

**FASTER RECOVERY WITHOUT THE USE OF A TOURNIQUET IN TOTAL KNEE ARTHROPLASTY**Swapna Pran Saikia<sup>1</sup>, Nayan Moni Dutta<sup>2</sup><sup>1</sup>Assistant Professor, Department of Physical Medicine and Rehabilitation, Jorhat Medical College and Hospital, Jorhat, Assam.<sup>2</sup>Registrar, Department of Orthopaedics, Jorhat Medical College and Hospital, Jorhat, Assam.**ABSTRACT****BACKGROUND**

To create a bloodless surgical field and to ensure less intraoperative bleeding, tourniquets are applied in total knee arthroplasty, which results in improvement of cementation quality, reducing time of surgery and ensuring implant fixing for a long term. Thigh pain, nerve palsy, ischaemia, damage of soft tissue, thromboembolism and poor wound healing and patella maltracking are the disadvantages of this technique. Due to reduced muscle strength, reduced knee ROM and increased pain, recovery may be delayed. Amongst the surgeons, the use of tourniquets is a common practise as it has many benefits such as it can enhance speed of procedure and recovery of patient. It minimises intraoperative blood loss, improves interdigitations of cement and bone and reduce the operative time. This study evaluates the effects of tourniquet use on functional and clinical outcome and on ROM of knee.

The aim of the study is to evaluate the effects of tourniquet use on functional and clinical outcome and on ROM of knee.

**MATERIALS AND METHODS**

This was a prospective study, which was randomised and it was conducted on 100 patients in Jorhat Medical College, Jorhat, Assam, between March 2013 to March 2014. 100 patients were assessed for eligibility, however, 20 patients were excluded as they had diabetes mellitus with vascular disease peripherally (10), using anticoagulant (6) and refused to participate (4). The number of patients selected for randomisation were 80, out of which, one group allocated to tourniquet group (A) n=40, and other group, (B) in which, no tourniquet group; out of 40 in group A, 2 patients did not receive allocated intervention; in group B, 4 patients did not receive allocated intervention, i.e. preoperative switch to general anaesthesia. Hence, the total number of patients in group A who were analysed were 38 and total number of patients in group B who were analysed were 36. All the patients had signed, given informed consent and this study was approved by ethical committee.

Inclusion Criteria- ASA physical status I-III, patients of age >45 years and <85 years were selected.

Exclusion Criteria- Patients who had previous major knee injury to the same knee, preoperative ability to flex the knee >90, rheumatoid arthritis and allergy to any of the drugs used in the study. Using a ventral incision with a parapatellar medial entrance to the joint, TKA was performed. The patella was everted. A cemented single radius cruciate retaining total knee was used.

**RESULTS**

That there was an 85% knee extension strength reduction from 1.7 N/kg at baseline to 1.0 N/kg after surgery. However, after 48 hours post-surgery, there was no significant loss of knee extension strength. There was no differences in nausea, pain, LOS and periarticular swelling between the groups. There was no adverse events during the study.

**CONCLUSION**

This randomised study has concluded that without a tourniquet, a TKA surgery results in better TKA outcomes and improved knee ROM in early stages of rehabilitation.

**KEYWORDS**

ROM, TKA, Tourniquet.

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**BACKGROUND**

To create a bloodless surgical field and to ensure less intraoperative bleeding, tourniquets are applied in total knee arthroplasty, which result in improvement of cementation

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quality, reducing time of surgery, ensuring implant fixing for a long term.<sup>1,2</sup> Thigh pain, nerve palsy, ischaemia, damage of soft tissue, thromboembolism and poor wound healing and patella maltracking are the disadvantages of this technique.<sup>3,4</sup> Due to reduced muscle strength, reduced knee ROM and increased pain, recovery may be delayed. Amongst the surgeons, the use of tourniquets is a common practise as it has many benefits such as it can enhance speed of procedure and recovery of patient.<sup>5</sup> It minimises intraoperative blood loss, improves interdigitations of cement and bone and reduce the operative time. This study evaluates the effects of tourniquet use on functional and clinical outcome and on ROM of knee.



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## RESULTS

Demographics	Group A (n=38)	Group B (n=36)
Weight (kg)	85 ± 15	84 ± 15
Height	170 ± 7	172 ± 8
Male/female	20/18	19/17
Age in years	65 ± 9	67 ± 7
<b>ASA Physical Status</b>		
I	12	10
II	18	16
III	8	10
Duration of surgery	40 ± 9	42 ± 10
Intraoperative bleeding (mL)	185	58

**Table 1. Shows Demographics**

The primary outcome was the knee extension strength loss, which was calculated from pre-surgery to 48 hrs. post-surgery in the leg, which was operated. This was measured isometrically at 60 degrees knee flexion using an isokinetic dynamometer (Biodex) and it was in newtons/kilo body mass. It was done by a data assessor who was blinded to allocation and all the measurements were performed. 5 maximal contractions were the highest value, which was used as the data point. The patients were positioned as follows- the patients were made to sit on a dynamometer

chair with the knees flexed to 60 degrees, the hips flexed to 110 degrees, their hands rested on the thighs and palms up. Two straps were used to fixate the upper body and one strap was used to fix the leg. Above the center of lateral malleolus, the center of the dynamometer strain was placed 4-5 cm. The rotational extension/flexion axis of the knee joint was aligned visually with the rotational axis of the dynamometer and the center of the leg was aligned visually to the dynamometer lever. During strong verbal encouragement, maximum voluntary contractions of 5 seconds duration each were performed. Contractions were separated by 120 second pause. On both the operated and non-operated knee in all patients, measurements were performed.

	Operated Knee	
	Group A (n=38)	Group B (n=36)
Preoperation	1.78	1.70
48 hrs. postop	0.12	0.13
Loss	1.5	1.56

**Table 2. Shows Knee Extension Strength (N/Kg)**

Table 2 shows that there was an 85% knee extension strength reduction from 1.7 N/kg at baseline to 1.0 N/kg after surgery. However, after 48 hours post-surgery, there was no significant loss of knee extension strength.

### Secondary Outcomes

There was no differences in nausea, pain, LOS and periarticular swelling between the groups. There was no adverse events during the study.

## DISCUSSION

Many studies have been reported regarding the use of tourniquet in knee arthroplasty. Andreas Harsten et al conducted a study to examine if not using a thigh tourniquet during surgery was more effective than using a thigh tourniquet in preserving knee-extension strength 48 hours after fast-track TKA. A total of 64 patients undergoing TKA were randomised (1:1) to the use of tourniquet (T-group) or no tourniquet (NT-group). In the T-group, the tourniquet cuff pressure was based on the patient's systolic pressure and a margin of 100 mmHg. It was inflated immediately before surgery and deflated as soon as surgery ended. The primary outcome was the change in knee-extension strength from pre-surgery to 48 hours after surgery (primary end point). Secondary outcomes were pain, nausea, length of hospital stay (LOS) and periarticular swelling. Knee-extension strength 48 hours after surgery was substantially reduced by about 90% in both groups with no statistically significant difference between groups (mean difference 1.5 n/kg, 95%, CI 1.3-1.6). Among the secondary outcomes, the T-group had less bleeding during surgery (56 vs. 182 mL, P <0.01) compared with the NT group. There was no difference in postoperative haemoglobin levels, pain, nausea, LOS or periarticular swelling between the groups. Not using a thigh tourniquet during surgery was not superior in preserving knee extension strength at the primary endpoint 48 hours after fast-track TKA compared to using a tourniquet. Serkan Akpancar et al,<sup>6</sup> tourniquet has long been

used in TKA (total knee arthroplasty) as the other orthopaedic procedures for decreasing operation time and blood loss providing better visualisation of anatomic structures. While having much more advantages, these devices have a potential of serious complications, so they must be used with adequate knowledge and attention. Paralysis, compression neuropathy, compartment syndrome, prolonged period of rehabilitation, oedema, pain, skin problems, nerve damage and systemic problems are the some complications seen. Selections of appropriate blood pressure, cuff selection and tourniquet timing are the essential points of tourniquet use. Through these increasing complication rates and improvements in the surgical and anaesthesia methods contrary to old beliefs, surgery has been preferred without tourniquet in the patients who have no cardiovascular problems and morbidity. In the patients who have any contraindicated situations as stated above, TKA must be performed with tourniquet with proper control of the amount of pressure and the duration of application, the risk of complications decrease in the other situations, TKA can be performed without tourniquet with the aims for fast-recovery, post-surgical pain relief and better muscle activity. Ashir Ejaz et al<sup>7</sup> evaluated the effects of tourniquet use on functional and clinical outcome and on knee Range of Motion (ROM). 70 patients who underwent TKA were randomised into a tourniquet group (n=35) and a non-tourniquet group (n=35). All operations were performed by the same surgeon and followup was for 1 year. Primary outcomes were functional and clinical outcomes as evaluated by KOOS and knee ROM. Secondary outcomes were intraoperative blood loss, surgical time and visibility, postoperative pain, analgesic consumption and transfusion requirements. Patients in the non-tourniquet group showed a better outcome in all KOOS subscores and better early knee ROM from surgery to week 8. No difference was detected at the 6 and 12-months follow-ups. Postoperative pain and analgesic consumption were less when a tourniquet was not used. Surgical time and visibility were similar between groups. Intraoperative blood loss was greater when not using a tourniquet, but no postoperative transfusions were required. This study shows that TKA without the use of a tourniquet results in faster recovery in terms of better functional outcome and improved knee ROM. Furthermore, reduced pain and analgesic use were registered and no intraoperative difficulties were encountered. Abdel Salam A et al,<sup>8</sup> the effects of using a tourniquet during total knee arthroplasty were studied in 80 patients randomly allocated to two groups, either with or without a tourniquet. The groups were similar in mean age, gender, preoperative knee score and radiographic grading and the patients were all operated on by the same surgeon using one type of prosthesis. There was no significant difference between the two groups in operating time or total blood loss, but postoperative pain was less in the patients in whom a tourniquet had not been used. They achieved straight leg raising and knee flexion earlier and had fewer superficial wound infections and deep vein thromboses. Total knee arthroplasty can be safely performed without the use of the

tourniquet with the benefit that several adverse effects associated with its use can be avoided. Alcelik I et al,<sup>9</sup> a tourniquet is often used in total knee arthroplasty resulting in improved visualisation of structures, reduced intraoperative bleeding and better cementation. The risks include deep vein thrombosis and pulmonary embolism. To quantify the case for or against tourniquet use, we carried out a systematic review and meta-analysis of selected randomised controlled trials. Ten studies were included in the meta-analysis. Of the 8 outcomes analysed (surgery duration; total, intraoperative and postoperative blood losses; deep vein thrombosis; pulmonary embolism; and minor/major complications), the total and intraoperative blood losses were less using a tourniquet. Minor complications were more common in the tourniquet group. The remaining outcomes showed no difference between the groups. Using a tourniquet maybe beneficial, but long-term studies of outcome are needed. Wei Zhang et al,<sup>10</sup> conducted a study to evaluate the effects of a tourniquet in Total Knee Arthroplasty (TKA). The study was done by Randomised Controlled Trials (RCTs) on the effects of a tourniquet in TKA. All related articles which were published up to June 2013 from Medline, Embase and Cochrane Central Register of Controlled Trials were identified. The methodological quality of the included studies was assessed by the Physiotherapy Evidence Database (PEDro) scale. The meta-analysis was performed using Cochrane RevMan software version 5.1. Thirteen RCTs that involved a total of 689 patients with 689 knees were included in the meta-analysis, which were divided into two groups. The tourniquet group included 351 knees and the non-tourniquet group included 338 knees. The meta-analysis showed that using a tourniquet in TKA could reduce intraoperative blood loss (Weighted Mean Difference (WMD)), -198.21; 95%, Confidence Interval (CI), -279.82 to -116.60;  $P < 0.01$ , but did not decrease the calculated blood loss ( $P = 0.80$ ), which indicates the actual blood loss. Although, TKA with a tourniquet could save the operation time for 4.57 mins. compared to TKA without a tourniquet (WMD, -4.57; 95%, CI, -7.59 to -1.56;  $P < 0.01$ ), it had no clinical significance. Meanwhile, the use of tourniquet could not reduce the possibility of blood transfusion ( $P > 0.05$ ). Postoperative knee Range of Motion (ROM) in tourniquet group was 10.41° less than that in the non-tourniquet group in early stage ( $\leq 10$  days after surgery) (WMD, -10.41; 95%, CI, -16.41 to -4.41;  $P < 0.01$ ). Moreover, the use of a tourniquet increased the risk of either thrombotic events (Risk Ratio (RR), 5.00; 95%, CI, 1.31 to 19.10;  $P = 0.02$ ) or non-thrombotic complications (RR, 2.03; 95%, CI, 1.12 to 3.67;  $P = 0.02$ ). TKA without a tourniquet was superior to TKA with a tourniquet in thromboembolic events and the other related complications. There were no significant differences between the two groups in the actual blood loss. TKA with a tourniquet might hinder patients' early postoperative rehabilitation exercises.

**CONCLUSION**

This randomised study has concluded that without a tourniquet, a TKA surgery results in better TKA outcomes and improved knee ROM in early stages of rehabilitation.

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