



## Original research

# Routine Type and Screens Are Unnecessary for Primary Total Hip and Knee Arthroplasties at an Academic Hospital

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## ABSTRACT

**Background:** Despite decreasing transfusion rates, routine type and screens are frequently used before primary total hip arthroplasty (THA) and total knee arthroplasty (TKA). The aims of this study were to characterize transfusion rates and identify any factors that affect the likelihood of transfusion to determine if it is safe to discontinue routine preoperative type and screens at an academic hospital.

**Methods:** A retrospective chart review was performed for all patients who underwent primary THA or TKA in 2019 at an academic institution by a fellowship-trained arthroplasty surgeon. Data on preoperative type and screens, transfusion rates, bleeding disorders, and anticoagulation status were obtained. Patients were considered to have a preoperative type and screen if it was performed within 30 days before surgery.

**Results:** Overall, 379 patients were included in the study. Of these, 210 underwent primary THA and 169 underwent primary TKA. Four patients received transfusions during their hospitalization for a cumulative transfusion rate of 1.06%. No patients received an intraoperative transfusion. One (0.59%) patient received a postoperative transfusion after TKA, and 3 (1.43%) patients received a postoperative transfusion after THA. The mean preoperative hemoglobin of the 4 transfused patients was 10.8 g/dL.

**Conclusions:** In summary, performing a preoperative routine type and screen is likely unnecessary at academic medical centers. Consideration for obtaining a type and screen may include complex primary surgeries or when patients have preoperative hemoglobin of less than 11 g/dL. Ultimately, preoperative type and screen should be considered on a case-by-case basis using clinical judgment.

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## Introduction

Primary total hip arthroplasty (THA) and total knee arthroplasty (TKA) are common procedures that can result in significant blood loss of up to 1000–1500 mL and a mean drop in hemoglobin of approximately 4g/dL [1,2]. Before the implementation of modern blood management and conservation techniques in THA and TKA, blood loss anemia was a common complication requiring postoperative transfusion. Historical transfusion rates after THA and TKA ranged from 15% to 68% [2–6]. As a result, it became a common

practice to perform routine type and screen (T&S) before these procedures. However, recent postoperative transfusion rates in these patients suggest that this may be unnecessary. Studies have shown a decline in transfusion rates with some rates as low as 1%–2% with improved surgical techniques, presurgical optimization, and the implementation of various blood management protocols including the use of tranexamic acid (TXA) and changing transfusion thresholds [7–11]. Despite the decline seen in transfusion rates, T&S is still routinely ordered before these procedures.

Given the advance in modern surgical techniques, guidelines outlined in the 1970s are no longer pertinent [12]. Recently, institutions have begun evaluating blood product ordering for surgical procedures, including orthopaedic procedures, to update and develop institution-specific maximum surgical blood order schedules that can be used to reduce unnecessary testing and costs while

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maximizing patient safety [13–15]. With TKA and THA volumes expected to reach a combined 2 million cases annually by 2030 [16], these investigations have unearthed the potential to save nearly \$200 per patient, resulting in hundreds of millions of cost savings annually. A prior study has shown omitting preoperative T&S to be both safe and cost-effective for primary TKA and THA [11]. Previous studies have focused on inpatient and surgical centers. To our knowledge, there is limited information in the literature from academic hospitals.

With this in mind, we conducted a retrospective review of transfusion data and preoperative T&S testing in the setting of primary TKA and THA. The primary objective was to characterize transfusion rates and identify any factors that affect the likelihood of transfusion to thereby determine if it is safe to discontinue routine preoperative T&S at an academic hospital in a major metropolitan area.

## Material and methods

Institutional review board exemption status was granted for this study. A retrospective chart review was performed for all patients who underwent primary THA and TKA performed at an academic institution from January 1, 2019, to December 31, 2019. Patients who underwent arthroplasty by either of the 2 fellowship-trained adult reconstruction surgeons were included. In addition to the attending surgeons, residents and fellows were involved in patient care at this teaching facility. Exclusion criteria included hemiarthroplasty, revision THA or TKA, and comorbid transfusion-dependent conditions including myelodysplastic syndrome. Patients were considered to have a preoperative T&S if it was performed within 30 days before surgery. THAs were performed through either an anterior or posterior approach. All patients received a standard 2-g dose of TXA preoperatively. In addition, all patients received weight-based dosing of local periarticular injection containing ropivacaine, epinephrine, ketorolac, and morphine sulfate [17].

As the primary objective was to determine the overall transfusion rate of patients undergoing elective, unilateral primary THA or TKA, we identified patients who received a transfusion during their admission to the hospital, either intraoperatively or postoperatively. All patients who underwent arthroplasty routinely receive a postoperative hemoglobin check. General indications for transfusion included hemoglobin less than 7 g/dL or symptomatic anemia; however, this was ultimately at the discretion of the treating surgeon. In the patients requiring transfusion, we analyzed the preoperative and postoperative hemoglobin, the change in hemoglobin, the quantity transfused, the timing of transfusions (intraoperative or postoperative), and estimated blood loss. Other data collected included the use of pharmacologic anticoagulation and comorbid bleeding disorders. Descriptive statistics were used in this study. Univariate analyses of studied variables were performed to assess the transfused cohort.

A secondary objective was to determine potential cost savings for patients undergoing total joint arthroplasty (TJA) at an academic hospital. The total savings per patient was calculated using

the Centers for Medicaid and Medicare Services 2019 payment rates for an ABO type (code 86900), Rh type (code 86901), and antibody screen (code 86850). This information was then applied to the patient cohort to calculate the total cost savings for the group.

## Results

A total of 391 patients who underwent primary TKA or THA in 2019 were identified. Eleven were identified as having undergone bipolar hemiarthroplasty and were excluded. One patient was excluded because of transfusion-dependent myelodysplastic syndrome. Overall, 379 patients met criteria and were included in the study. Of these, 210 underwent primary THA and 169 underwent primary TKA. A total of 4 patients received transfusions during their hospitalization for a cumulative transfusion rate of 1.06%. No patients received an intraoperative transfusion; all 4 were postoperative. In patients who underwent TKA, one (0.59%) patient received a postoperative transfusion. Three (1.43%) patients who underwent THA received a postoperative transfusion. These findings are summarized in Table 1.

A total of 320 of 379 (84.4%) patients who underwent TJA had T&S performed before surgery. All 4 of the patients who received a packed red blood cell transfusion had a T&S before surgery. Of these 4, 2 were routine THA and TKA procedures. The other 2 were complex primary THAs. One was a patient with multiple epiphyseal dysplasia, and the other required removal of a large proximal femur plate before THA and the use of a distally engaging fluted tapered stem. The primary THA was performed through an anterior approach, and the 2 complex THAs were performed through posterior approaches.

The mean preoperative hemoglobin of the 4 transfused patients was 10.8 g/dL. The mean change in hemoglobin was 4.1 g/dL, and the mean estimated blood loss was 500 mL. The mean quantity transfused was 1.8 units of packed red blood cells. The data for these 4 patients can be found in Table 2. All transfusions were performed on postoperative day 1 or 2. Thirty-eight patients were on pharmacologic anticoagulation before surgery, but none required transfusion. Anticoagulation was held before surgery based on the recommendations of the preoperative anticoagulation clinic. Thirteen patients were identified with an underlying bleeding disorder, and one (7.7%) required transfusion.

A secondary outcome in this study was the potential cost savings of the cohort. The total cost per patient based on the Centers for Medicaid and Medicare Services Healthcare Common Procedure Coding System was calculated by adding the cost of ABO blood typing (\$106.97), Rh blood typing (\$32.89), and RBC antibody screening (\$51.41) for a total cost of \$191.27 per patient. In this group of 379 patients, the total cost savings would be \$61,206.40 for the 320 patients who underwent T&S.

## Discussion

Routine T&S has been the standard in many hospitals because of historically high transfusion rates in primary THA and TKA. Recently, there has been a shift from the traditional maximum

**Table 1**  
Transfusion rates after primary THA and TKA.

Type and screen cumulative data							
	Total procedures	Pharmacologic anticoagulation before surgery	Bleeding disorder	Intraoperative transfusion	%	Postoperative transfusion	%
KNEE	169	22	4	0	0.00%	1	0.59%
HIP	210	16	9	0	0.00%	3	1.43%
TOTAL	379	38	13	0		4	

**Table 2**  
Transfused cohort perioperative data.

Transfused patients after total joint arthroplasty									
Patients	Age/gender	ASA class	Preoperative Hgb (g/dL)	Postoperative Hgb (g/dL)	Change in Hgb (g/dL)	EBL (mL)	Units of PRBCs transfused	Bleeding disorder present?	Notes
1	92 M	3	9.5	6.5	3.0	150	1	Y	Uncomplicated primary TKA
2	64 F	3	10.7	7.0	3.7	600	1	N	Uncomplicated primary THA
3	73 F	2	12	6.8	5.2	250	2	N	THA with previous proximal femur fracture requiring removal of plate/screws
4	49 M	1	11.1	6.7	4.4	1000	3	N	Complex THA in a patient with multiple epiphyseal dysplasia
Mean			10.8	6.8	4.1	500	1.8		

Hgb, hemoglobin; ASA, American Society of Anesthesiologists; EBL, estimated blood loss; PRBCs, packed red blood cells.

surgical blood order schedules to modern strategies based on newer literature [12–15,18]. This is likely due to a combination of improved surgical techniques, the use of pharmaceutical agents such as TXA and local vasoconstrictors, improved fluid management in the perioperative period, and changing transfusion thresholds. There has been extensive and compelling literature on TXA proving its efficacy of reducing blood loss and transfusion rates [9,19–23]. Some institutions have implemented practice changes within the past few years, foregoing routine T&S in low-risk patients [8,11]. Notably, these studies occurred at a specialty surgical hospital [8] and a tertiary orthopaedic hospital [11]. To our knowledge, there are no studies specifically reviewing T&S data at academic medical centers serving a major metropolitan area.

In this study, the overall transfusion rate was extremely low (1.06%) and consistent with recent data [8,11,23]. Tischler et al [8] compared the overall transfusion rate at a specialty surgical hospital (1.8%) with that at a university hospital (2.9%). The present study demonstrates even lower rates of transfusion, and none of the patients required emergent or intraoperative transfusions. Furthermore, the mean preoperative hemoglobin in the transfused cohort was 10.8 g/dL. Preoperative anemia has previously been shown to be a risk factor for transfusion in multiple studies [5,10,24,25]. Yeh et al [25] evaluated 1457 patients who underwent primary unilateral TKA to determine an ideal T&S cutoff level based on the preoperative hemoglobin. The authors recommended cutoff values of 12.4 g/dL for age >70 years and 12.1 g/dL for age <70 years. In our study, the 2 transfused patients who underwent uncomplicated primary THA and TKA both had starting hemoglobin values less than 11 g/dL. No patients were transfused intraoperatively or emergently. This finding led to a change of practice at our institution, where routine T&S is not performed on patients with preoperative hemoglobin greater than 11 g/dL, unless significant blood loss is anticipated for a complex primary TJA. If blood loss is greater than expected, T&S can safely be considered intraoperatively or postoperatively.

As a secondary measure, total cost savings was calculated for this group of patients. An estimated \$61,206.40 in this 2-surgeon cohort alone could have been saved if the 320 T&S were not performed. Given that more than one million TJAs are performed annually in the United States, the potential savings could exceed 100 million dollars for appropriately selected patients. In an era where cost savings and value are critical in arthroplasty, the implications are sizable.

This study has several limitations. As a retrospective study, it is subject to possible selection and misclassification biases. We were unable to control for all variables but attempted to identify possible confounders including anticoagulation status and manually reviewed each case for confounding comorbidities or surgical complexities. We did not obtain or compare hemoglobin values in

the patients who did not receive transfusion, as our study aim was to identify transfusion rates and characterize the transfused cohort. This sample represents cases from 2 surgeons at a single institution and may not be generalizable to all populations. Furthermore, there was no standard protocol for transfusion initiation, and the threshold was determined on a case-by-case basis by the treatment team. No multivariate analysis was performed because of the limited sample requiring a transfusion.

## Conclusions

In summary, performing a preoperative routine T&S is likely unnecessary at academic medical centers. This study demonstrated that transfusion after primary unilateral THA and TKA is exceedingly uncommon (1.06%), and no case in this sample required emergent or intraoperative transfusion. The mean preoperative hemoglobin of those transfused was 10.8 g/dL, and in the 2 uncomplicated patients, the preoperative hemoglobin was less than 11 g/dL. Therefore, the authors propose that routine preoperative T&S is unnecessary for uncomplicated primary THA and TKA at academic hospitals. Consideration for obtaining a T&S may include complex primary surgeries when increased blood loss is anticipated or when patients have preoperative hemoglobin of less than 11 g/dL. However, with such a low transfusion rate, obtaining a T&S should be considered on a case-by-case basis using clinical judgment.

## Conflict of Interests

M.J. Spanghel receives royalties from BodyCad, receives research support from DePuy Synthes and Stryker, receives other financial or material support from Zimmer Biomet, is a member of the editorial or governing board of *Arthroplasty Today* and the *Journal of Arthroplasty*, and is a board or committee member for the AAHKS; all other authors declare no potential conflicts of interest.

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