The Use of Intravenous Tranexamic Acid Does Not Improve Arthroscopic Visualization in Shoulder Surgery: A Randomized Controlled Trial

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INTRODUCTION: Adequate visual clarity is paramount to performing arthroscopic shoulder surgery safely, efficiently, and effectively. The addition of epinephrine in irrigation fluid, and the intravenous or local administration of tranexamic acid (TXA) have independently been reported to decrease bleeding thereby improving the surgeon's visualization during arthroscopic shoulder procedures. No study has compared the effect of systemic administered TXA, epinephrine added in the irrigation fluid or the combination of both TXA and epinephrine on visual clarity during shoulder arthroscopy with a placebo group. The purpose of this study is to determine if intravenous TXA is an effective alternative to epinephrine delivered by a pressure-controlled pump in improving arthroscopic shoulder visualization during arthroscopic procedures and whether using both TXA and epinephrine together has an additive effect in improving visualization.

METHODS: The design of the study was a double-blinded, randomized controlled trial with four 1:1:1:1 parallel groups conducted at one center. Patients aged ≥18 years undergoing arthroscopic shoulder procedures including rotator cuff repair, arthroscopic biceps tenotomy/tenodesis, distal clavicle excision, subacromial decompression, and labral repair by five fellowship-trained upper extremity surgeons were randomized into one of four arms: Pressure pump-controlled regular saline irrigation fluid (control), epinephrine (1ml of 1:1000) mixed in irrigation fluid (EPI), 1g intravenous TXA (TXA), and epinephrine and TXA (EPI/TXA). Visualization was rated on a 4-point Likert scale every 15 minutes with 0 indicating 'poor' quality and 3 indicating 'excellent' quality. The primary outcome measure was the unweighted mean of these ratings. Secondary outcomes included mean arterial blood pressure (MAP), surgery duration, surgery complexity, and adverse events within the first postoperative week. Unweighted means (SD) were calculated for visualization and mean arterial pressure (MAP) for each patient. Study group allocation was represented with epinephrine and tranexamic acid being coded in dichotomous variables (used or not used) for each patient. A step-wise linear regression was performed using visualization as the dependent variable and a series of independent variables considered for inclusion: epinephrine, tranexamic acid, surgery duration, complexity, mean arterial pressure, increase in pump pressure, and volume of irrigation fluid. All statistical tests were considered significant if $p<0.05$.

RESULTS: One-hundred-twenty-eight participants with a mean age (± SD) of 56 (± 11) years were randomized. Figure 1 presents the patient flow through the study. Mean visualization quality for the control, TXA, EPI, and EPI/TXA groups were 2.1 (±0.40), 2.1 (±0.52), 2.6 (±0.37), 2.6 (±0.35), respectively. In a regression model with visual quality as the dependent variable, the presence/absence of EPI was the most significant predictor of visualization quality ($R=0.525$; $p<0.001$). TXA presence/absence had no effect, and there was no interaction between TXA and EPI. The addition of MAP and surgery duration strengthened the model ($R=0.529$; $p<0.001$). Increased MAP and surgery duration were both associated with decreased visualization quality. When surgery duration was controlled, surgery complexity was not a significant predictor of visualization quality. No adverse events were recorded in any of the groups.

DISCUSSION AND CONCLUSION: Our study found that epinephrine improves visualization compared to a control, tranexamic acid does not improve visualization compared to a control, and that there is no advantage to using tranexamic acid and epinephrine in combination.

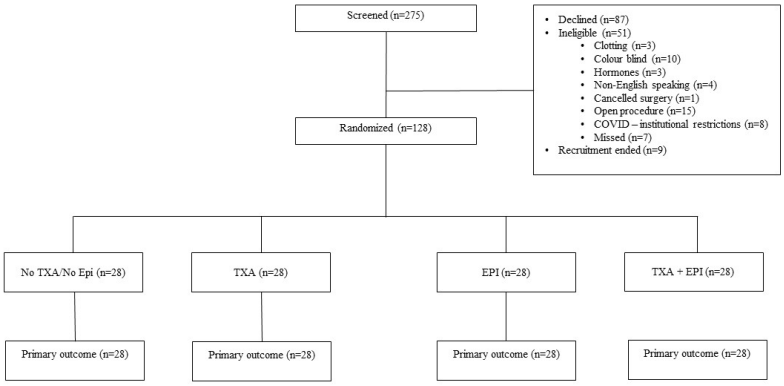

Figure 1. Patient flow through study.