



## Original Article

## Does blood transfusion type affect complication and length of stay following same-day bilateral total knee arthroplasty?

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## ABSTRACT

Same-day Bilateral Total Knee Arthroplasty (BTKA) safety is still controversial. The aim of this study was to examine the association of blood transfusion type (pure autologous, pure allogeneic, and combined) with complication and prolonged length of stay (PLOS) following same-day BTKA. 649 consecutive patients were retrospectively identified over a two-year period.

Pure allogeneic transfusions were associated with increased odds of minor complication when compared to patients who had pure autologous transfusions. No association was found between blood transfusion type and major complication or PLOS. Our results suggest that blood transfusion type may be influential in minor complication after BTKA.

## 1. Introduction

Even though, same-day BTKA (simultaneous or sequential) is a widely accepted procedure in the contemporary orthopedic armamentarium,<sup>1</sup> potential effect on patient morbidity is still nebulous in the literature. This double “surgical hit” has been associated with increased complications,<sup>2–5</sup> mortality<sup>4,5</sup> and hospital LOS<sup>3,5–7</sup> when compared to unilateral TKA or staged BTKA. However, other authors<sup>8–11</sup> consider this approach as relatively safe especially when proper patient selection criteria are applied.

On the other hand, many studies report worse outcomes in patients receiving blood transfusions compared to non-transfused patients in various medical settings including TKA, although these adverse outcomes may be partly attributable to other confounders.<sup>12</sup> The fact that, transfusion rates are higher in same-day BTKA than unilateral TKA or staged BTKA,<sup>9,13–15</sup> highlights even more the potential effect of transfusion on complication rate in these patients. Moreover, allogeneic blood transfusion has been associated with increased LOS after unilateral TKA.<sup>16,17</sup> However, it has not been clarified yet in the literature, whether the type of transfusion (autologous, allogeneic or combined) might be associated with the development of complications in a same-day BTKA patient cohort and affect hospital LOS.

## 2. Patients and methods

## 2.1. Patient population

This is a retrospective study of 649 patients undergone same-day (sequential) BTKA over a 2-year period from 1 January 2008 to 31 December 2009 in a high volume institution. Same-day BTKA patients had two primary TKA procedure codes during a single admission with the same procedure date, as defined by discharge coding rules. An appropriate institutional review board (IRB) approved the project (IRB# 29141). Eligibility for same-day operation was depended upon fulfilling our suggested institutional criteria (Table 1). However, in rare occasions and after thorough deliberation of risks and benefits, patients were deemed candidates for BTKA even if they had any of these exclusion criteria. Excluded patients with bilateral disease were scheduled for staged BTKA procedure. The procedures followed, were in accordance with the ethical standards of the responsible institutional committee on human experimentation.

## 2.2. Surgical protocol

All surgeries were performed by a fellowship trained and highly

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**Table 1**  
Suggested institutional exclusion criteria for same-day BTKA.



ASA: American Society of anesthesiologists; LV: Left Ventricle; LVEF: Left Ventricular Ejection Fraction; DOE: Dyspnea On Exertion; SOB: Shortness Of Breath; COPD: Chronic Obstructive Pulmonary Disease; BMI: Body Mass Index; HTN: Hypertension; DM: Diabetes Mellitus; IHD: Ischemic Heart Disease; Cr: Creatinine; Hgb: Hemoglobin.

experienced group of orthopedic surgeons. The two procedures were performed sequentially, starting from the most painful joint. Cemented posterior stabilized prostheses were implanted in all patients following standard midline incision and medial parapatellar arthrotomy. Both procedures were done under pneumatic tourniquet control. Preoperatively, patients were advised to donate autologous blood in a case by case basis.<sup>18,19</sup> The donation period began 4 to 6 weeks before surgery in order to optimize the balance between the length of allowable storage time and time for regeneration of blood cells. Orthopedic Perioperative Auto-Transfusion system OrthoPAT<sup>®</sup> (Transfusion Technologies Corporation, Natick, MA) was used intra- and postoperatively when: 1) high blood loss was anticipated (coagulopathy or complex procedures), and/or 2) allogeneic transfusion would not be possible (compatibility issues or religious beliefs), and/or 3) the patient was unable to donate sufficient quantities of autologous blood prior to surgery to adequately cover the anticipated transfusion requirement. After the operation, patients were transferred to post-anesthesia care unit (PACU) for 12–24 h. Subsequently, when hemodynamic status, urine output and pain control were deemed acceptable, patients were transferred to the orthopedic wards. Discharge from hospital was allowed when meeting rehabilitation criteria. All patients received postoperative thromboembolic prophylaxis for 4–6 weeks.

### 2.3. Transfusion criteria

Our institution transfusion criteria included: 1) Hemoglobin (Hgb)  $<$  8 g/dL not due to iron, folate or vitamin B<sub>12</sub> deficiency (only if clinically indicated), 2) Actively bleeding and clinically unstable patient, 3) Hgb  $<$  10 g/dL and coexisting cardiac, pulmonary or cerebrovascular disease; symptoms of decreased O<sub>2</sub> delivery; or patient on chronic transfusion regimen.

### 2.4. Study measures

Patient demographic and clinical data were recorded (Table 2). Depending on transfusion status they were divided in four groups: 0 (not transfused), 1 (pure autologous transfusion), 2 (pure allogeneic transfusion) and 3 (combined autologous and allogeneic transfusion). Transfusion status was based on International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes: 99.00–99.04. Autologous transfusion was defined as the transfusion of preoperative

**Table 2**  
Descriptive data for the total cohort (n = 649).

Characteristic	Value
<b>Age (mean <math>\pm</math> SD)</b>	65.09 $\pm$ 8.78
<b>Sex (%)</b>	
Male	239 (36.83)
Female	410 (63.17)
<b>ASA status (%) (n = 604)</b>	
1	17 (2.81)
2	529 (87.58)
3	58 (9.6)
<b>OrthoPAT<sup>®</sup> use (%)</b>	
Yes	250 (38.52)
No	399 (61.48)
<b>Units received (%)</b>	
0	61 (9.4)
1	120 (18.49)
2	268 (41.29)
3	129 (19.88)
4	48 (7.4)
5	17 (2.62)
6	6 (0.92)
<b>Transfusion (%)</b>	
No	61 (9.41)
Pure autologous	336 (51.77)
Pure allogeneic	79 (12.17)
Combined	173 (26.65)
<b>Complications (%)</b>	
Major	17 (2.62)
Minor	62 (9.55)
Local	1 (0.15)
None	569 (87.68)
<b>LOS (%)</b>	
Regular ( $\leq$ 5 days)	609 (93.84)
Prolonged ( $>$ 5 days)	40 (6.16)

SD: Standard deviation; ASA: American Society of anesthesiologists; OrthoPAT<sup>®</sup>: Orthopedic Perioperative Auto-Transfusion system; LOS: Length of stay.

blood donated by the same patient.

Complications were classified as major, minor and local (orthopedic) adopting a previous published system<sup>9,20</sup> based on ICD-9-CM coding (Table 3). Only complications during admission for index surgery (in-hospital) were evaluated and were recorded as per patient. Complications were classified as major if they required complex surgical or medical intervention or they were deemed life-threatening or resulted in functional impairment. Minor complications included those that required medical treatment or necessitated additional observation. Finally, intra- and postoperative surgical site complications were considered as local.

LOS was also recorded and counted in whole days as the number of postoperative nights in the hospital. LOS greater than 5 days was considered prolonged.

### 2.5. Statistical analysis

Descriptive statistics were calculated to examine patient characteristics, transfusion data, complication rates and LOS. Means and standard deviations are reported for continuous variables and frequencies and percent for categorical variables. The association between transfusion type and the outcomes of complication (major and minor) and PLOS was examined using multivariable logistic regressions. Statistical significance was set at  $p <$  0.05.

## 3. Results

Mean patient age was 65.09  $\pm$  8.78 years and 36.83% were male. American Society of anesthesiologists (ASA) physical status was documented for 604 patients. Among them, 17 were classified as ASA 1 (2.81%), 529 as ASA 2 (87.58%) and 58 as ASA 3 (9.6%). Mean

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