Comparing Intra-Articular and Intravenous Route of Tranexamic Acid Administration and Evaluating its Efficacy in Preventing Blood Loss during Hip Replacement Surgery

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INTRODUCTION:

Total Hip Replacement (THR) is one of the most common major elective orthopaedic surgeries. By 2030 the demand for primary total hip arthroplasty is estimated to grow by 174% to 572,000. Blood loss in THR is about 700mL to 2000mL. This blood loss may lead to acute anemia and therefore the risk of perioperative cardiovascular complications. The incidence of major bleeding events (requiring more than two red blood cell (RBC) packs or reoperation or causing death) is 1.4%.

Blood transfusion remains the mainstay treatment for blood loss during major surgeries and trauma induced coagulopathy. Perioperative transfusions are associated with several risks, including transmission of infectious agents, hemolytic transfusion reaction, surgical site infection acute lung damage, circulatory overload, increased associated costs, prolonged hospital stays, and short-term mortality. Pharmacological methods that have been used to treat coagulopathy include antifibrinolytics like Tranexemic acid (TXA), aminocaproic acid, aprotinin, recombinant factor concentrates including Recombinant factor VIIa, prothrombin complex concentrate (PCC), and fibrinogen.

TXA is a synthetic analog of amino acid lysine which exerts its antifibrinolytic effect by blocking lysine binding sites on plasminogen and inhibiting fibrinolysis. TXA can be administered intravenously (IV), topically, orally, and in combination of these. However the efficient route of administration still remains controversial.

This study aimed to determine the safe and superior route to use TXA when administered either topically or intravenously and to compare postoperative hemoglobin decline, transfusion rates, the incidence rate of DVT, PE, and wound infection.

METHODS:

In this randomized prospective double blind comparative study 120 patients aged 18 and above belonging to either sex with ASA grade I-III and preoperative hemoglobin levels of 10g/dL and above (as per institutional protocol) undergoing hip replacement surgery under combined spinal epidural anesthesia were randomized into three equal groups destined to receive normal saline 15 mL IV + normal saline 15mL intra-articular infiltration (Group A) or tranexamic acid 15 mg/kg IV + normal saline 15 mL intra-articular infiltration (Group B) or normal saline 15 mL IV + Tranexamic acid 15 mg/kg intra-articular infiltration (Group C).

Patients with allergy to tranexamic acid, ASA Grade IV and higher, known thromboembolic complications, deep Vein Thrombosis (DVT), pulmonary embolism, hemoglobin levels less than 10g/dL, preoperative blood transfusion, patients on anti-coagulants, and refusal to participate were excluded from the study. Preoperative and 24-hour postoperative hemogram and number of PCV transfusions was recorded and analyzed. The outcome was measured in terms of fall in hemoglobin when compared to the preoperative values 24 hours after the surgery. The need for transmission of more than 1 unit PCV was recorded.

RESULTS:

We found that perioperative blood loss was significantly low in TXA treated group than in placebo group [Mean postoperative Hb; Placebo: 10.88 ± 1.31, TXA Local: 12.89 ± 1.35, TXA-IV: 12.58 ± 1.53 (p value - < .00001)]. The magnitude of fall in Hb and HCT were significantly low in TXA Local group compared to TXA IV group. [Mean fall in Hb; Placebo: 1.69 ± 0.74, TXA Local: -0.42 ± 0.41, TXA-IV: 0.03 ± 0.41, Mean fall in HCT; Placebo: - 4.39 ±1.83, TXA Local: -1.80 ± 2.16, TXA-IV: -0.53 ± 1.81]. Mean blood transfusion rates significantly varied among the three groups as Placebo: 1.38 ± 0.58, TXA Local: 1.03 ± 0.16, and TXA IV: 1.05 ±0.22 (p value -0.000043).

Thirteen of 40 (32.5%) received additional transfusion in Placebo group as compared to 1/40 (2.5%) in TXA – Local group and 2/40 patients (5%) in the TXA – IV groups which was statistically significant (Chi – square test p value: 0.000068). Post Hoc Tukey values of the 3 groups showed significant difference in the transfusion rates between Placebo – TXA local groups (p value : 0.00015) and Placebo – TXA IV groups (p value: 0.00047) whereas there was no statistically significant difference in the transfusion rates between TXA Local – TXA IV groups (p value: 0.95162). There was no incidence of thromboembolic complications (like DVT, PE), allergic reactions, and wound infections in any of the study participants.

DISCUSSION AND CONCLUSION:

The study found that tranexamic acid reduced the postoperative blood loss in hip replacement surgeries when given topically or intravenously. However, the topical route was found to be superior to the intravenous route. The present study found that the use of tranexamic acid reduces blood loss in hip replacement surgeries when administered topically (intra-articular) and intravenously. Perioperative treatment with TXA significantly decreases the fall in hemoglobin, hematocrit, blood transfusion rates, and the cost of patient management. Topical route of administration is superior to intravenous route of administration. TXA administration does not increase the incidence of DVT, PE, and wound infection. In our study

we noted that perioperative treatment with TXA in intravenous or topical route significantly decreased the blood transfusion rates and the cost of anesthetic management. The risks of anemia must be weighed against the need for transfusion since transfusion of blood and blood products have their own complications. Simple pharmacologic methods and blood sparing strategies like use of TXA evades this risk with minimal side-effects.