

Comparison of Intravenous and Intra-Articular Use of Tranexamic Acid on Blood Loss after Primary Total Knee Arthroplasty

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Abstract

Original Research Article

Total Knee Arthroplasty is associated with significant amount of blood loss and may increase the need of blood transfusions. Various blood loss management strategies have been used in the past and Tranexamic Acid is one such commonly used method due to ease of administration and low cost. The use of TXA in primary TKA is associated with reduced transfusion rates, early discharge to home, and reduced economic burden on the patient. Tranexamic Acid can be administered through various routes that include oral, intravenous and intra-articular. However there is no clear consensus on the ideal dosage and route of administration. This study was conducted to compare the effect of intra-venous Tranexamic acid with intra-articular Tranexamic acid on post-operative blood loss after unilateral primary total knee arthroplasty (TKA). A total of 58 patients of either gender planned to undergo unilateral total knee replacement (TKR) were enrolled in each of the two groups. In group A (Intra venous Tranexamic acid group) 2 gram intra venous Tranexamic acid was injected. In Group B (Intra-articular Tranexamic acid group), patients were given 2 gram intra-articular Tranexamic acid. All patients were followed up to 72 hours after completion of surgery. Blood collection in negative suction drain was noted after every 24 hours. The mean drainage total blood loss during 72 hours was 637.32 ± 103.53 ml in Group A (intravenous Tranexamic acid) and 546.35 ± 70.73 ml in Group B (Intra-articular Tranexamic acid). The difference was significant in Group A and Group B. Patients who received intra-articular TXA had a lesser drain output ($p < 0.05$) as compared to intravenous administration of Tranexamic Acid. Intra-articular administration of TXA is more effective in reducing postoperative blood loss after primary TKA as compared to intravenous route.

Keywords: Blood loss, Intravenous, Intra-articular, Total knee arthroplasty, Tranexamic acid.

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INTRODUCTION

Although Total Knee Arthroplasty (TKA) is one of the most successful surgeries done to relieve pain of severe Osteoarthritis Knee, but the blood loss during the surgery and post-operatively is estimated to be 800mL-1200 mL and therefore remains a major issue [1]. TKA is one of the most common reasons for allogenic blood transfusion in patients undergoing surgery [2]. Allogenic blood transfusions are associated with many risks that include hemolytic reaction, fluid and hemodynamic overload, acute lung injury, coagulopathy, allergic reaction, febrile non-hemolytic reaction and risks of disease transmission [3]. Therefore blood management strategies aim at reducing the need for allogenic blood transfusions but preventing the anaemia as well.

Tranexamic acid (TXA) is an antifibrinolytic agent that promotes the formation of stable hemostasis

and is effective in reducing blood loss during total knee arthroplasty (TKA) [4]. TXA inhibits the activation of plasminogen to plasmin by blocking the lysine binding sites of plasminogen to fibrin. The result is decreased proteolytic action on fibrin monomers and fibrinogen, leading to clot stabilization [5]. The use of TXA in primary TKA is associated with reduced transfusion rates, reduced duration of hospital stay and decreased economic burden on the patient [6]. While TXA have been reported to be used by oral, intra-articular and intravenous routes in total knee arthroplasty (TKA), there is no clear consensus on the optimal route of administration [7, 8].

OBJECTIVE

The objective of the study was to compare the effect of intra-venous Tranexamic acid with intra-articular Tranexamic Acid on drainage blood loss after unilateral primary total knee arthroplasty (TKA).

MATERIAL AND METHODS

In this study a total of 56 patients of severe osteoarthritis of knee enrolled for unilateral primary total knee arthroplasty(TKA) admitted in Orthopaedics Department of Adesh Institute of Medical Sciences and Research (AIMSR), Bathinda, Punjab from January 2020 to July 2020 who fulfill the inclusion criteria are included. All the patients were operated by the same surgical team. Informed consent from patients was taken. Approval from Institutional Ethical Committee was taken. Selected patients were divided into two groups. Patients in which intravenous Tranexamic acid was given, were allotted Group A. Group B consisted of the patients in which intra-articular Tranexamic acid was given.

Inclusion Criteria

Patients of age 45-71 years of either gender presenting with Osteoarthritis knee and planned to undergo unilateral primary TKA.

Exclusion Criteria

Patients with major deformities that would lead to extensive bone cuts or release of a more extensive area of soft tissue, patients who had undergone previous surgeries of the same knee, INR>2, haemoglobin<10gm/dL, taking atorvastatins or aspirin, cardiac disease, IV drug abuser, alcoholics, thalassemia or leukemia, thrombocytopenia, idiopathic thrombocytopenic purpura, deep vein thrombosis were excluded.

Procedure

All surgeries are done under spinal anaesthesia by single surgical team through midline vertical skin incision. Arthrotomy was done through medial parapatellar approach. Tourniquet was inflated at pressure of 350 mmHg before giving skin incision. Trial implant was put after making appropriate bone cuts and soft tissue releases. Cemented prosthesis was implanted after washing the bone surfaces with Pulse lavage. In Group A (I.v. Tranexamic group) 1 gram Tranexamic acid was given through intra venous route 15 minutes before tourniquet release. Second dose of 1gram Tranexamic acid was given 3 hours after surgery.

Wound was stitched in layers over negative suction drain. 50ml of normal saline was injected intra-articularly before doing dressing. In Group B, 2 gram Tranexamic acid diluted in 50 ml normal saline was injected intra-articularly. Tourniquet was released after closure of wound. Drain was clamped for 15 minutes for absorption of Tranexamic acid. Patient was shifted to post surgical care facility. Patients were followed up for next 72 hours. Blood loss (collected in negative suction drain) was noted after every 24 hours for next 72 hours.

Data Analysis

Data was analysed using OpenEpi software. By taking p -value ≤ 0.05 as statistically significant, for comparing mean of these various variables, independent sample test t -test was applied. Mean and standard deviations were calculated for age and blood loss.

RESULTS

Mean age of patients In Group A (i.v Tranexamic Acid) was 57.78 ± 6.74 years, in Group B (Intra articular Tranexamic acid) was 58.75 ± 6.97 years. Male to female ratio in Group A was 10:18 and in Group B was 11:17. There were 4(14%) hypertensive patients in group A and 5(18%) in Group B and 2(7%) diabetic patients in Group A and 3(11%) in Group B. (Table 1)

The mean blood loss during first 24 hours was 270.25 ± 41.76 ml in Group A and 220.17 ± 37.86 ml in Group B. The difference was statistically significant ($p=0.0000182$). The mean blood loss during next 24 hours was 214.39 ± 42.56 ml in Group A and 192.10 ± 24.06 ml in Group B. The difference was significant ($p=0.0192$). The mean blood loss during next 24 hours was 152.67 ± 29.43 ml in Group A and 134.10 ± 26.67 ml in Group B. The difference was significant in Group A and Group B ($p=0.0165$). The mean drainage total blood loss during 72 hours was 637.32 ± 103.53 ml in Group A (intravenous Tranexamic acid)) and 546.35 ± 70.73 ml in Group B (Intra-articular Tranexamic acid). The difference was significant in Group A and Group B ($p=0.000326$). (Table 2)

Table-1: Demography of patients in two groups

	I.v. Tranexamic acid group	Intra-articular Tranexamic acid group
Number	28	28
Age (years)	57.78 ± 6.74	58.75 ± 6.97
Male	10	11
Female	18	17
Hypertension	4(14%)	5(18%)
Diabetes	2(7%)	3(11%)

Table-2: Comparison of blood loss between two groups (ml)

	I.v. Tranexamic acid group	Intra-articular Tranexamic acid group	p-value
N	28	28	
First 24 hour	270.25±41.76	220.17±37.86	=0.0000182
Second 24hour	214.39±42.56	192.10±24.06	=0.0192
Third 24 hours	152.67±29.43	134.10±26.67	=0.0165
Total blood loss(after 72 hours)	637.32±103.53	546.35±70.73	=0.000326

DISCUSSION

Different measures are used to reduce intra operative blood loss have been employed in orthopedic surgery to reduce the need for transfusion and hasten the patient's recovery in the post-operative period [9]. One technique is transfusion of autologous blood which also reduces the risk of infection and risk of transfusion reaction but it is expensive and not every center has facility for this [9, 10]. Another technique to reduce perioperative blood loss is the application of anti-fibrinolytic agents including aprotinin, epsilon-aminocaproic acid, and tranexamic acid (TXA). Among them, Tranexamic acid is used most commonly. It can be given intravenous or intra-articular during the surgery [11].

In our study, we concluded that intra-articular administration of 2 gram Tranexamic Acid is more effective in reducing drainage blood loss after unilateral primary TKA as compared to intra venous route. The difference in post operative blood loss between Group A(intra venous Tranexamic acid) and group B(Intra articular Tranexamic acid) is statistically significant ($p=0.000326$). Similar results have been reported by various other studies.

Yuhui Wang *et al.* concluded that intra-articular injection of tranexamic acid has significant hemostatic effect for TKA surgery and it can effectively reduce the occult blood loss, postoperative drainage volume as well as total blood loss and prevent the incidence of deep venous thrombosis and improve the prognosis in patients of practical application value [12].

The study by Seo JG *et al.* showed that as compared to intravenous administration, intra-articular administration of Tranexamic Acid seems to be more effective in terms of reducing blood loss and transfusion frequency. Tranexamic Acid may improve the general conditions of patients given TKA by maintaining a hemodynamically stable state, aiding in recovery, and reducing the chance of transfusion-associated side effects and complications [13].

Prakash J *et al.* showed that intra-articular administration through drain and IV administration are equally effective and superior to topical wash method in reducing blood loss, haemoglobin fall and transfusion requirements [14].

The meta-analysis conducted by Shin YS *et al* indicates that IV administration of 10 mg/kg of TXA 20 min before inflation of the tourniquet followed by 10 mg/kg of TXA 15 min before deflation of the tourniquet is effective and safe. The topical administration of 2 g of TXA mixed with 100 mL of normal saline after wound closure could be an alternative option in patients at greater risk of thromboembolic complications [15].

The biggest limitation of this study is that it is an observational study and there may have been a bias during selection of the patients. Secondly, the intra-operative blood loss was not evaluated. Thirdly, the effects of intra-venous and intra-articular tranexamic acid on coagulation profile should also have been compared as it can be expected that intra-articular tranexamic acid may not be having as much systemic deleterious effects as expected from intravenous administration.

CONCLUSION

Tranexamic acid effectively reduces the post-operative drainage blood loss given through both the intra-articular or intravenous route. However there is less post-operative blood loss in patients who received tranexamic Acid through the intra-articular route. Due to convenience of use, the intra-articular route of administration of tranexamic acid after primary TKA may be considered for future practice.

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