-to-one matching based on estimated propensity scores to adjust for patients' baseline characteristics. The proportions of complications were compared in patients with and without transfusions. This study was funded by grants from the Ministry of Health, Labour and Welfare, Japan.

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The authors declare that they have no conflicts of interest.

* Corresponding author. Department of Orthopaedic Surgery, Sensory and Motor System Medicine, Surgical Sciences, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan. Tel.: +81 3 3815 5411; fax: +81 3 3818 4082.

E-mail address: skatou-tky@umin.org (S. Kato)

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RESULTS: Of the 84,650 patients identified, 5,289 patients (6.1%) received transfusions, with 4,436 (5.2%) receiving up to 840 mL. One-to-one propensity score matching resulted in 4,275 pairs with and without transfusion. Patients transfused were at increased risk of SSI (odds ratio [OR], 1.9; 95% confidence interval [CI], 1.4–2.5; p<.001) and urinary tract infection (OR, 2.5; 95% CI, 1.5–4.2; p<.001) than those not transfused.
CONCLUSIONS: Allogeneic blood transfusion after elective lumbar surgery was associated with increased risks of SSI and urinary tract infection.

Keywords: Adverse impact; Blood transfusion; Complication; Infection; Lumbar surgery; National database; Patient blood management; Propensity score; Surgical site infection; Urinary tract infection

Introduction

The increase in the number of major spinal surgeries has increased the overall demand for blood transfusions. In 2009, for example, 8% of patients who underwent spinal fusion surgery in the United States required allogeneic blood transfusion [1]. Despite its widespread use, however, allogeneic blood transfusion has been reported to have multiple potential drawbacks, including increased cost [2], risks of disease transmission [3], and negative impact on patients' immune system, which may cause postoperative infections [4]. In particular, transfusion is known to be a significant risk factor for the development of surgical site infection (SSI) [5]. These drawbacks have led to efforts to minimize intraoperative blood loss and avoid unnecessary transfusion, thus enhancing patient safety [6–8].

Despite increasing recognition of the drawbacks of transfusion, less is known about transfusion-related risks in patients undergoing spinal surgery. This study therefore evaluated whether perioperative allogeneic blood transfusion in patients undergoing elective lumbar decompression surgery was associated with increased risk of postoperative infectious complications by using data on over 80,000 patients obtained from a national inpatient database in Japan.

Materials and methods

Data source

Data were obtained from the Japanese Diagnosis Procedure Combination (DPC) database, a national inpatient database in Japan consisting of discharge abstract and administrative claim data. All 82 academic hospitals in Japan are obliged to participate in the database, but the participation of community hospitals is voluntary. Inpatient data were obtained on patients who underwent surgery from July 1 to December 31 in each year from 2007 to 2010, and from January 1, 2011 to March 31, 2012 (total, 39 months). In 2012, approximately 50% of all acute-care inpatients in Japan were included in the DPC database. The database includes data on patient sex, age, diagnoses, length of stay, and comorbidities at admission; complications after admission, according to International Classification of Diseases, Tenth Revision (ICD-10) codes; procedures coded with original Japanese codes; duration of anesthesia; blood transfusions; and in-hospital deaths. The DPC database clearly differentiates between comorbidities and complications and has been used in several of our previous studies [9–14]. The study protocol was approved by the Institutional Review Board of The University of Tokyo, which waived the requirement for informed consent because of the anonymous nature of the data.

Study subjects

All patients aged ≥20 years who underwent laminectomy and laminoplasty or fusion surgery of the lumbar spine for spinal stenosis (ICD-10 code, M480) and spondylolisthesis (M431) were included. Emergency admissions were excluded from the study. Clinical information obtained from the database included patient sex and age; length of stay; type of hospital (academic or non-academic); preoperative comorbidities, including diabetes mellitus [E10–E14], cardiovascular diseases [I20–I25], and cerebrovascular diseases [I60–I63]; hemodialysis; duration of anesthesia, volume of allogeneic blood transfused during the hospitalization, and cell saver use. Clinical outcomes included the occurrence of infection, including SSI [T814], respiratory tract infection [J12–J18, J95, J96], urinary tract infection [N390], and sepsis [A40, A41]; and in-hospital death.

Statistical analysis

Continuous variables in the two groups were compared using Student *t* test, and categorical variables using the chi-square test. Propensity score matched analyses were performed to compare complication rates in patients who did and did not receive transfusions. Propensity score matched analysis is widely used in retrospective cohort studies to control for confounding biases [15]. Propensity scores, which estimate the probability of the use of a certain treatment based on patient characteristics, are calculated by a logistic regression model in which patient demographic parameters are dependent variables, with goodness of fit determined by C-statistics. In propensity score matching, one patient who did not receive treatment was matched with each patient who did, thus allowing a comparison between two groups with comparable baseline characteristics. This type of analysis mimics a randomized trial, with the assumption that all relevant confounders are measured and controlled. This model has been increasingly used in studies assessing outcomes after blood transfusion [16–18]. In the present study, propensity scores were calculated