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Original article

Short term outcomes of long duration versus short duration tourniquet in primary total knee arthroplasty: A randomized controlled trial

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ABSTRACT

Introduction: A tourniquet is used during the total knee replacement surgery to improve the visibility, to reduce the blood loss and for better cementation. Indirectly it decreases the duration of surgery and enhances the recovery of the patient. Their use however is controversial due to some side effects associated with the use of tourniquet. They may increase the risk of deep vein thrombosis and pulmonary embolism by causing venous stasis, endothelial damage and increased platelet adhesion secondary to distal limb ischemia.

Material and Methods: We conducted a randomized controlled trial (RCT) to examine the benefits and risks associated with the use of long duration over short duration tourniquets during TKA. The study was a prospective randomised control trial with a total of 80 knees (40 knees in each group) included in the study. The knees selected for surgery were randomly allocated to one of the two groups: Group A - long duration tourniquet (LT-group) or Group B - short duration tourniquet (ST-group).

Result: The average operating time in Group A (43.53±3.11 minutes) was statistically less significant than that of Group B (51.7±2.56 minutes). Intra-operative blood loss in Group B, was significantly more than that of Group A. Post-operative blood loss in the drain was more in long duration tourniquet group. Total blood loss (intra-operative + post-operative) was more in short duration tourniquet group. Pain score (using VAS scale) was comparable in both the groups at the end of the second and sixth week. At sixth weeks there was no significant difference in the range of motion in both the groups. The KSS score was not significantly different in both the groups in post operative period at first, second, and six weeks. There were no events of thrombo-embolism and deep vein thrombosis in either groups. In 11 patients (27.5%) of long duration tourniquet group, swelling, and redness of knee was seen post operatively as compared to three patients (7.5%) of short duration tourniquet group.

Conclusion: The use of a short duration tourniquet during TKA gives better symptomatic pain relief in the early postoperative period as compared to long duration use of tourniquet. However, this is associated with increased blood loss, more operating time and not having a clear operative field. We suggest that a rational thinking and reconsidering the practice of routine use of long duration tourniquet in each and every case of TKA is required.

1. Introduction

With the advent of technology and instruments, Total Knee Arthroplasty (TKA) has now become one of the most commonly performed Orthopaedic surgery.[1,2] Although recent advances in surgical materials and techniques have increased the efficacy of this procedure, still the patients remain concerned about the pain and length of recovery associated with TKA.

During TKA, an intraoperative tourniquet is often placed on the upper thigh to reduce blood flow to the extremity.[3,4] The tourniquets seemingly have various benefits that can enhance procedural speed and patient recovery. These advantages include minimizing the amount of both intra-operative and post-operative blood loss, producing an intra-operative 'bloodless' visual field, improving the cement-bone inter-digitations and reducing the operation time.[5,6] However, the reported disadvantages of

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Table 1
The inclusion and exclusion criteria of the study.

INCLUSION CRITERIA	EXCLUSION CRITERIA
- Symptomatic grade IV bilateral knee OA - Patients who have signed written informed consent for the procedure.	- Patient with any hematological diseases (coagulopathy). - Patient with any infective foci in the body. - Patient with history of immune-suppression. - Patient with the peripheral neuro-vascular disease. - Inflammatory arthritis like rheumatoid arthritis.

tourniquet application include an increased risk of nerve palsy, vascular injury, muscle damage, post-operative swelling and stiffness.[7,8] A tourniquet application during TKA may also associated with an increased incidence of symptomatic deep vein thrombosis (DVT) and pulmonary embolism (PE),[9,10] by venous stasis and endothelial damage with increased platelet adhesion secondary to distal limb ischemia.

The use of a tourniquet for TKA is therefore controversial. Based on the current conflicting evidence, there is a fundamental need to further investigate the efficacy and safety of tourniquets during TKA. We thus conducted a randomized controlled trial (RCT) to examine the benefits and risks associated with the use of long duration over short duration tourniquets during TKA. We did this study to analyze the functional outcome and pain score both the groups after primary TKA and hoped that the findings of our study will contribute to improvements in procedural recommendations for TKA.

2. Material and methods

The study was a prospective RCT and included patients who were admitted for bilateral simultaneous TKA, same surgeon doing one knee after the other in single anaestheia setting, for severe and symptomatic Osteoarthritis (OA) of the knees. A total of 80 knees (40 knees in each group) were included in the study. Inclusion and exclusion criteria's were pre-defined (Table 1). A prior Institutional Ethical Committee (IEC) approval was taken before conducting this study. Informed consent was obtained from all the included patients before they underwent pre-operative assessment. Pain score, using visual analog scale (VAS scale), Functional scores using Knee Society Score (KSS), the range of motion (ROM) were recorded. All the cases were operated by the same surgeon and by the same technique, using similar implants. Randomization and blinding was done. Bilateral simultaneous TKA was done in all these patients by an anterior midline approach Scorpio™ Knee System (Stryker, Mahwah, New Jersey, USA). The knees selected for surgery were randomly allocated to one of the two groups: Group A – long duration tourniquet (LT-group) or Group B – short duration tourniquet (ST-group).

2.1. Randomization

A surgeon, who was not involved in the study, picked up the slip from non-transparent sealed envelope containing the slip of both the knees of the patient to decide which knee should receive long or short duration tourniquet.

2.2. Blinding

Subjects and personnel involved in the study were blinded to treatment group until before surgery. Both the patients and the staff in the operating theater were aware of the side for which knee, long, or short duration tourniquet was being used. The investigator collecting the data was blinded during procedure and follow-up.

In the long duration tourniquet group (Group A), the tourniquet was set to 150 mmHg above the patient's systolic blood pressure and was inflated just before the skin incision and deflated after setting of the bone cement. Whereas, in short duration tourniquet group (Group B), the tourniquet was inflated to the same level (150 mmHg above the patient's systolic blood pressure) just before cement application and deflated after setting of the bone cement. Electrocautery was used for hemostasis, and a suction drain was used in both the groups. A pneumatic tourniquet was applied on the thigh and inflated after two minutes of elevation of the limb. No exsanguination was done in either group (by Esmarch bandage). The operative time was taken from the time of the inflation of the tourniquet to the setting of bone cement in Group A, while in Group B, it was calculated from the time of incision taken to the setting of the bone cement. Intraoperative blood loss was measured [(volume in suction container-amount of saline wash used) + (total weight of wet mops used − total weight of dry mops used)] in all the cases. Postoperative blood loss was calculated from the volume of blood in drains. On the first post-operative day, hemoglobin and X-ray of both knees were done. The threshold of

Table 2
A comparison of operating time between short and long duration tourniquet groups.

	Short duration tourniquet	Long duration tourniquet	p value
Operating time (in minutes)	51.7 ± 2.56	43.53 ± 3.11	.03*

Table 3
Comparison of blood loss (intra, post operative and overall) between short and long duration tourniquet.

Blood loss (ml)	Short duration tourniquet	Long duration tourniquet	p value
Intra operative	288.41 ± 2.1	165.98 ± 2.33	.001*
Post operative	210.73 ± 1.46	266.94 ± 1.02	.04*
Overall	499.14 ± 3.56	432.92 ± 3.35	.003*

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