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The role of Tranexamic acid in reducing the need for intraoperative and postoperative blood transfusion in patients undergoing arthroplasty for osteoarthritis

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ABSTRACT

Intraoperative blood loss and postoperative anaemia in patients undergoing arthroplasty of the hip and knee increase patient's morbidity and mortality. This increases the need for postoperative transfusion of blood products. Though mechanical methods like using tourniquet reduce the intraoperative blood loss, postoperative loss and resulting anaemia cannot be prevented. Our aim was to establish that the use of low dose tranexamic acid Intravenously and Topically in these patients reduce the total blood loss in these patients and hence the need for postoperative blood transfusion and associated complications of anaemia. Our study conducted in SRIHER between 2018-2020 prospectively, included an analysis of 84 patient's undergoing arthroplasty of the hip and knee. All patients included were above 55 years undergoing arthroplasty for hip and knee for osteoarthritis. Patients with h/o stroke, cardiac stents and chronic liver and renal diseases were excluded. Intravenous Tranexamic acid 1gm was given to all patients an hour before surgery as an infusion in normal saline along with tranexamic acid 500mg injected through the drain after closure. The average blood loss was 480ml intraoperatively and the average drain volume was 140ml. Only 14 patients (16.6%) had postoperative anaemia and required transfusion of allogenic blood. The mean postoperative haemoglobin in these patients was 12.2gm/dl. Our study indicates that low dose intravenous and topical Tranexamic acid significantly reduces the intraoperative and postoperative blood loss and resulting anaemia. This effectively reduces the need for postoperative blood transfusion and associated complications.

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INTRODUCTION

Intraoperative and postoperative blood loss in patients undergoing arthroplasty of the hip and knee lead to complications that increases morbidity and mortality. These surgeries are associated with acute postoperative anaemia and often require allogenic or autologous blood transfusion (Fillingham *et al.*, 2019). Though mechanical methods like using a tourniquet during the surgery reduced intraoperative blood loss, it does not prevent anaemia in the immediate postoperative period. Anaemia in patients undergoing arthroplasty increases the risk of infection. Prosthetic joint infection is a night-

mare to the orthopaedic surgeon, as it compromises the functional outcome of the surgery, which was intended to improve the functional status of the patients (Muñoz *et al.*, 2009) . Anaemia in the post-operative period decreases the functional recovery of the patients as it increases the incidence of prosthetic joint infection (Eka, 2015). Tranexamic acid is an antifibrinolytic agent that prevents acute blood loss in the preoperative and postoperative period. It is a synthetic lysine analogue, it inhibits the conversion of plasminogen to plasmin, an enzyme that breaks down fibrin-containing clots. By stabilizing the clot TXA reduces active bleeding.

Although TXA is widely used in total hip arthroplasty and total knee arthroplasty, it has not become the choice to most of the surgeons, due to concerns of the safety of the drug and its benefit (Fillingham *et al.*, 2018) . Recently significant literature has become available to justify the routine use of the drug in patients undergoing arthroplasty. The intravenous and topical TXA has been found to reduce the need for transfusion by 60-70%.

Our aim was to establish the safe use of the drug in patients undergoing arthroplasty of the hip and knee both intravenously and topically combined, to observe the incidence of anaemia in the immediate postoperative period and the need for blood transfusion.

MATERIALS AND METHODS

Our study was conducted in Sri Ramachandra institute for higher education and research, between 2018-2020. It is a prospective analysis of 84 patients who underwent total hip arthroplasty and total knee arthroplasty for primary osteoarthritis of the joint. Inclusion criteria were adult patients aged above 55 years operated for primary osteoarthritis of the hip and knee. Patients with previous h/o stroke, cardiac stents, with secondary arthritis, chronic renal failure and liver diseases were not included in the study.

All patients underwent routine preoperative workup protocol. Routine blood investigations like CBC, renal function test, liver function test, thyroid function test and coagulation profile were done. All the patients underwent clinical screening for associated co-morbid conditions and documented. Patients with a history of ischemic heart disease and who were on antiplatelets were evaluated preoperatively for the risk for surgery and the antiplatelets were stopped 3 days prior to the surgery. A standardized dose of 1 gm of tranexamic acid was given as IV infusion in 100ml of normal saline (100cc/hr), 1 hour prior to induction of anaesthesia. All patients received preoperative prophylactic antibiotic (cefaperazone with sulbactam 1.5gm). The patients had the arthroplasty done under regional anaesthesia (combined spinal and epidural anaesthesia). The surgery was performed by a single senior orthopaedic arthroplasty surgeon. No tourniquet was used for the total knee arthroplasty patients. Strict haemostasis was achieved prior to closure of the wound. Periarticular injection with a cocktail (42ml) of ropivacaine, ketorol, clonidine and normal saline was given to all patients for postoperative analgesia. A closed suction drain was used in all patients who underwent total hip arthroplasty. Tranexamic acid 500 mg was injected through the drain after the wound closure and the drain was opened to function 3 hours after the closure in the postoperative ward. Venous thromboprophylaxis was given by mechanical (calf pump) for all patients.

Additionally, chemical prophylaxis (Inj. Enoxaparin 40mg/0.4ml) was given to patients who were in high risk group started hrs after the removal of drain and epidural catheter, whichever was later. Chemical prophylaxis was continued in the high risk group for 7 days postoperatively and the antiplatelets were started on the 3^{rd} postoperative day. The drain was removed 48 hours postoperatively. The prophylactic antibiotic was continued for 36 hours postoperatively. Postoperative haemoglobin and Haematocrit were done on POD 1 and POD 7.

RESULTS

We had a total of 84 patients, of which 56 (66.6%) were female and 28 (33%) were male. The average age of the patients in the study was 64 (range 55-74). 62 (73%) patients underwent total knee arthroplasty and 26 (27%) patients underwent total hip arthroplasty. Associated comorbidities were documented. 46 patients were hypertensive, 66 patients had diabetes and 44 patients had ischemic heart disease. The average preoperative haemoglobin was 11.8gm/dl (range 11-15.2gm/dl). Six patients in our study group had preoperative anaemia (Hb<13). The mean preoperative anaemia in these patients was 11.2gm/dl (range 11-12.4). The preoperative anaemia was corrected by allogenic blood transfusion. All these patients received one unit of allogenic whole blood transfusion one day before the surgery.

During hospitalization standard protocol was followed and allogenic blood transfusion was done for all patients if the postoperative hemoglobin was less than 13 gm/dl.

The primary outcome measure was 72 hour blood loss. The total blood loss was calculated by the

anaesthetist perioperatively based on the surgical swabs intraoperatively and suction drain contents postoperatively.

The average perioperative blood loss was 420ml in the total knee arthroplasty patients and 560ml in the total hip arthroplasty patients. The postoperative blood loss was calculated based on the drain volume. The average drain volume was 140 ml in the operated patients.

The secondary outcome measure was Hb and Haematocrit on the 1^{st} and 3^{rd} postoperative day. The average Hb in the 1^{st} POD was 12.6gm/dl and 13.4gm/dl in the 3^{rd} POD. In our study, 14 patients (16.6%) required blood transfusion. The average haemoglobin in these patients prior to transfusion was 12.2 gm/dl. The average volume of blood transfused was 2 units. The post transfusion haemoglobin was 13.4gm/dl. The postoperative Haematocrit 42%.

The patients were followed up as outpatients routinely. None of our patients had evidence of superficial infection in the immediate postoperative and deep infection in the follow up postoperative period up till 1 year. None of the patients exhibited complication like DVT or PE.

DISCUSSION

Numerous studies have reported that IV and topical tranexamic acid administration was effective in reducing postoperative and perioperative blood loss with no risk of postoperative thromboembolic complications in arthroplasty 1. Our study evaluates the perioperative and postoperative blood loss following preoperative administration of IV single dose TXA as 100 ml transfusion over 1 hour before anaesthesia and topical TXA 500mg through the drain postoperatively. The primary finding in our study was that significant improvement in intraoperative blood loss. The average intraoperative blood loss in our study was 280ml (range 260-380) in total knee arthroplasty patients and 450ml (range 280-560) in total hip arthroplasty patients. Prasad *et al.* (2007) studied the risk factors in the blood loss in total knee arthroplasty and found in their study the average blood loss was studied was 220ml (+/- 115.6). The average blood loss in our study of patients undergoing total hip arthroplasty was 480ml (+/- 140ml). Carling *et al.* (2015) observed a median blood loss for hip arthroplasty patients was 450ml (range 150ml-3000). Yuan *et al.* (2016) prospective, randomized, controlled studies on the effectiveness of TXA administered in primary unilateral total knee arthroplasty concluded significantly reduced blood loss and transfusion rates. Though our study only used Intravenous administration of TXA and topical administration through the drain, yuan et al. study used oral administration in addition. Their study recommended oral TXA as it offered similar clinical benefits.

In our study, the preoperative intravenous administration offered a better view of the surgical field without the use of a tourniquet and reduced bleeding. The average blood loss intraoperatively was 490ml in patients undergoing arthroplasty. The average postoperative blood loss was 340ml which was comparable to the study reported by Alipour *et al.* (2013). They recommended oral TXA over intravenous administration. Our study used a safer IV bolus dose of 1 gm, compared to Irwin et al., who reported that a 2g oral bolus could be effective.

In our study, the average Hb in the 1^{st} POD was 12.6gm/dl and 13.4gm/dl in the 3^{rd} POD Wong *et al.* (2010) observed that the postoperative haemoglobin levels were higher in patients receiving TXM acid compared to the placebo group. In conclusion of their study topical application of TXA directly into the surgical wound reduced postoperative bleeding by 20 to 25%, resulting in 16-17% higher postoperative haemoglobin levels compared with placebo.

Various studies have documented the high prevalence of anaemia and the frequent use of allogenic blood transfusion in the postoperative period. In our study, 14 patients (16.6%) required blood transfusion. The average haemoglobin in these patients prior to transfusion was 12.2 gm/dl Newman *et al.* (2017) prospectively collected data of patients undergoing arthroplasty. They concluded that a significant reduction in transfusion could be achieved when we adhere to a strict perioperative blood management guideline and TXA is an important contributor in improving transfusion rates in patients undergoing arthroplasty.

Our study had several limitations. First, our study trial included no placebo group because there is sufficient evidence confirming TXA in arthroplasty. Second, we did not use oral TXA in our study as we were confident in using the Intravenous TXA in the immediate preoperative period would effectively provide a blood less operative field, increase the surgeons vision and reduce blood loss intraoperatively. Third, several potential variations, such as haemodilution during IV fluid use during surgery, may affect estimated blood loss.

CONCLUSIONS

This study indicates that a lower 1gm Intravenous infusion of TXA in the immediate preoperative period results in a significant reduction in blood loss during the surgery in patients operated without tourniquet for Total knee arthroplasty. The equivalent efficacy in THA justifies the convenient administration of IV TXA and need no continuation oral TXA support. This low dose IV and topical TXA showed to significantly reduce the incidence of anaemia in the postoperative period and reduce the need for blood transfusion.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

REFERENCES

Alipour, M., Tabari, M., Keramati, M., Zarmehri, A. M., Makhmalbaf, H. 2013. Effectiveness of oral Tranexamic acid administration on blood loss after knee artroplasty: A randomized clinical trial. *Transfusion and Apheresis Science*, 49(3):574–577.

Carling, M. S., Jeppsson, A., Eriksson, B. I., Brisby, H. 2015. Transfusions and blood loss in total hip and knee arthroplasty: a prospective observational study. *Journal of Orthopaedic Surgery and Research*, 10(1).

Eka, A. 2015. Patient-related medical risk factors for periprosthetic joint infection of the hip and knee. *Annals of Translational Medicine*, (16):3–3.

Fillingham, Y. A., Ramkumar, D. B., Jevsevar, D. S., Yates, A. J., Bini, S. A., Clarke, H. D., Schemitsch, E., Johnson, R. L., Memtsoudis, S. G., Sayeed, S. A., Sah, A. P., Valle, C. J. D. 2019. Tranexamic acid in total joint arthroplasty: the endorsed clinical practice guides of the American Association of Hip and Knee Surgeons, American Society of Regional Anesthesia and Pain Medicine, American Academy of Orthopaedic Surgeons, Hip Society, and Knee Society. *Regional Anesthesia & Pain Medicine*, 44(1):7–11.

Fillingham, Y. A., Ramkumar, D. B., Jevsevar, D. S., Yates, A. J., Shores, P., Mullen, K., Bini, S. A., Clarke, H. D., Schemitsch, E., Johnson, R. L., Memtsoudis, S. G., Sayeed, S. A., Sah, A. P., Valle, C. J. D. 2018. The Safety of Tranexamic Acid in Total Joint Arthroplasty: A Direct Meta-Analysis. *The Journal of Arthroplasty*, 33(10):3070–3082.e1.

Muñoz, M., García-Erce, J. A., Cuenca, J. 2009. Management of Postoperative Anemia After Lower Limb Arthroplasty in Patients Over 65 Years Old. *Anesthesia & Analgesia*, 108:1045–1046.

Newman, C., Tran, P., McGregor, S., Bramley, D. 2017. Patient blood management strategies in total hip and knee arthroplasty. *Current Orthopaedic Practice*, 29(1):1–1.

Prasad, N., Padmanabhan, V., Mullaji, A. 2007. Blood loss in total knee arthroplasty: an analysis of risk factors. *International Orthopaedics*, 31(1):39–44.

Wong, J., Abrishami, A., Beheiry, H. E., Mahomed, N. N., Davey, J. R., Gandhi, R., Syed, K. A., Hasan, S. M. O., Silva, Y. D., Chung, F. 2010. Topical Application of Tranexamic Acid Reduces Postoperative Blood Loss in Total Knee Arthroplasty. *The Journal of Bone and Joint Surgery-American Volume*, 92(15):2503–2513.

Yuan, Z. F., Yin, H., Ma, W. P., Xing, D. L. 2016. The combined effect of administration of intravenous and topical tranexamic acid on blood loss and transfusion rate in total knee arthroplasty. *Bone & Joint Research*, 5(8):353–361.