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Effectiveness of tranexamic acid in reducing blood loss during hip surgery

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Abstract
The main objective of this double blinded case-Control study was to evaluate the role of Intravenous Tranexamic Acid therapy in reducing total blood loss in patients undergoing joint replacement surgeries.
Group A had administrated with the Normal Saline (0.1 ml/kg) and Group B patients were administered with the Tranexamic Acid (0.1 ml/kg).
The blood loss during surgery is seen more in the patient administered with the normal saline patients, where as the patient administered with the Tranexamic Acid show lower amount of blood loss. Similar observations were seen the blood loss during the post-operative drain. The difference in the Haemoglobin in the Pre-Operative and post-operative conditions also suggest the narrower difference the Tranexamic Acid administered patients.
Tranexamic acid is effective in reducing perioperative blood loss when given by infusion. Continuation of an infusion postoperatively is more useful than a single dose in decreasing blood loss in the first 6 h after surgery. Tranexamic acid significantly reduces the need for allogenic blood transfusion.

Keywords: tranexamic acid, Blood loss, hip surgeries

Introduction
Replacement arthroplasty or joint replacement surgery, is a procedure of orthopedic surgery in which an arthritic or dysfunctional joint surface is replaced with an orthopedic prosthesis. Joint replacement is considered as a treatment when severe joint pain or dysfunction is not alleviated by less-invasive therapies. During the latter half of the 20th century, rheumasurgery developed as a subspecialty focused on these and a few other procedures in patients with rheumatic diseases. Joint replacement surgery is becoming more common with knees and hips replaced most often. About 773,000 Americans had a hip or knee replaced in 2009 [1].

Before major surgery is performed, a complete pre-anaesthetic work-up is required. In elderly patients this usually would include ECG, urine tests, hematology and blood tests. Cross match of blood is routine also, as a high percentage of patients receive a blood transfusion. Pre-operative planning requires accurate Xrays of the affected joint, implant design selecting and size-matching to the xray images (a process known as templating).
A few days' hospitalization is followed by several weeks of protected function, healing and rehabilitation. This may then be followed by several months of slow improvement in strength and endurance.

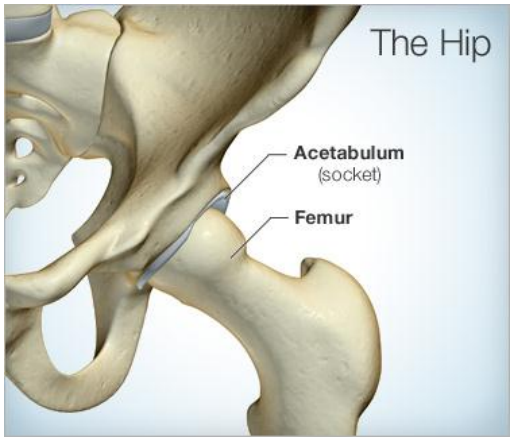

Fig 1

Early mobilisation of the patient is thought to be the key to reducing the chances of complications [1] such as venous thromboembolism and Pneumonia. Modern practice is to mobilize patients as soon as possible and ambulate with walking aids when tolerated. Depending on the joint involved and the pre-op status of the patient, the time of hospitalization

varies from 1 day to 2 weeks, with the average being 4–7 days in most regions.

Physiotherapy is used extensively to help patients recover function after joint replacement surgery. A graded exercise programme is needed initially, as the patients' muscles take time to heal after the surgery; exercises for range of motion of the joints and ambulation should not be strenuous. Later when the muscles have healed, the aim of exercise expands to include strengthening and recovery of function.

It is normal to lose blood during and after hip or knee replacement surgery. Some people need a blood transfusion during surgery or during their recovery period in the hospital. You are less likely to need a transfusion if your red blood count is high enough before surgery. Some surgeries require you to donate blood before surgery. You should ask your provider about whether there is a need for that.

Much of the bleeding during surgery comes from the bone that has been cut. A bruise may occur if blood collects around the new joint or under the skin after surgery [2].

The main objective of this double blinded case-Control study was to evaluate the role of Intravenous Tranexamic Acid therapy in reducing total blood loss in patients undergoing joint replacement surgeries.

Methodology

The study was planned in the Anugrah Narayan Magadh Medical College and Hospital undergoing the Joint replacement therapy. The study was conducted from Oct 2015 to July 2017. The age group of the patients is ranges from 20 to 60 years. Total 50 patients were evaluated for the study. After taking informed written consent and approval of the Institutional Ethics Committee.

Following are the inclusion and exclusion criteria for the present study:

Inclusion Criteria

- Patients undergoing the Joint replacement therapy

Exclusion Criteria

- Patients with thromboembolic disease, myocardial infarction, cerebrovascular disease, angina, coagulopathy
- Patient with Renal or Liver diseases
- Patients with bleeding history

The two groups were created. Group A had administrated with the Normal Saline (0.1 ml/kg) and Group B patients were administered with the Tranexamic Acid (0.1 ml/kg). Anesthetist injected the contents of the drug intravenously gradually at a rate of 1 ml/min starting at the incision time (forTotal Hip Arthroplasty or Hemiarthroplasty) of surgery or 15 minutes before Tourniquet inflation (in case of Total Knee Arthroplasty) to the patient. Post-operatively samesyringe content was administered to the patient at 8th hour and at 16th hour from incision time. The blood loss was calculated by the weight of all used blood soaked mop pieces post-surgery in each case.

Results & Discussion

The data from the both the study group was collected and presented as below.

Table 1: Demographic Data

	Group A: Normal Saline Patients	Group B: Tranexamic Acid Patient
Age in yrs	45-65	48-62
Weight in kg	50-80	58-83
Males	25	22
Females	15	18
Total	40	40

Table 2: Observation of blood loss during surgery

Type of Surgery	Group A: Normal Saline Patients	Group B: Tranexamic Acid Patient
Hemiarthroplasty	530-650 gm	405-483 gm
Total Hip Arthroplasty	670-988 gm	580-735 gm
Total Knee Arthroplasty	832-1035 gm	578-668 gm

The blood loss during surgery is seen more in the patient administered with the normal saline patients, whereas the patient administered with the Tranexamic Acid show lower amount of blood loss. Similar observations were seen the blood loss during the post-operative drain. The difference in the Haemoglobin in the Pre-Operative and post-operative conditions also suggest the narrower difference the Tranexamic Acid administered patients.

Table 3: Comparison of Blood loss in post-operative drain

Type of Surgery	Group A: Normal Saline Patients	Group B: Tranexamic Acid Patient
Hemiarthroplasty	138-252 gm	82-158gm
Total Hip Arthroplasty	146-389 gm	101-215gm
Total Knee Arthroplasty	241-486 gm	108-220gm

Table 3: Comparison of Hb Difference in the Pre-Operative and post-operative conditions

Type of Surgery	Group A: Normal Saline Patients	Group B: Tranexamic Acid Patient
Hemiarthroplasty	1.25-2.50	0.85-1.57
Total Hip Arthroplasty	1.51-3.25	1.05-2.10
Total Knee Arthroplasty	1.58-2.80	0.68-2.06

In today's setup Total Knee Arthroplasty surgeries are done under tourniquet but many authors havestated that the application of a pneumatic tourniquet enhances fibrinolytic activity several times above the basallevel in the extremity. The acceleration of fibrinolysis is due to tissue plasminogen activator released from the vascular endothelium. The release is triggered by anoxia or venous distension. It is logical to assume that thislocal phenomenon serves as a protective mechanism against vascular thrombosis during inflation of thetourniquet [3].

Hiippala ST *et al* [4] found that blood loss volume in Total Knee Arthroplasty after using tourniquet was 1509 ±643 ml and 689 ± 289 ml ($p < 0.0001$) which is comparable with our study. Our results were consistent with their study with significantreduction in blood loss in Experimental group.

In Total Hip Arthroplasty surgeries Niskanen RO *et al* [5] found that there was significant reductionin blood loss (792 ml and 1102 ml in Experimental and Control group respectively) by using a three doseregimen of 10 mg/kg at 0, 8 and 16 hours. We found similar results with same dose regimen.

Sarzaeem MM *et al* found that intravenous route was more effective in reducing the post-operativehemoglobin drop when compared to topical or intra-articular route [6]. All these studies state that use Tranexamic Acid intravenously significantly leads to higher post-operative hemoglobin compared to placebowhich is consistent with our study. A minimum of two dose regimen should be administered to significantlyreduce blood loss volume.

Conclusion

Tranexamic acid is effective in reducing perioperative blood loss when given by infusion. Continuation of an infusion postoperatively is more useful than a single dose in decreasing blood loss in the first 6 h after surgery. Tranexamic acid significantly reduces the need for allogenic blood transfusion.

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