

Tranexamic Acid Administration Routes For Total Knee Arthroplasty

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Structured Abstract

Background

Patients undergoing total knee arthroplasty (TKA) present unique challenges for healthcare providers. With these procedures, blood loss is a major complication that can lead to anemia, delayed wound healing, joint contractures, and increased infection risk. Researchers report that the intra-operative administration of tranexamic acid (TXA) via peri-articular, intra-articular, or intravenous (IV) routes can lead to reduced blood loss and diminished transfusion requirements for patients post-operatively. While TXA has been routinely administered as an IV injection, this route only allows a small portion of the agent to reach the target tissue. In addition, the systemic effects and increased risk of venous thromboembolism associated with intravenous TXA can cause concern for specific patient populations (e.g., cardiovascular disease, strong history of thromboembolic events, renal impairment). The peri-articular and intra-articular approaches to TXA administration have recently been adopted as an alternative to IV TXA. These alternative TXA administration routes result in diminished systemic absorption while still achieving a reduction in blood loss and post-operative transfusion requirements.

A 59-year-old female with coronary artery disease presented for a left TKA. The anesthesia plan for the patient included monitored anesthesia care using intravenous IV dexmedetomidine and propofol infusions with the placement of spinal and adductor canal blocks. Prior to pneumatic tourniquet inflation, the patient received an initial dose of IV TXA (1,000mg/100mL) via a secondary infusion over 15 minutes. As the surgeon began wound closure, the pneumatic tourniquet was deflated and a second dose of IV TXA (1,000mg/100mL) was administered over 15 minutes. The patient remained hemodynamically stable throughout the case. Total surgical blood loss was 350mL; the patient did not require a blood transfusion.

Clinical Question

In patients undergoing TKA, how does intra-operative administration of peri-articular or intra-articular TXA compare to intravenous administration on blood loss in the initial post-operative 24-hour period?

Evidence Based Discussion

For patients undergoing TKA, the peri-articular, intra-articular, and combination approaches to TXA administration have recently been adopted as alternatives to IV TXA use.

Patients who received peri-articular TXA had significantly lower total and hidden blood loss compared to those who received IV TXA. In addition, bilateral TKA patients who received peri-articular TXA had significantly lower drain output than those that received intra-articular TXA. Recent studies have also found that patients who received peri-articular TXA showed significant

reductions in post-operative hematocrit changes compared to those who received intra-articular or IV TXA.

Another alternative approach for TXA administration that has been studied in recent clinical trials is the intra-articular route. Studies comparing intravenous TXA and intra-articular TXA have had mixed results regarding effects on blood loss, drainage output, and post-operative complication rates. While some trials have reported superior outcomes regarding total blood loss and drain output with intra-articular TXA use, others have shown no significant differences in outcomes between intra-articular and IV TXA groups.

In an effort to discover the most ideal route of TXA administration, recent studies have evaluated the effects of a combined approach where patients receive both intra-articular and IV TXA during TKA. The results from these studies show that total blood loss and drain output for the combined TXA group was significantly lower than those for groups who received IV or intra-articular TXA alone. There were no significant differences in post-operative transfusion rates or thromboembolic complication rates between the groups.

Translation to Practice

Further research is still needed to determine the optimal dosage and route for TXA administration in TKA patients. Current guidelines for topical TXA recommend preparing 2g in 100mL of 0.9% sodium chloride and administering prior to wound closure. For IV TXA, the recommended dosage is 10-15mg/kg bolus prior to the start of the procedure with an additional 10-15mg/kg bolus during incision closure. The maximum dosage recommended for IV TXA is 40mg/kg per day. Administering IV TXA in doses exceeding 40mg/kg per day can lead to toxicity and TXA-induced seizures.

In addition to evaluating blood loss and drainage output, further studies should evaluate differences in hematoma incidence, visual analog scale (VAS) pain scores, functional joint outcomes (knee range-of-motion, gait distance), and cost differences between the administration routes. Future studies should also investigate TXA use in high-risk patient populations (e.g., cardiovascular disease, strong history of thromboembolic events, renal impairment) to determine which administration route is associated with the best safety profile.

A pilot study focusing on TKA patients receiving high-dose combination TXA (IV dose 10mg/kg with 2g intra-articular) that included high-risk patients should be developed and data gathered. The results from this pilot study would be disseminated to clinicians who can develop safer evidence-based protocols regarding TXA use.

Recent evidence shows that intra-articular, peri-articular, and combination approaches (IV and intra-articular) to TXA administration can reduce blood loss and drainage output without increasing risks of peri-operative complications. These treatment modalities should be considered acceptable alternatives to intravenous only administration for patients undergoing TKA.

References

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