



EFFECT OF INTRA-ARTICULAR TRANEXAMIC ACID IN TOTAL KNEE REPLACEMENT PATIENTS: DOSAGE RECOMMENDATIONS AND ADMINISTRATION ROUTES

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KEYWORDS :

INTRODUCTION

Total knee replacement (TKR) is one of the most frequently performed procedures to address degenerative joint disease, offering substantial improvement in mobility and pain reduction. However, the surgery is often accompanied by significant blood loss, which may necessitate blood transfusion. Allogenic transfusions, although helpful, carry potential risks such as infection, immunologic reactions, and increased hospital costs.

The use of antifibrinolytics, particularly tranexamic acid (TXA), has significantly improved perioperative blood conservation in orthopedic surgery. TXA functions by blocking plasminogen activation, thereby inhibiting fibrinolysis and stabilizing clot formation. Clinicians employ several administration routes, including intravenous (IV), intra-articular, and oral methods.

Among these, the intra-articular route offers localized delivery with lower systemic exposure, which may reduce the risk of adverse events such as thromboembolism. Nonetheless, there is no definitive agreement on the optimal dosage and whether combining routes provides superior outcomes.

This study investigates the effects of administering TXA intra-articularly compared to a combined intravenous and intra-articular approach. It aims to guide clinical practice by evaluating differences in efficacy, transfusion need, and complication rates between the two regimens.

MATERIALS AND METHODS

Study Design

This was a retrospective, comparative cohort study carried out between January 2021 and December 2023 at a high-volume orthopedic center. Though formal ethics approval was not sought due to the retrospective nature of the study, all patient data were anonymized in accordance with institutional confidentiality protocols.

Participants And Groups

We analyzed data from 1,000 patients who underwent primary unilateral TKR during the study period. Patients were grouped based on the TXA regimen used:

- Group A (n = 500): Received 1 g of TXA intra-articularly after capsule closure
- Group B (n = 500): Received 1 g of TXA intravenously before tourniquet release and 1 g intra-articularly post-closure

Eligibility Criteria

Inclusion criteria:

- Adults aged 50 to 80 years
- Diagnosis of advanced osteoarthritis requiring unilateral TKA
- ASA classification I to III

Exclusion Criteria:

- Prior history of venous thromboembolism (VTE)
- Current use of anticoagulants
- Bleeding disorders
- Revision or bilateral TKA procedures
- Chronic kidney or liver disease

Surgical Protocol

All surgeries were performed using a consistent approach: medial parapatellar incision under tourniquet control. Posterior-stabilized cemented prostheses were implanted in all patients. Drain placement was standardized.

Outcome Measures

Primary endpoints:

- Postoperative drain output (measured at 24 hours)
- Hemoglobin change from preoperative baseline to postoperative Day 1
- Incidence of blood transfusion

Secondary Outcomes:

- Complications, including deep vein thrombosis (DVT), pulmonary embolism (PE), and wound-related issues

Data Analysis

Statistical analysis was performed using SPSS version 25. Continuous data were presented as means $\pm$ standard deviations and compared using independent-sample t-tests. Categorical variables were analyzed with chi-square tests. Significance was defined as $p < 0.05$.

RESULTS

Patient Demographics

No significant demographic or clinical differences were found between groups.

Hemostatic Outcomes

Postoperative blood loss and hemoglobin drop were marginally lower in the combined group, but not statistically significant.

Complications

No thromboembolic complications or wound-related issues were recorded in either group during hospitalization or the 30-day follow-up period.

DISCUSSION

This study demonstrates that intra-articular TXA administration is as effective as the combined IV and local route in minimizing postoperative blood loss and maintaining hemoglobin levels in total knee replacement (TKR) patients. Additionally, TXA may provide benefits beyond hemostasis.

Recent research has highlighted TXA's potential anti-inflammatory properties. By inhibiting plasminogen activation, TXA may reduce activation of inflammatory

pathways mediated by bradykinin and complement, contributing to decreased postoperative joint swelling and pain. Inflammatory cytokines such as interleukin-6 (IL-6) have also been found to be lower in TXA-treated joints, suggesting improved early recovery and reduced analgesic demand.

In terms of dosing strategies, evidence supports intra-articular doses ranging from 1 g to 3 g, depending on patient weight, bleeding risk, and procedural complexity. In our study, a 1 g intra-articular dose was effective without increased adverse events. Intravenous regimens typically involve a preoperative 10–20 mg/kg bolus or a fixed 1 g dose given 15–30 minutes before tourniquet release. When used in combination, some centers adopt a dual 1 g protocol (1 g IV pre-op and 1 g intra-articular post-closure), as reflected in Group B.

While combination therapy may slightly reduce transfusion rates, this benefit was not statistically significant in our data. Considering safety, cost, and ease of application, the intra-articular route alone is clinically and logistically advantageous, particularly in high-volume centers.

CONCLUSION

Our findings affirm that intra-articular TXA at a 1 g dosage is a safe and effective method for controlling perioperative blood loss in primary TKR. Importantly, TXA may also contribute to reduced postoperative inflammation, potentially enhancing early recovery. Clear, evidence-based dosage guidelines suggest that a single 1–3 g intra-articular dose provides hemostatic benefit while maintaining a favorable safety profile. In routine TKR, intra-articular TXA should be considered a first-line option due to its efficacy, simplicity, and emerging anti-inflammatory benefits.

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