

Hematological Outcomes with and Without a Pneumatic Tourniquet in Total Knee Replacement Surgery-A Comparative Study

Sudha Sethy¹, Rabi Narayan Dhar²

¹Assistant Professor, Department of Clinical Hematology, SCB Medical College, Hospital, Cuttack, Odisha, India

²Associate Professor, Department of Orthopedics, VIMSAR, Burla, Oisha, India

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ABSTRACT

Background: Tourniquets are commonly used in total knee replacement surgery to reduce blood loss. But it is usually associated with many side effects. Our aim was to evaluate the hematological parameter in patients undergoing primary total knee replacement with and without the use of tourniquet. **Methods:** This is a prospective, randomized study which includes 50 patients posted for total knee replacement in a tertiary care hospital in Odisha. 25 patients were operated with the use of a tourniquet (group T), and 25 patients without the use of a tourniquet (group NT). Comparison was done of hemoglobin (HB) and hematocrit (HT) variation during the pre- and post-operative period between the two groups. **Results:** Blood loss in suction drainage was more in NT group compared to T group which was statistically significant. Higher Hb level was evident pre-operatively in the non-tourniquet group compared to postoperative value which was statistically significant. No significant difference found in tourniquet group in Hb value. **Conclusion:** Tourniquet use helped in reducing blood loss in total knee replacement surgery thereby avoiding frequent blood transfusion.

Keywords: Tourniquets, total knee replacement, infection, hematological.

INTRODUCTION

Total knee replacement surgery is the most definitive treatment of degenerative diseases of the knee.^[1] It is associated with a great loss of blood, which can be equal to or greater than 1.5 L, a situation in which blood transfusion becomes mandatory.^[2] Total knee joint replacement surgery has been carried out with the use of a tourniquet placed in a proximal thigh position.^[3] The benefits of using a tourniquet are improved visualization of structures by allowing the surgeon a bloodless operative field, reduced intraoperative bleeding and better cementation and reduction in the operative time.^[4] As the bloodless field permits better penetration of cement into bone thereby improving the cementing technique during prosthetic implantation.^[5] Use of tourniquets also avoids frequent transfusions. The use of homologous blood components is associated with an increase in mortality and morbidity. Risks associated with homologous transfusions include the transmission of infectious agents, and non-infectious risks. But many studies are there in literature using no tourniquet technique. There is some evidence that tourniquet use may be of significant help.^[6] The aim of this study is to evaluate the difference between

total blood loss in patients undergoing total knee joint replacement with and without the use of a tourniquet.

MATERIALS AND METHODS

This is a prospective, randomized study which includes 50 patients. All the patients underwent total knee replacement surgery in a tertiary care hospital in Odisha between Jan 2016 to Jan 2018. 25 patients were operated on with the use of a tourniquet (group T), and 25 patients operated without the use of a tourniquet (group NT). Patients having coagulopathy, previous history of thromboembolism, previous open knee surgery and bilateral total joint arthroplasty were excluded from study.

The randomization of patients was made by computer generated table of randomized numbers. In group T, the limb was first exsanguinated by elevation for 3 min, then the tourniquet was inflated to 125 mm Hg above systolic pressure. If the duration of tourniquet use exceeded 90 min, the tourniquet was released intraoperatively and haemostasis was completed. After 10 min of release a new exsanguination was instituted. The tourniquet was deflated after the bone cement had set, and only then was electrocautery used for hemostasis. In the non-tourniquet group electrocautery was used frequently throughout the procedure.

All operations were performed under epidural anesthesia. The surgical procedure was performed through a medial parapatellar approach, followed by eversion and lateral dislocation of the patella,

Name & Address of Corresponding Author

Dr. Rabi Narayan Dhar,
Associate Professor,
Department of Orthopedics
VIMSAR, Burla,
Oisha, India

resection of the menisci and anterior cruciate ligament, femoral and tibial cut according to standardized technique for knee arthroplasty. The femoral cuts were performed with an intramedullary guide and the tibial with an extramedullary guide. All the prostheses were cemented and the femoral orifice obliterated with bone graft. After the procedure, all the patients remained hospitalized in the ward, new hematometric tests were performed, as well as anti-thromboembolism prophylaxis. For anticoagulant prophylaxis calf pump were use in all patients. In all patients a posterior stabilized prosthesis were used and patella was not resurfaced in all cases. Negative suction drains were inserted before closure. After closure the knee was placed in a compressive dressing after the application of a wool and crepe bandage to the limb. The total operating time was recorded. Hemoglobin and haematocrit was recorded pre-operatively and at the first and third day post-operatively. Drains were removed when the drainage was recorded as less than 100 ml during a 12-h period. Overall blood loss was calculated as the sum of compensated and non-compensated blood loss. The latter was calculated as described by Gross.^[7] The level of hemoglobin guided the need for transfusion. Generally, a patient received one or more blood units if the hemoglobin level was less than 8 g/dl. The chi-square test for qualitative variables and Student's t-test for quantitative variables (HB and HT before and after surgery and their variations) with a 95% confidence interval were applied to evaluate hematologic parameters.

RESULTS

Table 1: Comparison of demographic and hematologic parameters

Parameters	Group T	Group NT	P-value
Age (in years)	68.3 ± 6.9	67.3 ± 7.5	0.114
Male/female	13/12	12/13	0.345
Weight (kg)	74.6 ± 12.5	76.2 ± 13.7	0.312
Height (cm)	150.4 ± 25.5	148.2 ± 27.8	0.354
Preop Hb (g/dL)	12.2 ± 1.5	12.6 ± 1.7	0.257
POD 1Hb (g/dL)	11.5 ± 1.4	9.1 ± 1.2	0.117
POD 3Hb (g/dL)	10.1 ± 1.7	8.3 ± 1.9	0.241
Ht preoperative (%)	36.0 ± 2.8	36.0 ± 3.8	0.561
POD 1 Ht (%)	33.0 ± 3.2	27.2 ± 2.4	0.005
POD 3 Ht (%)	30.0 ± 1.9	25.7 ± 2.1	0.002
1st 24-h drained blood (ml)	340.5 ± 55.4	645.8 ± 56.9	0.007
Mean measured blood loss in suction drainage (ml)	560.5 ± 260.3	790.6 ± 186.9	0.005
Mean calculated overall blood loss (ml)	1158.6 ± 266.1	1412.6 ± 260.9	0.001
Mean total number of blood transfused(unit)	1.6 ± 0.8	3.1 ± 0.7	0.008
Postop blood loss (mL)	760.4 ± 345.7	893.2 ± 290.3	0.003

A total of 50 patients were included in the study who had undergone total knee replacement were divided into 25 in each group. There were no significant differences in between both group respect to age, gender, height and weight and Hb. On comparing the mean measured blood loss in suction drainage between the two groups statistical significance was noted ($p = 0.001$) Patient in the tourniquet group had less blood loss, in suction drain compared to NT group. The post-operative Hb levels were low in NT group compared to T group which was statistically significant ($p = 0.002$). Transfusion requirements were more in NT group compared to T group which was statistically significant ($p = 0.003$). [Table 1].

DISCUSSION

Elderly patients with limited cardiovascular function may not tolerate acute blood loss. So it is important to reduce blood loss during total knee replacement. Tourniquet use is the most common method to limit blood loss.^[8] Though we did not encounter any technical difficulty in operating without tourniquet in our study, there was significant loss of blood which required frequent transfusion. We have found that more blood loss occurs in suction drain when a tourniquet is not used for primary total knee replacement, and also the overall blood loss is the more in NT group. Our study finding is in agreement with studies of some authors who find increase blood loss without tourniquet.^[9,10] Our study is in disagreement with the study of Li et al in which he found no difference in the total blood loss with or without the use of a tourniquet.^[11] Vasconcelos observed that the removal of the intraoperative or postoperative tourniquet showed no difference in blood loss when comparing hemoglobin and hematocrit variation in the pre and postoperative period.^[12] Furthermore there was significant difference in the transfusion rates between the two groups. The main reason for using a tourniquet in total knee replacement is to achieve better cementation. The use of a pneumatic tourniquet in total knee replacement allows an exsanguinous field, which facilitates the dissection of soft parts and bone cuts, and improves the prosthesis cementation.

CONCLUSION

Our study concluded that with the use of a tourniquet, there was a lower reduction of Hb, blood loss and lower number of blood transfusions were necessary in patients undergoing total knee replacement surgery.

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