

# Outcome of Midvastus versus Subvastus Approach in Single Stage Bilateral Total Knee Arthroplasty

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## ABSTRACT

**Objective:** To compare midvastus and subvastus approach regarding operative parameters (lateral retinacular release, operative time, neurovascular injury) and outcome (Knee Society Score, Straight Leg Raise) at 12 weeks in single stage bilateral total knee arthroplasty.

**Study Design:** Randomized clinical trial study

**Place and Duration of Study:** Institute of Orthopaedic Surgery and South City Hospital Karachi from 1<sup>st</sup> January 2016 to 31<sup>st</sup> December 2018.

**Methodology:** Fifty two patients of both genders of more than 50 years with osteoarthritis grade III or IV and bony changes confirmed by AP and lateral radiographs of knee were included. Patients with previous knee surgeries including high tibial osteotomy, deformities >20° (on mechanical axis), any neuromuscular problem and BMI ≥30 were excluded. Final assessment was done at 12 weeks. Isometric quadriceps strength was assessed by holding of contraction in seconds during the lifting (10cm above the plinth) phase of SLR (patient lying supine). Knee score (preoperative and final follow-up) was performed by Knee Society Score.

**Results:** Thirty five were females and 21 males with mean age 65.3 years (50-78 years). Mean body mass index was 27.8 Kg/m<sup>2</sup> (26.4-29.9). In midvastus TKR, the mean operative time was 61.7 minutes (range 52-70) whereas the same was 68.3 minutes (range 58-74) in subvastus TKR with p value 0.002. Rate of lateral retinacular release (LLR) was significantly (p=0.011) different between the midvastus TKR 5 (8.9%) and subvastus TKR 11 (19.6%). Neither group had neurovascular injury or early infection of the knee. Active SLR in subvastus group was achieved in shorter time (mean 3.1 days) as compared to midvastus group (mean 4.7 days). There was no difference (p=0.173) in isometric quadriceps strength at 12 weeks between subvastus TKR (mean 18 seconds) and midvastus TKR (mean 17 seconds). Knee society pain and functional scores were comparable between the two approaches at final follow up.

**Conclusion:** Subvastus exposure has advantage of achieving active straight leg raise earlier while midvastus has lower frequency of lateral retinacular release. No difference in hospital stay and postoperative pain scores. Both subvastus and midvastus approaches are safe and offer comparable Knee Society Score outcomes.

**Keywords:** Midvastus, Subvastus, Total knee arthroplasty, Knee Society Score, Straight leg raise

## INTRODUCTION

Total knee replacement (TKR) surgery is the best solution to relieve pain for cases of advanced knee osteoarthritis. Planning of incision and the joint exposure is crucial. A good surgical exposure is a key component for TKR success and optimal positioning of the implants.<sup>1</sup> Commonly used approaches for primary TKR includes medial parapatellar (PP), midvastus (MV) and subvastus (SV). Many long term studies have consistently expressed better results with medial PP approach. However there is concern regarding patellar tracking and Quadriceps functional deficiency with this medial arthrotomy approach.<sup>2,3</sup> As intratendinous incision is used to separate vastus medialis from patella in medial PP approach, blood supply to patella also get disconnected from medial genicular and descending genicular arteries.<sup>4</sup>

Subvastus and midvastus approaches were developed to avoid incision of quadriceps tendon and many studies have reported good short term results. The midvastus exposure has more consistent patellar tracking along with early advantage of rapid recovery, less pain and without notable complications but potential risk to neurovascular stuff cannot be ignored.<sup>3-5</sup> The significant

advantages of subvastus approach over the other approaches are maintaining the blood supply of patella and leaving quadriceps mechanism intact. It also offers rapid recovery with less pain, early SLR and less blood transfusion requirements. Regarding downside of subvastus, exposure is difficult as marked during patellar eversion and lateral retinacular release may be required more for improving patellar tracking.<sup>3,6,7</sup>

However controversy still exists among the approaches. Most of the studies have compared either SV with medial PP or MV approach with medial PP. Only a few studies have been conducted to compare directly MV with SV approach in primary TKR. No such study has been conducted in Pakistan. Therefore we have designed this RCT to compare MV with SV approach regarding operative parameters, safety and recovery.

## MATERIALS AND METHODS

This randomized clinical trial study was conducted at Institute of Orthopaedic Surgery and South City Hospital Karachi from 1<sup>st</sup> January 2016 to 31<sup>st</sup> December 2018. After informed consent 52 patients were enrolled. Both male and female patients of more than 50 years with

osteoarthritis grade IV (Kellgren-Lawrence Scale)<sup>15</sup> and bony changes confirmed by AP and Lateral radiographs of knee were included. Patients with previous knee surgery including high tibial osteotomy, deformities > 20° (on mechanical axis), any neuromuscular problem and BMI ≥30 were excluded from the study. All primary TKR surgeries were executed by the senior surgeon who had performed more than 500 TKR surgeries by each approach (SV & MV) in the past prior to the study. Simple lottery method was used for selection of approach on the knee to be operated first and then other approach was used for the contralateral knee. The PS cemented Knee implant (Nexgen LPS-Flex Zimmer Biomet USA) was used in each case. Patellar resurfacing was done in each case.

Skin incision was midline for each case and deep exposure was performed either by MV approach (Engh technique)<sup>7</sup> or SV approach (Hoffman et al technique).<sup>8</sup> Electrocautery was used for any bleeding points while doing MV & SV approach to prevent hematoma postoperatively. Intraoperatively patella was assessed with no-thumb test for lateral drifting and lateral retinacular release (LRR) was done where required to make sure central patellar tracking before capsular closure. Drain was not inserted in any case. All patients were operated under tourniquet and it was not deflated until compression dressing applied. All patients were operated under general anaesthesia and identical postoperative pain protocol was followed between the groups. Pain assessment was done at day 1 and day 5 postoperatively with "visual analogue scale" (VAS) consisting of zero to hundred points on 10cm line<sup>16-17</sup> and finally at 12 weeks. Rehabilitation was started from the day of surgery with CPM set at 60° which was increased by 10° daily. Weight bearing and walking started from 2<sup>nd</sup> postoperative day under supervision of physical therapist. Active SLR performance was assessed daily from 2<sup>nd</sup> postoperative day. All patients were discharged (5<sup>th</sup> or 6<sup>th</sup> postoperative day) when stable as demonstrated by full weight bearing and walking with frame. Outpatient physical therapy continued for 04 weeks.

Final assessment was done at 12 weeks. Isometric quadriceps strength was assessed by holding of contraction in seconds during the lifting (10cm above the plinth) phase of SLR (patient lying supine). Knee score (preoperative and final follow up) was performed by Knee Society Score (Insall Modification 1993). Data was analyzed by using SPSS 22 version. Independent T test was used to analyze the results. P value less than 0.05 was taken as significant.

## RESULTS

There were 35 females and 21 males with mean age 65.3 years (50-78 years). Mean BMI was 27.8 Kg/m<sup>2</sup> (26.4-29.9). In MV TKR, the mean operative time was 61.7 minutes (range 52-70) whereas the same was 68.3 minutes (range 58-74) in SV TKR with p value 0.002. Rate of LLR (lateral retinacular release) was significantly (p=0.011) different between the MV TKR (8.9%) and SV TKR (19.6%). Neither group had neurovascular injury or early infection of the knee. The mean KSS improved from 38.6 preoperatively to 91.8 postoperatively in midvastus TKR and 39.3 to 90.7 in subvastus TKR. The functional KSS

was measured as 26.4 and 25.3 (preoperatively) whereas 88.1 and 87.5 postoperatively in midvastus TKR and subvastus TKR respectively (Tables 1-3).

Table 1: Comparison of clinical characteristics preoperatively (n=56)

Characteristic	Midvastus Approach Mean (range)	Subvastus Approach Mean (range)	P value
KF (Degrees)	96.2 (90-115)	96.9 (85-115)	0.384
KSS Pain (points)	37.6 (29-45)	38.3 (31-45)	0.175
KSS functional (points)	26.4 (10-30)	25.3 (10-30)	0.085

KF= Knee flexion KSS= Knee Society Knee Score

Table 2: Comparison of early postoperative clinical outcome (n=56)

Characteristic	MidvastusTKR Mean (range)	SubvastusTKR Mean (range)	P value
Pain day 1 (VAS Points)	67.9 (50-85)	65.5 (45-85)	0.081
Pain day 5 (VAS Points)	30.1 (25-50)	27.6 (20-45)	0.061
SLR (days)	4.7 (3-6)	3.1 (2-4)	0.002

Table 3: Comparison of final postoperative clinical outcomes (n=56)

Characteristic	MidvastusTKR Mean (range)	SubvastusTKR Mean (range)	P value
KF (Degrees)	117.2 (110-125)	116.8 (105-130)	0.531
KSS Pain (points)	91.8 (85-95)	90.7 (85-95)	0.247
KSS Functional (points)	88.1 (80-100)	87.5 (80-100)	0.310
Pain (VAS Points)	9.2 (3-20)	8.7 (2-20)	0.402
SLR (Seconds)	17 (13-21)	18 (14-22)	0.173

KF= Knee flexion KSS= Knee Society Score

## DISCUSSION

Primary objective of TKR is to achieve stable, painless and functional knee. It requires meticulous surgical technique along with good and safe exposure as primary step.<sup>4</sup> Demographic profile of this study is comparable with the other studies although some studies have slightly higher mean age and BMI.<sup>3-5,9</sup> Preoperative mean knee society pain score (37.6, 38.3) were very poor in our study as compared to Bonutti et al<sup>9</sup> (49) and Masjudin & Kamari<sup>3</sup> (45.9, 46.6). Similarly mean knee society functional score were also very poor (25.3, 26.4) as to Bonutti et al<sup>9</sup> (48, 49) and Masjudin & Kamari<sup>3</sup> (48, 49.3). This is because our patients hesitate and accept the option of TKR quite late.

Mean operative time was statistically significant (p=0.002) in midvastus TKR (61.7 minutes) and subvastus TKR (68.3 minutes) but clinically not significant. Our mean operative time was little lower as compared to Masjudin & Kamari<sup>3</sup> study (67 & 74 minutes). Rate of lateral retinacular release is significantly (p=0.011) different between the midvastus TKR (5, 8.9%) and subvastus TKR (11, 19.6%) in the present study. The studies directly comparing MV & SV are limited. Masjudin & Kamari<sup>3</sup> study has equal frequency (4.3%) between these two exposures. Most of studies have compared MV or SV approach with medial PP and expressed more frequency of LLR in medial PP approach.<sup>4,5,11-13</sup> High rate of LLR in our study may be related to resurfacing of patella that we did in all patients.

There is no significant difference (p values 0.081, 0.061) of VAS pain score between the study groups during the hospital stay and at final follow up. The same findings have been reported by many studies.<sup>4,5,11-14</sup> Difference in achieving active SLR is significant (p=0.002) between the groups in our study. Active SLR in subvastus group is achieved in shorter time (mean 3.1 days) as compared to

midvastus group (mean 4.7 days). Masjudin & Kamari<sup>3</sup> study has also expressed similar findings. Others studies comparing subvastus or midvastus with medial PP have also expressed earlier active SLR with midvastus and subvastus approaches.<sup>4,5,11-14</sup>

There was no difference ( $p=0.173$ ) in isometric quadriceps strength at 12 weeks between subvastus TKR (mean 18 seconds) and midvastus TKR (mean 17 seconds). Same results have been reported by various studies and meta-analysis consisting of studies upto two years of follow up.<sup>2-5,11-14</sup>

Our study has comparable results regarding KSS pain and functional scores at 12 weeks with no significant difference statistically ( $p=0.247, 0.310$ ) as well as clinically between the groups. Masjudin & Kamari<sup>3</sup> study has similar findings. Various meta-analysis have also described similar results.<sup>2,4,9,18,19</sup>

## CONCLUSION

Our patients hesitate and opt for knee arthroplasty quite late. Subvastus exposure has advantage of achieving active straight leg raise earlier while midvastus has lower frequency of lateral retinacular release. No difference in hospital stay and postoperative pain scores. Both subvastus and midvastus approaches are safe and offer comparable Knee Society Score outcomes. If surgeon is comfortable with any approach between the two he may choose either.

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