Effect of Tranexamic Acid on Transfusion Rates Following Total Joint Arthroplasty

A Cost and Comparative Effectiveness Analysis

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KEYWORDS

• Tranexamic acid • Primary joint arthroplasty • Cost comparative analysis • Blood transfusion

KEY POINTS

- Tranexamic acid (TXA) is useful in total joint arthroplasty to reduce blood loss and minimizes postoperative blood transfusions.
- Cost-containment is crucial, especially in regard to elective arthroplasty cases. TXA use helps decrease costs in total joint arthroplasty.
- TXA is safe and did not result in complications in this cohort.

INTRODUCTION

Bleeding is a major contributor to intraoperative and postoperative complications for total hip arthroplasty (THA) and total knee arthroplasty (TKA). Tranexamic acid (TXA) is a synthetic amino acid derivative of lysine that works by reversibly binding to plasminogen, thereby enhancing coagulation through prevention of fibrin degradation.[1,2] Several studies have demonstrated the safety and efficacy of TXA in reducing blood loss after primary and revision total joint arthroplasty (TJA),[3,4] and others have reported the potential risks of red blood cell (RBC) transfusions after surgical procedures.[5,6] However, these studies have all been in small participant populations. To understand the clinical effects of TXA therapy and its influence on comparative cost, safety, and effectiveness, a large cohort study using a standardized treatment protocol in primary TJA participants is necessary.

The purpose of this study was to evaluate the effectiveness of TXA in reducing transfusions and hospital costs of primary TJA. The authors' hypothesis was that TXA will minimize blood loss, thereby minimizing the need for transfusion and reducing costs after TJA.

Institutional Review Board approval was granted to complete this study. All authors have participated in the research. This paper has not been submitted to any other journal. No funding was received in the production of this publication.

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METHODS

Institutional review board approval was obtained and a retrospective analysis of participants who underwent elective primary TJA at a single orthopedic specialty hospital between 2012 and 2014 was conducted. The groups were categorized into 2 distinct cohorts:

1. Those who did not receive intravenous (IV) TXA
2. Those who received IV TXA.

All data were collected retrospectively using the hospital electronic medical record system by trained research assistants.

Participants or Study Subjects

In 2012, 856 and 969 consecutive primary THA and TKA participants who did not receive TXA were identified. During 2013, 1084 and 962 primary THA and TKA participants received TXA based on a department-wide protocol, which was implemented in 2013 at the authors' institution. The medical comorbidities and demographics of these participants were not matched.

Tranexamic Acid Protocol and Venous Thromboembolic Disease Prophylaxis

Both THA and TKA participants (in year 2013) received 1 g TXA after induction of anesthesia. THA participants received an additional 1 g of TXA before wound closure, whereas TKA participants received 1 g of TXA before release of the tourniquet.[7,8] However, participants were excluded from the TXA protocol if there was a history of coronary artery disease (CAD), stroke, and/or pulmonary embolism or deep venous thrombosis (DVT), per an institutional protocol. Both the 2012 and 2013 cohorts had the same venous thromboembolic disease (VTED) prevention protocol using enoxaparin, fondaparinux, rivaroxaban, or coumadin based on surgeon preference, unless contraindicated in cases of excessive bleeding risk or elevated coagulation studies. Most participants were treated beginning postoperative day 1 with 30 mg subcutaneously twice daily of enoxaparin while hospitalized and 40 mg subcutaneously daily after discharge, for a total of 28 days postoperation.

Description of Follow-up Routine

Participants were discharged to home, or rehabilitation facility, including skilled nursing facilities, based on rehabilitation medicine discharge protocol. Postoperative antibiotics were discontinued after 24 hours.

Definition of Outcome Variables and Measures

This study assessed and reported the number of units transfused, number of participants needed to treat with TXA to prevent 1 transfusion (ie, inverse of absolute risk reduction), direct hospital costs, transfusion and TXA costs, average length of stay (ALOS) in days, percentage of participants discharged to inpatient facilities, and their relationship to transfusion, as well as incidence of VTED, myocardial infarction (MI), and stroke. Transfusion rate was defined as the number of participants transfused with packed RBCs (PRBCs) divided by the number of participants in the cohort. The cost of transfusion was estimated by the total number of units of PRBC per unit cost. Actual and projected cost estimates were calculated.

Statistical Analysis

Descriptive statistics were used to describe the cohorts and their demographics. Categorical variables were analyzed using chi-square tests, whereas continuous data were analyzed using independent *t* or Mann Whitney U tests (based on distribution of data). We used relative risk reduction and number needed to treat to quantify the use of TXA needed to reduce a blood transfusion compared with the comparison group. All statistical analyses were performed with SPSS version 21.0 software (SPSS, Inc, Chicago, IL, USA) or Microsoft Excel 2010 (Microsoft, Redmond, WA, USA) and significance level was set at $P<.05$.

RESULTS

The average age of the non-TXA and TXA hip cohorts was 61 and 63 years, respectively. The average age for the non-TXA and TXA knee cohorts was 69 and 65, years respectively.

Among THA participants, 427 units of blood were transfused in 194 of 856 (22.7%) participants in the non-TXA cohort, whereas 248 units of blood were transfused in 129 of 1084 (11.9%) participants in the TXA cohort ($P<.001$). Among the TKA participants, 325 units of blood were transfused in 188 of 969 (19.4%) participants in the non-TXA cohort, whereas while 121 units of blood were transfused in 67 of 962 (7%) participants in the TXA cohort ($P<.001$). The number needed to treat with TXA to prevent 1 blood transfusion was 9.3 in the THA cohort and 8.0 in the TKA cohort, a 54.2% combined relative risk reduction.

The average costs of 1 g/10 mL TXA and 1 unit (PRBC) were $25.98 and $414.43,