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The Effect of Tranexamic Acid on Haemoglobin Level During Surgeries Around HIP

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Abstract

Background: The aim is to assess effect of tranexamic acid on haemoglobin level during surgeries around hip. **Material & Methods:** This was a prospective follow up study conducted in Mahender Reddy Institute of medical sciences, Chevella over a period of two years from June 2020 to June 2022. A total number of 123 patients who underwent hip surgeries by four different surgeons were selected for this study. Proximal femoral nailing (PFN) for intertrochantric fractures by surgeon A, dynamic hip screw (DHS) for intertrochantric fractures by surgeon B, total hip replacements by surgeon C and hemiarthroplasty by surgeon D were included for this study. The patients were grouped as treatment and control group. The treatment group and control group were selected by purposive sampling. In the treatment group, the patients undergoing surgeries around hip joint received single dose of intravenous tranexamic acid 10 mg/kg body weight 10 minutes before skin incision and equal volume of saline was injected in the control group. Intra operative blood loss was calculated by galvanometric method, weighing the sponges used and soiled by blood during surgery and measuring the amount of blood collected in suction apparatus used during the surgery. The haemoglobin level assessed post operatively and compared with preoperative haemoglobin level. The amount of fluid collected in the post-operative drain were also measured. **Results:** In the treatment group, 11 patients out of 16 had blood loss below 300 ml, and 5 patients had blood loss more than 300 ml. In control group 5 patients out of 15 had blood loss below 300 ml. 10 patients had blood loss more than 300 ml. Among the 25 patients of hemiarthroplasty group, 11 out of 13 patients of treatment group had drain below 100 ml on the first post operative day. In control group only 2 patients out of 12 had drain less than 100 ml. In DHS group, in the treatment group, 10 out of 11 patients had preoperative and post operative haemoglobin difference less than 1mg/dl. In control group, 12 out of 12 patients had preoperative and post operative Hb difference more than 1mg/dl. **Conclusions:** Tranexamic acid administrated before surgical incision is efficient in reducing bleeding during common surgeries around the hip joint. Especially surgery where more amount of blood loss was expected, like total joint replacement and hemiarthroplasty, the drug had shown significant benefit compared with the control group.

Keywords:- Tranexamic acid, Blood loss, Haemoglobin level.

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INTRODUCTION

Most of the major orthopaedic surgeries normally result in significant blood loss which increase the morbidity and mortality especially in patients whose haemoglobin level is low prior to surgery.[1] As a result, the blood loss in the elective orthopaedic surgeries results in transfusion rates that vary from 11% to 65%, depending on type of surgery. The blood transfusion is a life saving measure in hemorrhage but it is expensive, resource is rare and transfusion is involved with varied hazards.[2] The risk of infection, immune suppression, allergic manifestations, anaphylaxis, volume over load, transfusion-related lung injury, and graft versus host reactions etc. are not uncommon even with compatible transfusions. The packed red cells can cause hypothermia and coagulopathy. There are some people, who refuse blood transfusion because of religious or personal beliefs. Therefore, it may be better to restrict blood transfusion in dire necessity only.[3]

The successful outcomes around hip surgeries require adequate intra operative hemostasis in order to avoid hematoma formation and minimize blood loss through suction drains. Achieving a satisfactory postoperative range of movements also depend on soft tissue hemostasis. Persistent bleeding after surgery can cause pain, wound hematoma, seroma formation and arthrofibrosis leading to sub-optimal outcomes after surgeries.[4] So, it is important to consider minimize blood loss during surgeries around the hip joint. Efforts have been made to develop biological methods of hemostasis during the procedure. Tranexamic acid is well accepted hemostatic drug during coronary artery bypass surgery, epistaxis, menorrahagia, in hemophilia patients and dentistry.[5]

MATERIAL AND METHODS

The patients fulfilling the inclusion criteria at the department of orthopaedics in Mahender Reddy Institute of Medical Sciences irrespective of their sex, unilateral/bilateral disease, body mass index was included in this study. Duration of the study was from July 2020 to July 2022.

Inclusion criteria were all patients above 18 years undergoing surgeries around hip joint, no allergies tranexamic acid and informed consent signed by patient. Exclusion criteria were patients less than 18years of age, patients with upper tract genitourinary bleeding eg: kidney, ureter, patients with history of subarachnoid bleed, patients with acquired colour vision defect, patients with active intravascular clot and disseminated intravascular coagulation, patients with renal failure and abnormal renal parameters, patients with thromboembolic disorders, patients requiring blood transfusion due to anaemia and hypersensitivity to tranexamic acid.

The preoperative haemoglobin was assessed in all the patients. The patients were grouped as treatment(case) group and control group. The randomization was done by the rules of odds and even. In 61 subjects of treatment group, a single dose of tranexamic acid, 10 milligram per Kg body weight was given intravenously. The second group included the remaining 62 subjects in whom tranexamic acid was not given was considered as control group.

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The 123 patients were operated by four different surgeons for different problems around the hip. In order to avoid surgeon bias, only a single type of surgery performed by a particular surgeon was enrolled in the study. The proximal femoral nailing performed by surgeon A for intertrochantric fracture were included in the study; in this group, there were 16 cases in the treatment group and 15 were in the control group. The surgeon B did DHS for intertrochantric fractures in which 11 cases were in the treatment group and 12 in the control group. Total hip replacements were done by surgeon C, in which 21 cases were in the treatment group and 23 in the control group. There were 13 cases in the treatment group and 12 in control group among the 25 patients in whom the hemiarthroplasty was done by surgeon D. The cases of treatment and control group were selected by purposive sampling.

Injection tranexamic acid was administered in a dose of 10mg/kg as bolus injection (treatment group) given slow intravenously over 5 minutes. The heart rate, respiratory rate and blood pressure were checked and charted intraoperatively and postoperatively. A single brand of tranexamic acid from a reputed firm was used in all cases in order to minimize the brand related bias and for standardization. Intaoperative blood loss was calculated by galvanometric method, weighing the sponges used and soiled by blood during surgery and measuring the amount of blood collected in suction apparatus used during the surgery. The venous blood samples were collected from all the patients preoperatively and post operatively for determination of haemoglobin level. Postoperatively the drained fluid collected in the drain was also measured till the drain were removed. The haemoglobin level was assessed post operatively and was compared with preoperative haemoglobin level. The data were analyzed with Fisher exact test.

RESULTS

There were 123 patients in our study group of which, 61 (49.59%) patients received tranexamic acid were in the treatment group and remaining 61(50.4%) patients who did not receive the drug were in the control group [Table 1].

Surgeon A operated 31 hips with intertrochanteric/subtrochanteric fractures where proximal femoral nailing was done. In the treatment group, 11 patients out of 16 had blood loss below 300 ml, and 5 patients had blood loss more than 300 ml. In control group 5 patients out of 15 had blood loss below 300 ml. 10 patients had blood loss more than 300 ml [Table 2].

Of the 23 trochanteric fractures treated using DHS by surgeon B, 10 patients in the treatment group out of 11 patients had blood loss below 300 ml. In control group only 2 patients out of 12 had blood loss below 300 ml; and 10 patients had blood loss more than 300ml. The blood loss in the control group is significantly more compared to the treatment group [Table 3].

Of the 44 total hip replacements performed by surgeon C, 11 patients out of 21 patients of treatment group had blood loss below 600 ml, whereas in the control group only 9 patients out of 23 had blood loss below 600 ml.

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Trenaxamic acid has significant effect in preventing blood loss during THR [Table 4].

We included 25 patients who had undergone hemiarthroplasty for this study. In the treatment group, 9 patients out of 13 patients had blood loss below 600ml and in the control group 2 patients out of 12 had blood loss below 600ml. 10 patients had blood loss more than 600 ml [Table 5].

Among the 25 patients of hemiarthroplasty group, 11 out of 13 patients of treatment group had drain below 100 ml on the first postoperative day. In control group only 2 patients out of 12 had drain less than 100 ml [Figure 1].

In patients who had PFN, in the treatment group, 13 out of 16 patients had preoperative and postoperative Hb difference less than 1mg/dl. In the control group, 14 out of 15 patients had preoperative and postoperative Hb difference more than 1mg/dl [Figure 2].

In DHS group, in the treatment group, 10 out of 11 patients had preoperative and postoperative haemoglobin difference less than 1mg/dl. In control group, 12 out of 12 patients had preoperative and postoperative Hb difference more than 1mg/dl [Figure 3].

19 out of 21 patients who received tranexamic acid during THR had preoperative and postoperative haemoglobin difference less than 1mg/dl whereas those in control group, all patients had preoperative and postoperative haemoglobin difference more than 1mg/dl [Figure 4].

In patients who underwent hemiarthroplasty, the treatment group, 10 out of 13 patients had preoperative and postoperative difference in the haemoglobin less than 1mg/dl. In control group, 2 out of 12 patients had preoperative and postoperative haemoglobin difference less than 1mg/dl [Figure 5].

Table 1: Distribution of patients

Drug	**Total**	**Percentage**
Control	62	50.4
Treatment	61	49.59
Total	123	100

Table 2: Intraoperative blood loss in Group A

Groups	**200-300ml**	**300- 400ml**	**400-500ml**	**>500ml**	**Total**
Treatment	11	2	1	2	16
Control	5	6	1	3	15
P value 0.253.					

Table 3: Intra operative blood loss in group B

Groups	**<200 ml**	**200-300 ml**	**300-400 ml**	**400-500 ml**	**Total**
Treatment	1	9	1	0	11
control	o	2	8	2	12
Total	1	11	9	2	23

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P value 0.001

Table 4: Intra op blood loss in group C

Groups	**<600 ml**	**700-800 ml**	**800-900 ml**	**900-1000 ml**	**Total**
Treatment	11	6	4	0	21
Control	9	0	5	9	23
P value0.0001.					

Table 5: Intraoperative blood loss during hemiarthroplasty (Group D)

Groups	**<600ml**	**600-700ml**	**700-800**	**800-900**	**900-1000**	**>1000**	**Total**
Treatment	9	1	1	1	1	0	13
Control	2	0	1	5	2	2	12
Total	11	1	2	6	3	2	25
P value 0.016							

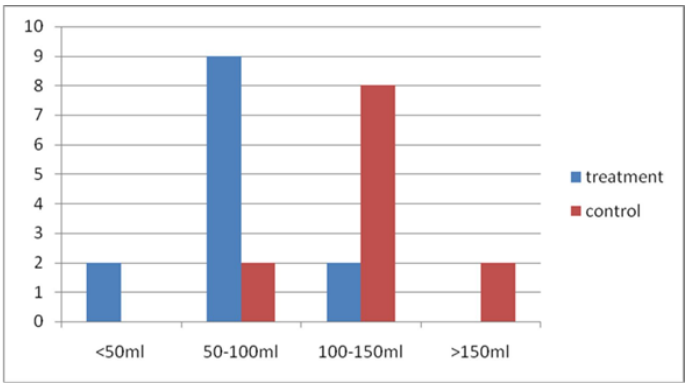

Figure 1: Blood loss on first postoperative day after hemiarthroplasty (Group D)

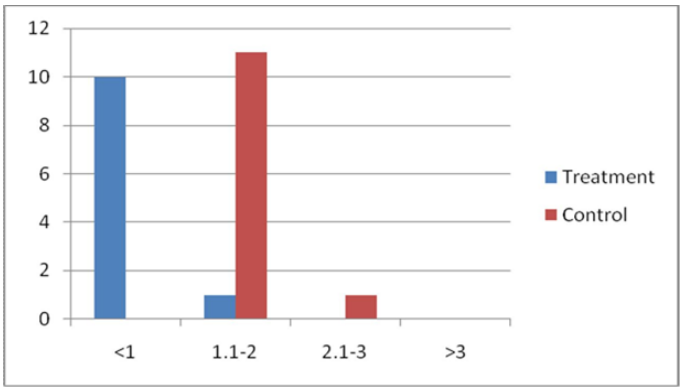

Figure 3: The difference between pre and post operative haemoglobin level in DHS group (Group B)

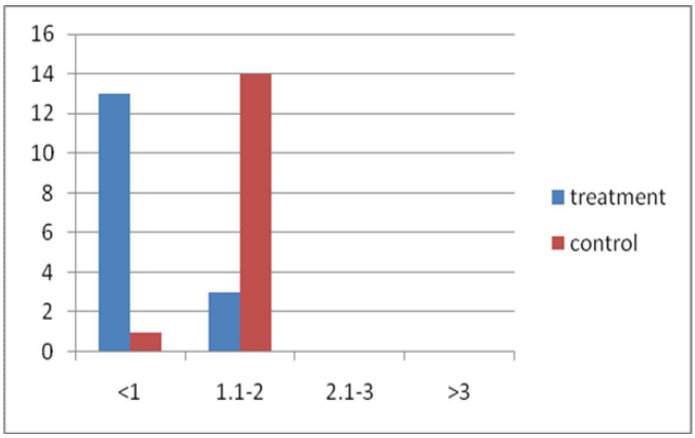

Figure 2: Difference between Pre and Post Operative Haemoglobin level in PFN patients (Group A)

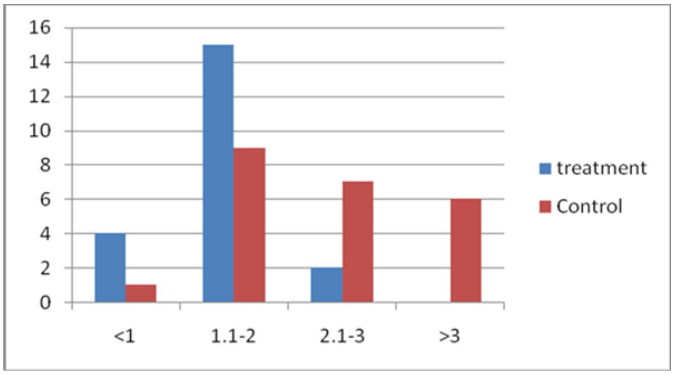

Figure 4: The difference between pre and post operative haemoglobin level among THR patients (Group C)

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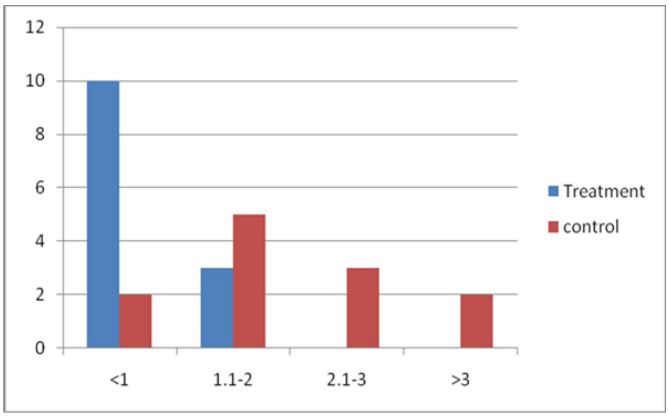

Figure 5: Difference between Pre and Post operative haemoglobin level following hemiarthroplasty (Group D)

DISCUSSION

Tranexamic acid is an anti- fibrinolytic drug which by competetive inhibition prevents conversion of plasminogen to plasmin and thereby prevents the breakdown of clot. Both procoagulative factors and fibrinolysis are activated by surgical trauma. In major surgical procedures large amounts of tissues will be exposed to injury.[6] These tissues will release enzymes, primarily tPA [tissue plasminogen activator] activating the fibrinolytic system. The fibrinolytic response is most pronounced intra operatively and early postoperatively. The half- life of tranexamic acid is 180 minutes which would cover the duration of surgery.[7]

Fibrinolytic activation is cascade process that is most easily inhibited in its early phase. Tranexamic acid inhibits clot lysis more efficiently when administered before clot formation than after the fibrine clot is formed. Once plasminogen is bound to the fibrin surface, tranexamic acid is no longer effective. This may explain why tranexamic acid has little effect when administered at the end of surgery. Benoni et al,[8] found no significant reduction in postoperative blood loss in total hip arthroplasty when tranexamic acid was given towards the end of surgery and 3 hours later. Likewise, in cardiac surgery postoperative 12 hours continuous infusion of tranexamic acid did not reduced the postoperative blood loss compared to no postoperative tranexamic acid administration.

We made no attempt to evaluate postoperative hematomas, since one of the previous studies had noted no significant difference in the amounts of the hematomas between patients treated with tranexamic acid or placebo. Intra operative blood loss was significantly less in group B (DHS patients), C (THR patients) and D (hemiarthroplasty) but less significant difference was noted in group A (PFN patients). This could probably be attributed to the amount of soft tissue and bone dissection involved in surgeries of group B, C and D and the increased duration required to perform those surgeries. In group A statistically significant difference with respect to intra operative blood loss was not noted but the mean blood loss was less in their case group. As these surgeries did not involve much dissection, measurable blood loss was less. These results of our study are in comparison to the study of Jashwant Singh et al.[9]

Drain was not used in the case of proximal femoral nail fixation and dynamic hip screw fixation. So we could not quantify the amount of postoperative blood loss in these cases. In total hip replacement and hemiarthroplasty series we found a significant decrease in the postoperative blood loss as well.

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Evidences from the orthopaedic literature regarding tranexamic acid indicates a role in knee arthroplasty. however, data regarding its use in other orthopaedic surgeries are less common. In our opinion, its use in orthopaedic surgeris is relatively uncommon in this country. Therefore, we performed a study to examine the results of the effects of tranexamic acid on haemoglobin falls postoperatively in patients undergoing surgeries around hip. In all the surgeries of our study, we noticed that there was no significant reduction of hemoglobin between pre and post operative levels. This in turn suggests that this drug helps to decrease the peri operative blood loss. The above findings were noted even in those surgeries (Group A) which did not show significant reduction of intra operative blood loss. So, we can infer that even in such surgeries this drug plays a role in controlling the haemorrhage. The need for blood transfusion was not compared, since no clear parameters had been defined in either group for the indications for transfusion and, therefore, was susceptible to bias. But we found that transfusion requirement was less in cases when tranexamic acid was used.

The study involved four surgeons but we have negated the surgeon bias by allotting only one particular surgery for one surgeon and surgeon wise results were deduced separately. P. J. zufferey et al10 in their study concluded that tranxemic acid may promote hypercoagulable state but contrary to this in our study, we did not notice any incidence of deep vein thrombosis. This result of ours could be explained based on the research on tranexamic acid by hippala.et al which states that fibrinolytic activity in vein was not affected by tranxemic acid. It should be noted here that tranexamic acid does not promote clot formation but simply stabilizes the clot that has formed.[10]

CONCLUSIONS

We conclude that, as tranexamic acid reduced the intra and postoperative bleeding in our patients who underwent various hip surgeries, Its use can be extended to other major orthopaedic surgeries. Prophylactic use of tranexamic acid also provides effective, safe and economical method for reducing blood loss and also in reducing the financial burden in terms of expenses incurred on blood transfusion. Tranexamic acid helps in reducing blood transfusion complications.

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