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Original Article

Are Preoperative Serologic Type and Screen Tests Necessary for Primary Total Joint Arthroplasty Patients in Specialty Surgical Hospitals?

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ABSTRACT

Background: Blood loss during total joint arthroplasty (TJA) has been a major concern requiring routine preoperative patient type and screen (T&S); however, with the implementation of blood conserving therapy, a marked decrease for perioperative transfusions has been observed. Many TJAs are now being performed in T&S mandated specialty surgical hospitals (SSHs) that lack on-site blood banks; therefore, the purpose of our study was to determine whether T&S (1) is necessary in SSH for TJA patients and (2) identifies patient risk factors associated with perioperative blood transfusion in SSH.

Methods: A retrospective study was conducted on 1034 consecutive primary TJAs performed between 2013 and 2014 at a 12-bed SSH who all received T&S. Patients were matched (1:1) to 964 inpatient TJA patients performed at a university hospital without routine T&S. Data on surgery type, patient demographics, hemoglobin and hematocrit results, and transfusion rates were collected. Multivariate logistic regression identified perioperative transfusion risk factors.

Results: Overall transfusion rates for the matched SSH (1.8% [17/964]) and university hospital populations (2.9% [28/964]) were similar ($P = .13$), with no emergent transfusions. SSH transfusion rates for simultaneous bilateral THA, simultaneous bilateral TKA, unilateral THA, and unilateral TKA were 21.1% (4/19), 3.1% (4/128), 2.7% (12/439), and 0.0% (0/448), respectively. Multivariate logistic regression identified unilateral THA ($P \leq .001$), simultaneous bilateral TJA ($P = .001$), age ($P = .05$), and abnormal preoperative hemoglobin ($P = .02$) as significant transfusion risk factors at SSH.

Conclusion: Due to low transfusion rates and lack of emergency transfusions, we recommend routinely ordering T&S for bilateral THA but not for unilateral TJA patients, at SSHs.

Within recent years, there has been a considerable increase in the volume of elective total joint arthroplasty (TJA) cases, noting a 16.2% increase between 1991 and 2010 [1]. Simultaneously, substantial improvement in TJA patient management has been observed, allowing for both shortened inhospital length of stay (LOS) [1-3] and a shift toward performing TJA in specialty surgical hospitals (SSHs). These changes may be attributed to both improved surgical techniques as well as multimodal pain management and early mobilization [3]. At many hospitals, the maximum surgical blood ordering schedule (MSBOS) is used to determine preoperative blood orders for specific surgical procedures; however, because the MSBOS list was developed in the late 1970s and many surgical procedures have since improved, this list may be outdated [4]. Specifically, for TJA procedures, the combination of decreased operative times [5] and routine use of intraoperative tranexamic acid (TXA) has led to a marked decrease in intraoperative blood loss and reduced transfusions [3,6-8]. In addition, the MSBOS does not stratify preoperative blood orders by patient risk factors, yet ample studies have identified that specific patient risk factors are associated with a significantly greater risk for increased perioperative blood loss and

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transfusion, such as gender, preoperative autologous blood donation, preoperative hemoglobin (HGB), age, body mass index (BMI), and operative time [9-13].

With the enactment of the Affordable Care Act, health care cost savings and bundle payments are under significant scrutiny [14,15], especially with regard to efficient use of auxiliary medical services and performing necessary laboratory testing. Because SSHs do not have blood banks directly on-site, TJA patients undergoing surgery at SSH currently require preoperative type and screen (T&S) laboratory tests before surgery. However, not all patients who get a T&S receive transfusions, and it is important to identify patients who are at risk of receiving transfusions. Thus, the purposes of this study were to: (1) compare transfusion rates of primary TJA patients between a SSH and a university hospital (UH) stratified by procedure type in a matched patient population and (2) identify patient risk factors associated with perioperative blood transfusion at a SSH.

Methods

After obtaining institutional review board approval, 979 patients who underwent 1034 primary TJAs at a 12-bed SSH between 2013 and 2014 were retrospectively identified from a prospectively maintained database. Patients were excluded from the final cohort if T&S was unavailable. All the SSH patients received a T&S, whereas 96.9% (1002/1034) received TXA, and 3.1% (32/1034) did not.

These patients at the SSH were matched 1:1 to 964 primary TJA patients at a UH based on the following parameters: age, gender, American Society of Anesthesiologists (ASA) score, surgical procedure, use of TXA, and operative time (Table 1). SSH patients were excluded if identical matches using a propensity score matching system were not found in the UH cohort. Within the matched cohort, there were 964 SSH procedures including: 540 (56.0%) TKA, of which 418 (77.4%) were unilateral TKA, and 122 (22.6%) were simultaneous bilateral TKA. There were 424 (44.0%) THA, of which 408 (96.2%) were unilateral THA, and 16 (3.8%) were simultaneous bilateral THA. The SSH cohort consisted of 445 (46.2%) men and 519 (53.8%) women with average age of 61.9 years (range: 29-87) and average BMI of 30.1 kg/m^2 (range: 16.7-47.3). In addition, 65 (6.7%), 755 (78.3%), and 144 (15.0%) reported an ASA score of 1, 2, and ≥3, respectively (Table 1).

The UH cohort consisted of 434 (45.0%) men and 530 (55.0%) women with an average age of 62.0 years (range 18-91) and BMI of 29.4 kg/m^2 (range 14.7-50.1). Within the entire cohort, there were 29 of 964 (3.0%) bilateral THAs, 79 of 964 (8.2%) bilateral TKAs, 488 of 964 (50.6%) unilateral THAs, and 368 of 964(38.2%) unilateral TKAs. In addition, 93 of 964 (9.6%), 666 of 964 (69.1%), and 205 of 964 (21.3%) reported an ASA score of 1, 2, and ≥3, respectively (Table 1). None of the UH patients received a T&S test.

To evaluate the parameters associated with intraoperative and postoperative transfusions, specific preoperative, intraoperative, and postoperative data were collected via manual chart review. The following preoperative parameters were identified: age, gender, BMI, ethnicity, ASA score [16], type of surgery, preoperative HGB and hematocrit (HCT), as well as a completed T&S result. Intraoperative and postoperative factors collected included: use and dose of TXA, operative time, total calculated blood loss, units of transfusion, and postoperative HGB and HCT. The established protocol for requiring transfusion at the SSH institution is the following: HGB < 7 g/dL in patients with acute coronary syndrome and HGB < 10 g/dL in patients with atrial fibrillation requiring warfarin or clopidogrel use, history of cardiac stent placement, history of cardiovascular disease, pulmonary embolism, deep vein thrombosis, transient ischemic attack (TIA), and renal insufficiency.

Table 1
Demographics of the Patient Populations at the Specialty Surgical and University Hospitals.

Type of Surgery	N (%)	N (%)
THA		
Total	424	517
Unilateral	408 (96.2)	488 (94.4)
Bilateral	16 (3.8)	29 (5.6)
TKA		
Total	540	447
Unilateral	418 (77.4)	368 (82.3)
Bilateral	122 (22.6)	79 (17.7)
Transfusion rate	1.8	2.9
THA		
Total	13 (3.1)	14.8
Unilateral	11 (2.7)	13 (2.7)
Bilateral	2 (12.5)	3 (10.3)
TKA		
Total	4 (0.7)	12 (2.7)
Unilateral	0 (0.0)	2 (0.5)
Bilateral	4 (3.3)	10 (12.7)
ASA score		
1	65 (6.7)	93 (9.6)
2	755 (78.3)	666 (69.1)
≥3	144 (15.0)	205 (21.3)

THA, total hip arthroplasty; TKA, total knee arthroplasty; ASA, American Society of Anesthesiologists.
[a]Statistically significant.

At the UH institution, the following protocol is implemented to evaluate patients for transfusion: (1) Hgb < 8 mg/dL and symptomatic; (2) Hgb 8-9 mg/dL; the patient may be symptomatic, and the patient's medical history is positive for cardiac history (cardiovascular disease, atrial fibrillation, and cardiac stent placement), TIA, renal insufficiency, and other comorbidities; and (3) Hgb < 10 mg/dL for symptomatic patients aged 80 years and those with significant comorbidities. Patients at both UH and SSH received TXA at a rate of 10 mg/kg before surgery but avoid in the following patients: patients taking clopidogrel, the presence of cardiac stents, history of cerebral vascular accident or TIA, pulmonary embolism, deep vein thrombosis, pregnancy, renal insufficiency, and cancer. Patients with atrial fibrillation on warfarin are administered TXA at the SSH but not at the UH.

Statistical Analysis

Descriptive statistics were used to report the cohort demographics and rate of transfusion. Differences in transfusion rates between the SSH and the UH were assessed with the chi-square test. To assess the independent association between preoperative and intraoperative parameters with transfusion rates, a multivariate analysis was used. A P value <.05 was considered to be statistically significant. All statistical analyses were done with R software (version 3.11; R Foundation for Statistical Computing, Vienna, Austria).

Results

The overall transfusion rate in the SSH was 1.9% (20/1034). There were neither any cases of emergent transfusion nor were any transfusions performed on the day of surgery. With regard to laboratory values, in the SSH population, the mean preoperative HGB and HCT were 13.9 ± 1.3 g/dL and 41.2% ± 3.8%, respectively. Furthermore, average calculated total blood loss based on postoperative decrease in HCT was 1500.8 ± 785.7 mL with mean postoperative HGB and HCT of 10.8 g/dL ± 1.6 g/dL and 32.1 ± 4.4%, respectively, in the SSH. Table 2 stratifies preoperative and postoperative HGB and HCT by specific procedure type.