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Original Research

Routine Type and Screens Are Unnecessary in Primary Total Joint Arthroplasty: Follow-up After a Change in Practice

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ABSTRACT

Background: Routine type and screens (T&S) prior to total hip (THA) and total knee arthroplasty (TKA) are common despite low transfusion rates. Our institution implemented a practice change after previously demonstrating a transfusion rate of 1.06%. The purpose of this study is to present the follow-up data 1 year after the practice change of discontinuing routine T&S orders in primary total joint arthroplasty.

Methods: A practice change was implemented discontinuing routine T&S orders prior to elective primary total joint arthroplasties. We retrospectively reviewed prospectively collected data on preoperative T&S, hemoglobin values, transfusion rates, bleeding disorders, and anticoagulation status.

Results: A total of 663 patients were included in the study (273 THAs and 390 TKAs). The cumulative transfusion rate was 0.75. No patients received an intraoperative transfusion. Three patients (1.1%) received a postoperative transfusion after THA, and 3 patients (0.5%) received a transfusion after TKA. The mean preoperative hemoglobin in the transfused patients was 12.1 g/dL. Thirteen patients underwent a preoperative T&S (2.0%), and only 2 required transfusion (15.4%). Only 1 patient who required transfusion was on preoperative anticoagulation, and no patients with bleeding disorders required transfusions. Discontinuing routine T&S resulted in an estimated cost savings of $124,325.50.

Conclusions: Discontinuation of routine T&S did not result in any adverse consequences. If required, T&S can safely be performed intraoperatively or postoperatively. Surgeons may consider obtaining a T&S if their preoperative hemoglobin is less than 11-12 g/dL or if significant blood loss is expected in a complex primary total joint arthroplasty.

Introduction

Perioperative blood management protocols in total hip (THAs) and knee arthroplasties (TKAs) have undergone dramatic changes over the last several decades. Before the implementation of modern surgical techniques, medical optimization, and blood management strategies, transfusion rates were as high as 68% [1]. Accordingly, routine type and screen (T&S) was performed to prepare for transfusion requirements during and after arthroplasty procedures. However, recent data suggest that contemporary transfusion rates have declined [2–4]. These reduced rates are likely secondary to improved preoperative treatment of anemia and appropriate use of evidence-based transfusion thresholds. Furthermore, administration of tranexamic acid (TXA) has enhanced perioperative hemostasis [5–9].

Institutions have begun updating protocols for use of blood products and related testing to minimize unnecessary costs without sacrificing patient safety. In the era of value-based health care and the bundle payment model, reduction of unnecessary testing allows for resource rollover to interventions that create value for the patient, including implant costs and postoperative rehabilitation [10–12]. Previous studies have found cost savings of nearly $200 per patient and potentially hundreds of millions annually across the U.S. health care system [9,13].

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Our institution recently evaluated the perioperative transfusion rates and demonstrated a rate of 1.06% after primary THA and TKA [14]. This study called into question the utility of routine T&S prior to elective primary total joint arthroplasty (TJA). Consequently, we recommended discontinuation of T&S orders unless preoperative hemoglobin was less than 11 g/dL due to the low transfusion rate even among patients with bleeding disorders and patients on anticoagulation [14].

The aim of the present study is to summarize the prospectively collected transfusion and hemoglobin data after these practice changes were implemented. We sought to evaluate if there were any adverse consequences of discontinuing routine T&S ordering, including increased transfusion rates and requirement for emergent T&S among arthroplasty patients. Additionally, we sought to determine whether there was a decrease in cost for patients after this change in practice was implemented. We hypothesized that discontinuing the use of routine T&S in primary TJA would not result in adverse consequences for patients and would ultimately decrease the cost of care.

Material and methods

Institutional review board approval was obtained prior to the initiation of the study. The methodology in this protocol is similar to that in previously published work [14]. Briefly, our institution implemented a departmental practice change, eliminating the use of routine T&S prior to elective, unilateral primary THA and TKA. Beginning on February 1, 2021, a practice change was implemented, and data were collected in a prospective manner on transfusion rates, type, and screen status; hemoglobin values; anticoagulation status; and other comorbidities that increase bleeding risk. Patients included in the study underwent primary hip or knee arthroplasty by 1 of 3 fellowship-trained arthroplasty surgeons. Patients were excluded from the study if they underwent THA or TKA for fracture, hemiarthroplasties, unicompartmental knee arthroplasties, simultaneous bilateral TJA, or additional surgery during the same admission. A retrospective review of this prospectively collected data was performed on patients who underwent primary TJA during the 1-year period after the implementation of the practice change (February 1, 2021, to January 31, 2022).

Results

In total, 711 patients were eligible for this study. Patients were excluded for the following factors: hemiarthroplasty (10 patients), unicompartmental knee arthroplasty (25 patients), hip fracture (6 patients), postoperative periprosthetic fractures requiring a revision surgery (2 patients), postoperative bowel perforation requiring sigmoidectomy (1 patient), and bilateral simultaneous TJA (4 patients). In total, 663 patients were included in the study for final analysis: 273 THAs and 390 TKAs.

Of the 663 total patients, only 5 required a transfusion during their admission for a transfusion rate of 0.75%. Three of the THA patients (1.1%) and 2 of the TKA patients (0.5%) required transfusion. All 5 patients received a postoperative transfusion (Table 1). There were no emergent or intraoperative transfusions. The mean hemoglobin level of the transfused cohort was 12.1 g/dL, and the mean blood loss reported was 180 mL (Table 2). Two of the 5 patients who received a postoperative transfusion had a preoperative T&S.

Table 1
Transfusion rates before and after implementation of the change in practice.

Transfusion rates		
Procedure	2021 Prior to practice change	2022 After practice change
THA	3/210 (1.43%)	3/273 (1.10%)
TKA	1/169 (0.59%)	2/390 (0.51%)
Total	4/379 (1.06%)	5/663 (0.75%)

Thirteen total patients had a T&S performed preoperatively (2.0%). The reasons for preoperative T&S in 6 patients included complex cases (up to the surgeon's discretion) with higher anticipated blood loss, bleeding history, and preoperative anemia. In 7 patients, it was not clear from the chart why a T&S was performed. Sixty-six patients in this cohort were on preoperative anticoagulation (10%). Only 1 patient who required transfusion was on preoperative anticoagulation. Eighteen patients had a bleeding disorder, and none required transfusion.

The potential cost savings was a secondary outcome of interest in this cohort. The total cost per patient was calculated by adding the cost of ABO blood typing ($106.97), Rh blood typing ($32.89), and red blood cell antibody screening ($51.41) for a total cost of $191.27 per patient based on the Centers for Medicaid and Medicare Services Healthcare Common Procedure Coding System. In this group of 663 patients, the total cost savings was $124,325.50 for the 650 patients who did not receive a preoperative T&S.

Discussion

These data demonstrate that after the discontinuation of routine T&S prior to TJA, there were no adverse consequences, as the transfusion rates were comparable before and after the institutional change was implemented (1.06% and 0.75%, respectively). No patients required emergent or intraoperative transfusions. These low rates in our cohort are consistent with trends in recent literature, which cite greater than two- and three-fold reductions in transfusion rates for THA and TKA from 2007 to 2015, respectively [5,15]. While TJA traditionally involved significant blood loss and high rates of transfusion, multimodal prevention of anemia has greatly reduced the use of blood products in the modern era [6–9,15]. Holt et al. found a significant reduction in transfusion rate to 1.4% through the use of preoperative hemoglobin screening, TXA, and evidence-based transfusion thresholds [7]. Other studies have corroborated the efficacy of TXA in reducing acute blood loss anemia [16–20]. At our institution, all patients undergo a comprehensive preoperative evaluation of medical comorbidities, including cardiovascular, pulmonary, and hematologic risk factors. These evaluations include the review of a complete blood count, basic metabolic panel, and coagulation studies. If anemia is discovered, an appropriate workup and corresponding treatment is initiated prior to TJA. All patients receive a standard 2-g dose of TXA perioperatively in addition to weight-based dosing of local periarticular injection containing ropivacaine, epinephrine, and ketorolac [21]. Blood products are given in accordance with evidence-based hemoglobin thresholds of 7 g/dL and 8 g/dL for patients with a cardiovascular disease [22,23].

Despite reductions in transfusion rates, few studies have implemented practice changes for routine T&S evaluation in low-risk patients [6,9]. Importantly, the use of a routine preoperative T&S would not have prevented transfusion for the patients who ultimately required blood products. Of the 5 patients in our cohort requiring transfusion, 3 did not meet the preoperative T&S criteria of hemoglobin levels less than 11 g/dL. Reasons for transfusion in these 5 patients included increased intraoperative blood loss (2/5, 40%), preoperative anemia (1/5, 20%), a complex case involving hardware removal (1/5, 20%), and postoperative gastrointestinal hemorrhage (1/5, 20%).

Preoperative anemia has previously been shown to be a risk factor for transfusion [1,8,24,25]. From a cohort of 1457 patients who underwent primary unilateral TKA, Yeh et al. determined that preoperative T&S was warranted for patients with hemoglobin

Table 2
Transfused cohort perioperative data.

Transfused cohort perioperative data										
Patient	Procedure	Preop Hgb (g/dL)	Postop Hgb (g/dL)	Change in Hgb (g/dL)	Estimated blood loss (mL)	Transfused POD	Total quantity transfused (units PRBCs)	Preop anticoagulation?	Bleeding disorder present?	Notes
1	TKA	11.4	6	5.4	50	POD 3	1	N	N	Primary TKA complicated by postop ulcer gastric hemorrhage
2	THA	10.4	6.7	3.7	250	POD 2	1	Warfarin	N	THA for failed cephalomedullary nail with hardware removal
3	TKA	11.5	6.5	5	100	POD 2	1	N	N	History of chronic macrocytic anemia
4	THA	14.5	7	7.5	200	POD 6	1	N	N	Likely combination of postoperative blood loss anemia and dilutional with SIADH
5	THA	12.9	7.1	5.8	300	POD 0	1	N	N	Primary THA DAA
Average		12.1	6.7	5.5	180.0					

Hgb, hemoglobin; POD, postoperative day; SIADH, syndrome of inappropriate antidiuretic hormone secretion; DAA, direct anterior approach; N, no; PRBC, packed red blood cells.

levels of <12.4 g/dL for age >70 years and 12.1 g/dL for age <70 years [25]. All patients in our cohort with a hemoglobin level less than 11 g/dL underwent T&S prior to the surgery in accordance with our institutional protocol based on a previous study [14]. However, only 2 of 13 (15.4%) patients who met the screening criteria threshold (Hgb <11 g/dL) required transfusion. While anemic patients are at higher risk of transfusion than the overall cohort (0.75%), these findings suggest that transfusion requirements are challenging to predict, even in the setting of low preoperative hemoglobin levels. Preoperative anticoagulation does not appear to be a risk factor for transfusion, as only 1 patient who required transfusion was on anticoagulation (1/66, 1.5%). Additionally, no patients with a bleeding disorder required a transfusion (0/18, 0%). The risk of transfusion after TJA is most likely related to surgical complexity, in addition to preoperative anemia. One patient in our cohort who required transfusion underwent a complex primary THA requiring removal of the intramedullary nail prior to placement of final implants. This patient received a preoperative T&S due to a screening hemoglobin level less than 11 g/dL. A previous study found that patients who underwent 2-component revision had a significantly increased rate of transfusion [15], which further suggests that this protocol for T&S may not be safely extrapolated to the revision setting.

In keeping with our previous cost savings predictions [14], we found a cumulative cost savings of $124,325.50 from this cohort of 650 patients who did not undergo routine T&S. This equated to $191.27 in savings per patient. As TKA and THA volumes are expected to climb to a combined 2 million cases annually by 2030 [13], system-wide health care savings could reach nearly half a billion for appropriately selected patients. These savings could be redistributed toward implant and rehabilitations costs, creating more value for the patient.

This study has several limitations. As a retrospective study, it is subject to possible misclassification biases. We attempted to control for all confounding variables, including anticoagulation status, medical comorbidities, and surgical complexity. However, our analysis is limited by the accuracy and completeness of details reported in the medical record. Additionally, the low number of transfusions reported in our cohort may limit our ability to detect associations as no multivariate analysis could be performed. Because our primary study aim was transfusion rate, we did not obtain or compare hemoglobin values of patients who did not receive transfusion. Institutional practice is in accordance with evidence-based transfusion protocols, but the decision to transfuse is determined on a case-by-case basis by the treatment team. Finally, the findings from our cohort may not be generalizable to all populations given the differences in demographic characteristics along with medical and surgical complexity.

Conclusion

In this study, we demonstrated that the transfusion rates in primary TJA are very low (0.75%) and that discontinuation of routine T&S did not result in any adverse consequences. Postoperative transfusion requirements are difficult to predict, and preoperative hemoglobin, bleeding disorders, blood loss, and anticoagulation status may not correlate well with transfusion needs. A T&S can safely be performed intraoperatively or postoperatively if required without compromising patient care.

Conflicts of interest

M. J. Spangehl is a member of the editorial or governing board of *Arthroplasty Today* and the *Journal of Arthroplasty*; is a consultant for Heraeus; has stock or stock options in Sonoran Biosciences; and

receives research support from DePuy and Stryker. H. D. Clarke is a consultant for and receives royalties from ConforMIS and Zimmer Biomet; is an unpaid consultant for OSSO VR; receives research support from Stryker; receives financial or material support from Journal of the American Academy of Orthopaedic Surgeons and American Academy of Orthopaedic Surgeons; is on the editorial board for JAAOS and Clinical Orthopedics and Related Research; and is a board member for AAOS, International Congress for Joint Replacement, Association of Bone and Joint Surgeons, and the Knee Society. All other authors declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.101077.

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