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Post-operative clinical outcomes in patients with or without the use of tourniquet in total knee replacement surgery

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Abstract

Introduction: The use of tourniquet in a total knee replacement (TKR) has been advocated by some researchers across the globe, though the evidence is still lacking. In this study we aimed to assess the effect of using a tourniquet in patients undergoing total knee replacement on the post-operative blood drainage and range of movement of the operated knee.

Methodology: We included patients who were admitted for undergoing total knee replacement (TKR) surgeries in the Department of Orthopedics at the A.J. Institute of Medical Sciences during the period of November 2014 to May 2016. We included 20 patients who underwent TKR using a tourniquet and 20 age and gender matched control patients who underwent TKR without the use of tourniquet. The cases underwent surgery with tourniquet throughout the surgery at a pressure of 350 mmHg and the control group without tourniquet (inflated only for 20 minutes during cementing). Post-operative drain collection and recovery of range of movements at knee joint on 7th post-operative day were compared using unpaired t-test. p value less than 0.05 was considered statistical significant.

Results: At baseline, with respect to the demographic data and pain, both the groups were comparable. A mean of 1009 ± 168 mL drainage was collected in the tourniquet group and 628 ± 116.5 mL drainage was collected in patients who were operated without the tourniquet ($p < 0.001$). Range of motion was more at the end of 1 week post-operatively in patients without the use of tourniquet ($p < 0.01$) as compared to patients with tourniquet.

Conclusions: We compared the effect of tourniquet in patient undergoing total knee replacement. Multi-centric randomized trials are needed to further substantiate our findings.

Keywords: arthroplasty, tourniquet, outcomes, treatment

Introduction

Total knee replacement is one of the most commonly performed orthopedic procedures across the globe. Pain relief, restoration of function, and mobility and a variety of pathologic conditions affecting the knee can be treated with total knee replacement. The most common indication for total knee arthroplasty is relief of pain associated with arthritis of the knee in patients who have failed nonoperative treatments. Conservative therapies for patients with knee osteoarthritis include physical activity modification, weight loss, use of a crutches, analgesics, and/or nonsteroidal antiinflammatory agents. Although uncommon, complications related specifically to total knee arthroplasty range from minor problems to devastating and life-threatening events. It has been reported that the incidence of these complications may potentially be reduced if the procedure is performed by an experienced surgeon and hospital^[1]. Literature shows that patients undergoing total knee arthroplasty are at risk of significant perioperative and post-operative blood loss. This places some high-risk patients at increased risk for myocardial infarction, angina, transient ischemic attack, stroke, and seizure (especially in patients with significant systemic illness). Stiffness is a postoperative limitation of range of motion that may result in functional impairment as a result of surgery. Studies show that the best predictor of postoperative stiffness is preoperative range of motion^[2]. The use of tourniquet has been advocated by some researchers across the globe, however the evidence regarding its usefulness in a total knee replacement is yet to be determined.

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Theoretically and clinically, the use of tourniquet can lower blood loss, however it is associated with a number of other complications like delayed healing and lower range of motion [3].

In this study we aimed to assess the effect of using a tourniquet in patients undergoing total knee replacement on the post-operative blood drainage and range of movement of the operated knee.

Methodology

We included patients who were admitted for undergoing total knee replacement (TKR) surgeries in the Department of Orthopedics at the A.J. Institute of Medical Sciences during the period of November 2014 to May 2016. During the study period we decided to include 20 patients who would undergo TKR using a tourniquet. We also included 20 age and gender matched patients who underwent TKR without the use of tourniquets, which became the control group. Inclusion criteria for the study was patients who would undergo either unilateral TKR or staged bilateral TKR, aged more than 50 years and patients with either primary or secondary osteoarthritis of knee. We excluded patients with an established underlying arterial or venous insufficiency, patients undergoing bilateral total knee replacement in single sitting and those undergoing revision surgery of total knee replacement. This study was approved by institutional ethical committee of A.J. Institute of Medical Sciences. All patients were consented for the surgery and the study. The patients would be admitted and detailed history would be taken and examination would be done.

Patients were allocated to each group by random allocation method. The cases group underwent surgery with tourniquet throughout the surgery at a pressure of 350 mmHg. The control group underwent surgery without tourniquet (inflated only for 20 minutes during process of cementing). However tourniquet was inflated in both the study groups during the process of cementing. The duration of surgery and tourniquet pressure were comparable in patients of both the groups. The surgery was conducted by experienced surgeons in both groups in order to avoid technical errors. The implants used were similar in both groups. Cementing was done for both femoral and tibial component. No patient received any pre-operative anticoagulants. Patients underwent total knee replacement under spinal anaesthesia followed by epidural analgesia for post-operative pain.

The assessment of pain in our study was done using the Simplified verbal scale (SVS) scoring method. Using the SPSS version 23, the demographic data were tested for its distribution through normality tests using Kolmogorov-Smirnov test. The data were found to be parametric in its distribution. SVS was presented as numerical mean. The means (SD) were compared using unpaired t test (two tailed). Post-operative drain collection and recovery of range of movements at knee joint on 7th post-operative day were compared using unpaired t-test (independent sample) (two-tailed) between the groups. p value less than 0.05 was considered as minimum value for statistical significance.

Results

We included 20 cases and 20 controls in the study. Average age of cases was found to be 62.8 with standard deviation of 7.47 years and that of controls was 63.1 with standard deviation of 7.21 years (Table 1). Similarly gender distribution in both the groups was found to be comparable as well, there were 5 males in the case group and 6 males in the

control group. Baseline SVS scores were noted for the groups and that were 2.65 and 2.2 for cases and controls respectively. At baseline, with respect to the demographic and pain, both the groups were comparable. After the surgery, we noted the amount of post-operative drain collection for all the patients. A mean of 1009 ± 168 mL drainage was collected in the tourniquet group and 628 ± 116.5 mL drainage was collected in patients who were operated without the tourniquet (Table 2). There was a statistically significantly higher drainage in the cases as compared to controls (p value less than 0.001). Range of motion was more at the end of 1 week post-operatively in patients without the use of tourniquet (p value less than 0.01) as compared to patients with tourniquet.

Discussion

The use of the tourniquet is based on the premise that maintaining a bloodless field minimizes the amount of both intraoperative and early postoperative blood loss. The relationship between the timing of tourniquet release and its effect on blood loss has been the subject of some investigative work, but the results of these studies have been inconsistent. The group of patients selected in our study were comparable based on demographic characteristics and all patients underwent Total knee replacement surgery by midline longitudinal para-patellar approach.

Vandenbussche *et al* found that there were higher incidence of pain in patient undergoing with surgery tourniquet compared to those without tourniquet [4]. There was early recovery in range of movements, low incidence of DVT in group undergoing surgery without tourniquet. However, there was increased blood loss in patients undergoing surgery without tourniquet. Similar results were found in our study with respect to range of movements, but in contrast there was less post-operative drain collection in patient undergoing surgery without tourniquet. This may be due to better hemostasis achieved intraoperatively. Tetro *et al* demonstrated that though there was less intraoperative blood loss in patient undergoing surgery with tourniquet, there was subsequent increase in post-operative drain collection hence resulting increased total blood loss and subsequently leading to increased transfusion studies. Similar results were seen in our study [5]. Furthermore, they found that intraoperative blood loss and total measured blood loss were higher in the control group (without tourniquet group), even though the total calculated blood loss was higher in the tourniquet group. Similar results were found in our study however we used tourniquet for a short duration of 20 min during cementing. This did not show any significant increase in post-operative drain collection and also helped in better hemostasis after deflation of tourniquet.

In a study conducted by Asp and Rand it was concluded that the study evaluated patient, anesthetic, and surgical risk factors for neurologic complications after prolonged total tourniquet time during TKA [6]. Tibial and/or peroneal nerve dysfunction occurred in 7.7% of patients and was associated with younger age, the presence of a preoperative flexion deformity, and longer total tourniquet time. A tourniquet deflation (reperfusion) interval only modestly decreased the risk of nerve ischemia. Similarly, in our study we noticed that the patients undergoing surgery with tourniquet had less range of movements compared to those without tourniquet, this may be attributed to the increased post-operative pain in this group when compared with the other and also because of the perfusion impairment to the nerves and muscles during period when tourniquet is inflated. Harvey *et al* concluded that use of

tourniquet till application of bandages reduces reduced intraoperative blood also does not increase the chances of post-operative deep venous thrombosis (DVT) [7]. In contrast to this, we found that though there is less intra operative bleeding with use of tourniquet, the subsequent drain collection is comparatively higher, the reason for which is the reactive hyperemia after the deflation of tourniquet. The initiation of post-operative DVT prophylaxis was followed in our study also but similar method (inj low molecular weight heparin 40mg subcutaneously once daily) was given to patients in both groups, there were no incidence of DVT in our study. DVT is common following knee arthroplasty, occurring in more than 50% of patients in one study. Further, 10–15% of patients develop DVT in the contralateral leg after unilateral knee arthroplasty. The use of the tourniquet during surgery does not have a clear detrimental effect on thrombus formation.

Our study has a few limitations. Selection bias may exist

because of the way we defined the cases and the controls. The tissue trauma related to extent of surgery may also have contributory effect. Bias in this study could originate from the surgical patterns of the two different surgeons; however, the baseline patient characteristics and the procedures were not significantly different between the two surgeons. Finally, small size in each group might have limited the true clinical significance of our comparison.

Conclusion

We compared the effect of tourniquet in patient undergoing total knee replacement. The amount of post-operative drain collection was significantly lower in patient undergoing surgery without tourniquet. The recovery of range of movements was better in patients undergoing surgery without tourniquet. Multi-centric randomized trials are needed to further substantiate our findings.

Table 1: Baseline information about the patients

	Cases (Tourniquet)	Controls (Without tourniquet)
<i>n</i>	20	20
Average age (\pm SD*)	62.8 \pm 7.47	63.1 \pm 7.21
Males	5	6
Baseline SVS score (\pm SD)	2.65 \pm 0.48	2.2 \pm 0.41

*SD: standard deviation

Table 2: Post-operative findings in cases and controls

	Cases (Tourniquet)	Controls (Without tourniquet)	
	Mean \pm SD*	Mean \pm SD*	p value**
Post-surgical drain collection (mL)	1009 \pm 168.	628 \pm 116.5	<0.001
Range of motion (in degrees)	70.5 \pm 14.04	80 \pm 6.88	<0.01

*SD: standard deviation

**p value less than 0.05 taken as statistically significant

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