Retrospective Study on transfusion requirements and deep vein thrombosis incidence with the use of Tranexamic acid on total knee replacement

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ABSTRACT

BACKGROUND

Total knee replacement is often associated with significant blood loss and increased rate of blood transfusion. Tranexamic acid is a potent anti-fibrinolytic agent and its use in major surgeries has shown to decrease blood loss as well as transfusion rates. It is used intravenous, oral and topical forms as well. This study aims to find out the effectiveness of systemic Tranexamic acid in terms of decrease in transfusion rate as well incidence of deep vein thrombosis (DVT) and thromboembolism.

MATERIAL AND METHODS

Total number of patients were 94 of which 58 had bilateral knees replacement and 36 patient underwent unilateral knee replacement over the period of 3 years (December 2018 –December 2021). All patients were screened for general condition as well as any coagulopathy pre –op. All patients were given IV form of Tranexamic acid followed by oral form for 3 days post operatively. Tourniquet was used in all cases and low molecular weight heparin (Clexane) 40 mg subcutaneous once a day for 1-2 days followed by oral aspirin was given for 6 weeks to all patients. SCD calf pumps were used for 4 to 5 days.

RESULTS

We found that incidence of blood transfusion was only 6.9% in our case series which was well within the incidence reported in varied literature on the use of Tranexamic acid in knee replacement surgery. There was no clinical feature of deep vein thrombosis / pulmonary embolism (DVT/PE) in any of our patients.

CONCLUSION

Use of Tranexamic acid is a safe and effective method for controlling blood loss and decreasing the transfusion rate after total knee replacement surgery. Its intravenous and oral forms are readily available and cost effective. Its use is not associated with DVT or PE.

KEYWORDS

Deep vein thrombosis; Tranexamic Acid; Total Knee Replacement

INTRODUCTION

Joint replacement surgery is regarded as the treatment of choice in end stage osteoarthritis of the knee. The main objective of replacement surgery is to give patient quality of life by giving relief of pain and ambulation. As with any major surgeries, joint replacement surgery can also associated with complications, among which peri and post-operative bleeding still remains the most common and sometimes leading to challenging sequeale like hypovolemia. It is expected that about 1.4 to 1.8 ltr blood can be lost during a joint replacement surgery. The rate of blood transfusion can be as high as 30 % (1). As majority of the patients are elderly and often associated with co morbid conditions, post-operative anemia can increase the risk of cardiopulmonary events as well as health care costs. (2). Blood transfusions on its own can be associated with complications like immunological reactions, transmission of certain blood borne diseases and also increased risk of post-operative infections (3).

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MATERIAL AND METHODS

Our study was conducted in the Department of Orthopaedics at Nepal Mediciti Hospital after taking clearance from the Research Committee at Nepal Mediciti. It is a retrospective study conducted for a duration of 3 years (Dec 2018 to Dec 2021). The total number of 152 knees were operated during this period on 94 patients,among which 58 were bilateral and 36 were unilateral total knee replacements. All patients operated had end stage osteoarthritis of the knee with activities of daily living severely affected and all the different methods of treatment tried before had failed to reduce pain . Standard pre-operative protocol for joint replacement surgery, given by American Academy of Orthopaedic Surgeons were followed in all cases (4) .Presence of any coagulopathy was ruled out in all cases. The study excluded patients with renal impairment, patients with previous myocardial infarction or atrial fibrillation, or severe cardiovascular disease (previous stroke or vascular surgery).

Tourniquets were used in all of our cases with pressure kept at 300mmHg. Tranexamic acid was used as an anti-fibrinolytic agent in all cases in combined formulations. It was given in intravenous form during perioperative period followed by oral formulation which was continued for 2 days post operatively. 1 gram intravenous was given half an hour before start of surgery followed by 500mg IV before the start of second knee in cases of bilateral knee replacement cases. Finally 500mg IV was given at the end of procedure which was followed by oral formulation of 500 mg thrice a day for next 2 days. Combined spinal and epidural anesthesia was used in all of our cases. All TKR was performed by using standard medial para patellar quadriceps splitting approach . The distal femur was prepared using an intramedullary and proximal tibia by using extra medullary jig. A bone plug was used the femoral intramedullary cavity after femoral cuts. Wound closure was done in layers following standard protocol and drain was kept in all cases in a neutral mode .Tourniquet was deflated once the sterile dressing was applied and compression bandaging was done. We have given Inj clexane 40mg S/c to all our patients and continued for 1 to 2 days depending upon the post op ambulatory status, which was followed by Tab Aspirin 75mg once a day for the next 6 weeks. Sequential compression device was applied to all patients for 5 days. Post operative transfusion was given if Hb dropped below 8gm/dl.

Clinical diagnosis for presence of DVT was accessed using Wells criteria for DVT.

RESULT

The primary outcome of this study was the transfusion incidence post operatively with drop of hemoglobin below 8gm/dl. It also gave us the prevalence of deep vein thromboembolic events up-to 30 days post operatively.

Our results showed transfusion was required only in 4 patients who had undergone bilateral total knee replacement and only 3 patient with unilateral knee replacement required blood transfusion. There was no transfusion related complication and none of the patient had deep vein thrombosis or pulmonary embolism.

	No. of Patients	Transfusion	% of transfusion	Reference in literature
Bilateral TKR	58	4	6.89%	6% to 23.2%
Unilateral TKR	36	3	8.33	

DISCUSSION

There are various methods that are regularly used during replacement surgeries to minimize blood loss. Use of tourniquets, hypotensive anesthesia during surgery, intramedullary femoral plugs and use of anti-fibrinolytic agents. Anti-fibrinolytic agents like Tranexamic acid, amino caproic acid and aprotinin are one of the most commonly used methods to decrease blood loss during surgery and has been practiced over the years by various specialty surgeries.

Among these agents, Tranexamic acid is the one which is most frequently used as it is readily available, cost effective and with least complications. It is a potent anti-fibninolytic agent and reaches concentration of 90 – 100% in joints as compared with its plasma concentration (4). It is available in various forms and is equally effective when administered in a single or combined formulations (5).

There has been a speedy rise in number of joint replacement cases performed worldwide, in western countries, there was nearly 27 fold rise in Total knee replacement surgery utilization rates when registry was compared in 18 countries (6) and Asia has seen similar trends with increase as high as 99 % to 140 % (7). Although it is regarded as a surgery with success rate of above 90%, complication can arise. Peri and post-operative bleeding still remains the most common and often troublesome complications that surgeons come across. It has been estimated that about 1.4 to 1.8ltr blood can be lost during replacement surgery. Transfusion requirement can be as high as 40% and with it, patients are at risk of immunological reactions, transmission of blood borne diseases and increased risk of infection (2).There has been limited studies on use and effectiveness on use of Tranexamic acid in reducing blood loss and decreasing the rate blood transfusion .Most of the publications are from western countries with limited study done on Asian population.

Tranexamic acid is a synthetic derivative of amino acid lysine. It reaches a concentration of 90 to 100% in joints compared with its plasma concentration (4). Its biological half- life in joint fluid is 3hrs and glomerular filtration rate is 90% in 3 hrs, making it a relatively safe drug for routine use (8).It competitively inhibits the activation of plasminogen and the binding of plasmin to receptor sites of fibrin (9). So, it prevents the breakdown of already formed clots by preventing the bond between plasmin and its binding sites in fibrin resulting in cessation of lysis of already formed fibrin clots and thus promotes coagulation already in progress. This makes it potentially suitable for use in reducing post-operative bleeding, where surgical haemostasis has been achieved and fibrinolysis needs to be stopped. There have been numerous studies on the rates of transfusion requirement in total knee replacement surgeries .The range varies from 24 to 31 % (10-12).

A randomized placebo controlled trail was conducted in 274 hospitals across 40 countries on effect of tranexamic acid on death, vascular occlusive events and transfusion on trauma patients with significant hemorrhage. In this study, Tranexamic acid was used IV in bolus dose followed by infusion and completion was within 8hr in patients receiving Tranexamic acid. The primary outcome was death in hospital within 4 weeks of injury, and was described with the following categories: bleeding, vascular occlusion (myocardial infarction, stroke and pulmonary embolism). 10096 patients were allocated to tranexamic acid and 10 115 to placebo, of whom 10 060 and 10 067, respectively, were analysed. All-cause mortality was significantly reduced with tranexamic acid (1463 [14·5%] tranexamic acid group vs 1613 [16·0%] placebo group; relative risk 0·91, 95% CI 0·85–0·97; p=0·0035). The risk of death due to bleeding was significantly reduced (489 [4·9%] vs 574 [5·7%]; relative risk 0·85, 95% CI 0·76–0·96; p=0·0077). This was one of the largest study done and popularly known as CRASH -2 trial strongly recommended that early use of Tranexamic acid in major trauma reduced the risk of death and more significant was the reduction in death due to bleeding (13).

Following this trial, numerous guidelines mainly from western countries recommended the use of Tranexamic acid mainly in polytrauma patients with emphasis on its early phase (guidelines).

A J Janson et al in their study on their study on use of Tranexamic acid on effective blood conservative strategy in total knee arthroplasty found that there was nearly 69% reduction in transfusion requirement with use of this agent (14).

Todd c Kelly et al in their study on staged total knee replacement found that with the use of Tranexamic acid was found to decrease blood loss and reduced blood transfusion requirement by 39% (15).

Similarly in the study by Chen et al, where 120 patients undergoing bilateral total knee replacement were divided into control and Tranexamic acid groups. The Tranexamic acid group had reduced blood loss and transfusion rate with no change in thromboembolic safety (16).

So, American Association of Hip and Knee surgeons in Jan 2001, came forward with endorsed guidelines for use of Tranexamic acid in total joint arthroplasty . This is Clinical Practice Guides of AAHKS, ASRA, American Academy of Orthopaedic Surgeons, Hip Society, and Knee Society. It suggests that intravenous, topical and oral TXA as well as combination of individual formulations of TXA are all effective strategies when compared with placebo for reducing calculated blood loss and the need for transfusion during the perioperative episode of a primary TJA. Apart from this, they have have recommended that its use in total joint arthroplasty is not associated with DVT or VTE.

By translating the above data, blood transfusion prevalence in bilateral TKR ranges from 6% to 23.2% .In our case series, the transfusion requirement was 6.9% which is within the transfusion reported in literature. There was no transfusion related complications nor DVT or PE.

Based on the current evidence based medicine, clinicians need to be familiar with the clinical benefits of Tranexamic acid in patients undergoing total knee replacement. Our study has also shown that there is decrease in transfusion requirement when Tranexamic acid is used in knee replacement surgeries and it is not associated with DVT or PE.

There were few limitations of study .Firstly, the participants included in the study excluded high risk patients since the exclusion criteria comprised of history of cardiovascular events, cerebral vascular disease and thromboembolic events. Secondly, this is a retrospective study.

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