Indian Journal of Basic and Applied Medical Research; September 2019: Vol.-8, Issue- 4, P. 264 - 268

Original article:

Comparison of efficacy of intra-articular and intravenous route of administration of tranexamic acid in reducing blood loss in total knee arthroplasty

[1]DR. RAJESH LALCHANDANI, [2]DR. RAGHAV TANDON, [3]DR. ROHAN KRISHNAN

Department of Orthopedics, PSI Hospital, Basaidarapur, New Delhi - 110015
Corresponding author - Dr. Raghav Tandon

ABSTRACT:

BACKGROUND: The antifibrinolytic tranexamic acid reduces surgical blood loss, but studies have not identified an ideal route of administration.

Aim of study: We tried to identify whether intra-articular route of administration of tranexamic acid is superior to its intravenous route of administration in reducing blood loss in post-operative period, number of transfusion units and complications e.g. thromboembolic phenomenon and DVT.

METHOD: We prospectively compared the two routes of administration (I/A and I/V) in a study population of 28 patients. In all the patients staged bilateral TKA was performed, one side receiving tranexamic acid I/A and the other I/V. The dose of both the routes was fixed at 10mg/kg. We recorded drop in Hb on post-op D1 and D5, drain output at 48h and blood transfusion if any done. All these parameters were evaluated statistically.

RESULTS: The drop in mean Hb was more in I/V group as compared to I/A group, statistically not significant. There was a difference of 17.14 mL in mean drain output between the two groups with I/V group having higher drain output. A total of 6 patients received blood transfusion, all of them belonging to I/V group, this parameter was statistically significant.

CONCLUSIONS: Intra-articular route of administration of tranexamic acid seems to be superior to the intravenous route of administration of tranexamic acid as far as need of blood transfusions. On evaluating the other parameters the two routes of administration did not differ significantly, probably a larger study population may be needed to conclusively prove I/A superiority over I/V route.

INTRODUCTION:

In advanced cases of osteoarthritis of knee, TKA is a successful procedure that can reduce pain and improve range of motion. Although an area of concern is the perioperative and post op bleeding during elective TKA. Periopertive blood loss may range from 800-1200 mL requiring blood transfusion in the post op period. Blood transfusion come with their own set of adverse effects such as transfusion reaction, TRALI, viral infection and transfusion related sepsis. Although many anti-fibrinolytic agents are available to control blood loss, TXA appears as a preferable drug to control perioperative blood loss. TXA is an anti-fibrinolytic drug which prevents clot lysis by blocking proteolytic activity of plasminogen activator. TXA is believed to have maximum anti-fibrinolytic action and minimal side effects.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

In theory IV TXA increases the risk of thrombotic events hence increasing the risk of DVT and arterial and venous thrombosis, exposing the patient to thromboembolic phenomenon.

Lately different authors have proposed the intra-articular route of administration for TXA. It's administrated through the drain after capsule closure with 20-40 mL of saline. IA TXA at surgical site provides a straight forward route of administration with rapid absorption at the site by inducing microvascular hemostasis.

MATERIAL AND METHODS:

The study was conducted in ESI-PGIMSR, Basaidarapur, New Delhi after clearance from institutional and university ethical committee. The duration of the study was from October 2017 to April 2019. A total of 28 patients were enrolled prospectively with diagnosis primary bilateral OA knee having less than 30° varus and flexion deformity. All the patients underwent routine pre-anaesthetic checkup before the surgery.

The exclusion criteria were patients with previous history of DVT and thromboembolic phenomenon, complex primary cases with more than 30 degree flexion or varus deformity, complex primary with extra-articular deformities, revision knee surgery, patients with previous history of cardiac and renal complication.

The patients underwent staged bilateral TKA with an interval of 6 weeks between the surgeries. As per protocol the first limb operated received TXA via intra-articular route and in the subsequent limb TXA was administrated via intravenous route. Patients meeting inclusion criteria were enrolled for study after taking prior consent in orthopedics department by the investigator.

All routine pre anesthetic blood and radiological investigations were done including standard antero posterior& lateral and Merchant's view to assess the patellar tilt. Pre-op antibiotics were given half an hour before incision. Patient were operated in the supine position and tourniquet was applied. All the knees were approached by anterior midline skin incision and medial parapatellar arthrotomy. The prosthesis was fixed with gentamicin cement.

Administration of tranexamic acid was done as per decided protocol i.e one limb received TXA intra-articularly and other limb received TXA intravenously. Intra-articular- 10mg/kg in 20ml of NS given through drain after capsule closure before tourniquet deflation and drain clamp for drain for 2 hours post-operatively. Intravenous- 10mg/kg before the deflation of tourniquet to keep the timing as close to intra-articular administration and clamping of drain for 2 hours to maintain uniformity in the methodology.

In the post operative period amount of blood in the drain at 48 hours was recorded, fall in hemoglobin compared to the pre-op level was recorded on day 1 and day 5 and number of units of blood transfused. Blood transfusion was performed if patients who had drain output more than 500 mL (D1+D2), those patients in which drop in Hemoglobin was found to be <8 g/dL and patients whose hemoglobin was above 8.5 g/dL but who had symptoms related to anemia develop, such as tachycardia and tachypnea.

Occurrence of any thromboembolic events like DVT and pulmonary embolism were recorded and appropriate steps were taken. All the patients received DVT prophylaxis in the form of calf pumps in the post-operative period, mobilisation along with quadriceps and hamstring exercises and in-bed knee ROM exercises after wearing off of anaethesia and Aspirin 75 mg HS till the patient was discharged.

RESULTS:

The overall drain loss was higher in the group II (intravenous) as compared to intra-articular, although. The value though was not statistically significant. In the intra-articular group the total mean drain loss was 270 mL in comparison to 287.14 in the intravenous group.

The intravenous route had a higher drop in Hb than the intra-articular route from their pre-operative Hb levels. there is a drop in Hb of 0.782 gm/dL on Post-Operative Day 1 and 0.832 gm/dL on Post-Operative Day 5 in Group I (intra-articular) as compared to drop in Hb of 1.132 gm/dL on Post-Operative Day 1 and 1.175 gm/dL on Post-Operative Day 5 in Group II (intervenous).All the patients requiring blood transfusion were from Group II (Intravenous) where total drain exceeded 500mL output. There is a statistical difference in blood transfusion units between the two groups (p value <0.05), which indicates that our study proves that there is reduction in requirement of allogenic blood transfusion, hence, proving the superiority of intra-articular route of administration of TXA over intravenous route.

DISCUSSION:

Periopertive blood loss is an important area of concern for an orthopedic surgeon. It causes significant morbidity to the patient and exposes the patient to adverse effects of allogenic blood transfusion. Amongst the various blood-conserving strategies, use of TXA is a preferable alternative with proven results in the literature. Multiple study designs have been used to determine the superior route of administration of TXA in controlling perioperative bleeding. Intravenous administration of TXA may expose the patient to DVT and thromboembloic events, intra-articular TXA would avoid problems associated with systemic absorption and it would take care of the reported fibrinolysis that predominantly is activated locally in the surgically treated tissue.

We perform this study not to judge the efficacy of TXA but try to find a superior route of administration for TXA.

Our study design involves comparing both IV and IA ROA by doing staged bilateral TKA by same surgeon using same implant in identical studies. We calculated the mean drop in haemoglobin, total drain output and blood transfusion units.

Post-operative anemia can be an important problem that could lead to increased morbidity and mortality and an increased duration of stay in the hospital. In our study the drop in hemoglobin as compared to their pre-operative hemoglobin status, was not statistically significant. The study shows that there was a drop in Hb of 0.782 gm/dL on post-operative Day 1 and 0.832 gm/dL on Post-Op Day 5 in Group I (Intra-articular) as compared to drop in Hb of 1.132 gm/dL on post-operative Day 1 and 1.175 gm/dL on post-operative Day 5 in Group II (Intravenous). These values were not statistically significant. Soni et al. and Patel JN et al also found superior drop in Hb in the group receiving TXA IV as compared to IA group, not statistically significant.

The difference in drain output was not statistically significant on comparison between the two groups. There was mean drain volume of 270.00 ml for Group I (Intra-articular), compared to 287.14 ml of Group II (Intravenous), with a mean difference of 16.86 mL. Showing no difference in the efficacy of TXA to reduce drain volume. Studies conducted by Maniar et al. and Digas et al. Had higher drain volume in the intravenous group but were not statistically significant.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

All the patients who required blood transfusion belonged to group II. A total of 21% patients had undergone blood transfusion for having drain >500mL. This observation was statistically significant. Sun Q et al and Meena et al show raised transfusion rate in groups receiving IV TXA as compared to group receiving IA TXA. Although the values were statistically insignificant.

During the period of the study only two patients from the intravenous group had developed DVT which were managed by the speciality in our hospital.

Our study showed that there was a lower rate of blood transfusion requirement in patients receiving IV TXA in comparison to IA TXA.

In the literature, there is no consensus regarding the ideal route of administration for TXA in patients undergoing TKA. Although there is a propensity of using TXA intra-articularly to reduce systemic exposure of the drug and reducing the complication rate in patients.

CONCLUSION

The difference in drain output was not statistically significant on comparison between the two groups. There was mean drain volume of 270.00 ml for Group I (Intra-articular), compared to 287.14 ml of Group II (Intravenous), with a mean difference of 16.86 mL. Showing no difference in the efficacy of TXA to reduce drain volume. Studies conducted by Maniar et al. and Digas et al. Had higher drain volume in the intravenous group but were not statistically significant.

All the patients who required blood transfusion belonged to group II. A total of 21% patients had undergone blood transfusion for having drain >500mL. This observation was statistically significant. Sun Q et al and Meena et al show raised transfusion rate in groups receiving IV TXA as compared to group receiving IA TXA. Although the values were statistically insignificant.

During the period of the study only two patients from the intravenous group had developed DVT which were managed by the speciality in our hospital.

Our study showed that there was a lower rate of blood transfusion requirement in patients receiving IV TXA in comparison to IA TXA.

In the literature, there is no consensus regarding the ideal route of administration for TXA in patients undergoing TKA. Although there is a propensity of using TXA intra-articularly to reduce systemic exposure of the drug and reducing the complication rate in patients.

REFRENCES

1. Tabutin J, Banon F, Catonne Y, Grobost J, Tessier JL, Tillie B (2005). Should we resurface the patella in total knee replacement? Experience with the Nex Gen prosthesis. Knee Surg Sports Traumatol Arthrosc. 13(7):534–538
2. Oh IS, Kim MK, You DS, Kang SB, Lee KH. Total knee arthroplasty without patellar resurfacing. Int Orthop. 2006;30(5):415–419.

3. Hasegawa M, Ohashi T. Long-term clinical results and radiographic changes in the nonresurfaced patella after total knee arthroplasty: 78 knees followed for mean 12 years. Acta Orthop Scand. 2002;73(5):539–545.
4. Ogon M, Hartig F, Bach C, Nogler M, Steingruber I, Biedermann R. Patella resurfacing: no benefit for the long-term outcome of total knee arthroplasty. A 10- to 16.3-year follow-up. Arch Orthop Trauma Surg. 2002;122(4):229–234.
5. Oztürk A, Bilgen S, Atici T, Ozer O, Bilgen OF. The evaluation of patients undergoing total knee arthroplasty with or without patellar resurfacing. Acta Orthop Traumatol Turc. 2006;40(1):29–37.
6. Hurson C, Kashir A, Flavin R, Kelly I. Routine patellar resurfacing using an inset patellar technique. Int Orthop. 2009.
7. Barrack RL, Bertot AJ, Wolfe MW, Waldman DA, Milicic M, Myers L. Patellar resurfacing in total knee arthroplasty. A prospective, randomized, double-blind study with five to seven years of follow-up. J Bone Joint Surg Am. 2001;83:1376–1381.
8. Barrack RL, Wolfe MW, Waldman DA, Milicic M, Bertot AJ, Myers L. Resurfacing of the patella in total knee arthroplasty. A prospective, randomized, double-blind study. J Bone Joint Surg Am. 1997;79:1121–1131.
9. Keblish PA, Varma AK, Greenwald AS. Patellar resurfacing or retention in total knee arthroplasty. A prospective study of patients with bilateral replacements. J Bone Joint Surg Br. 1994;76:930–937.
10. Frankel VH, Burstein AH. Orthopaedic Biomechanics. The Application of Engineering to the Musculoskeletal System. Philadelphia: Lea and Febiger; 1970.
11. Berger RA, Rubash HE, Seel MJ, Thompson WH, Crossett LS. Determining the rotational alignment of the femoral component in total knee arthroplasty using the epicondylar axis. Clin Orthop Relat Res. 1993;286:40-7.
12. Barrack RL, Schrader T, Bertot AJ, Wolfe MW, Myers L. Component rotation and anterior knee pain after total knee arthroplasty. Clin Orthop Relat Res 2001;392:46-49.
13. Ficat P, Hungerford D. Disorders of the Patellofemoral Joint. 1st ed. Baltimore: Williams & Wilkins; 1977.
14. Weinberg G. Roentgenographic and anatomic studies on the femoral patellar joint. Acta Orthopaedica Scandinavica. 1941;12:319-410.
15. Fulkerson JP & Hungerford DS 1990. Disorder of the patellofemoral joint 2nd ed. Baltimore. Williams and Wilkin