Journal of Orthopedic Research and Therapy
Sinha S, et al. J Orthop Res Ther 7: 1218.
www.doi.org/10.29011/2575-8241.001218
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Research Article

Comparison of Functional Outcome after Total Knee Arthroplasty by Medial Parapatellar Approach Versus Midvastus Approach: A Prospective Observational Study

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Citation: Sinha S, Ehsan NM, Muhammed MN, Shajil S, Gowrishankar, et al. (2022) Comparison of Functional Outcome after Total Knee Arthroplasty by Medial Parapatellar Approach Versus Midvastus Approach: A Prospective Observational Study. J Orthop Res Ther 7: 1218 DOI: 10.29011/2575-8241.001218

Received Date: 26 January, 2022; **Accepted Date:** 02 February, 2022; **Published Date:** 07 February, 2022

Abstract

Total knee arthroplasty has become one of the most successful joint replacement surgeries with patients reporting good function following the surgery. The parapatellar approach is most often used, whereas the midvastus approach is a suitable alternative. Presently, it is unknown, which of the two is most advantageous for the function of the patient. **Methodology:** double-blind prospective, observational, comparative study. **Results:** It has been demonstrated that the Midvastus Approach (MV) is advantageous in the early postoperative period compared to the medial parapatellar surgical approach (MPP). The midvastus group were able to perform straight leg raising earlier and experienced less extensor lag when compared to the medial parapatellar group. The Knee Society Knee Score and the functional scores were also better in the midvastus group in the immediate post operative period. **Conclusion:** The midvastus approach, which is based on diminished disruption of extensor mechanism and peripatellar plexus of vessels, relieves pain and improves range of motion in the early rehabilitation period following TKA.

Keywords: Medial parapatellar; Mid vastus; Total knee arthroplasty

Abbreviations: TKA: Total Knee Arthroplasty; MPP: Medial Parapatellar; MV: Mid Vastus; SLR: Straight Leg Raising

Introduction

Total knee arthroplasty has become one of the most performed and successful joint replacement surgeries to relieve knee pain in osteoarthritic knees [1]. For further improving the results, the long-term outcome of the procedure and to decrease the hospital stay, various modifications are being sought by improving implant design, patient selection, and the surgical approach used for arthrotomy [2]. A good exposure is essential during surgery for placement of prosthesis in proper alignment and rotation. First described in 1879 by Von Langenbeck, the medial parapatellar approach on the inner side of the knee, found early favour and was regarded as the gold standard for which other approaches are compared [3-7]. However, this approach has been said to affect the extensor function, resulting in inferior functional outcomes and delayed recovery [3,4]. As an alternative subvastus approach which avoids damage to the extensor

mechanism of the knee was proposed by Hofmann in 1991 [4,5]. But it had its own share of problems, including difficult exposure, increased chances of postoperative hematoma, muscle ischemia, and apprehension with detachment of patellar tendon from its insertion [6]. A compromise between preservation of quadriceps function and good surgical exposure was achieved when Engh reported the midvastus or vastus-splitting approach in 1997 [7]. The reported benefits of this approach include shorter hospital stay, decreased blood loss, early functional recovery, reduced postoperative pain, and decreased patellar complications [7,8].

Various studies had compared the functional and clinical outcomes of the medial parapatellar and the midvastus approach with TKA; however, there were paucity of studies in Indian population, particularly comparative study for early functional outcome. Moreover, only few of them were prospective randomized double blinded studies. [9-14]. The aim of the study is to evaluate and compare the clinical outcomes of TKA performed by the midvastus and medial parapatellar in the Indian population in a double-blind manner with emphasis on early post-operative functional outcome.

Materials and Methods

Study Site

The study was carried out in the Department of Orthopaedics at KIMS Health Hospital Trivandrum

Study Design: A prospective, observational, comparative study.

Sampling Strategy

Inclusion Criteria: Severe Knee Osteoarthritis (Kellgren-Lawrence grades 3 and 4) and willing to undergo TKA procedure.

Exclusion Criteria:

- BMI > 40,
- Fixed Varus deformity > 30 degrees,
- Fixed Valgus deformity > 05 degrees,
- Fixed flexion deformity> 30 degrees,
- Patients with a pre-operative active knee flexion < 80 degrees,
- Inflammatory arthritis,
- Active infection,
- Comorbid conditions such as psychiatric illness, neuromuscular disorders,
- Patients not motivated for physiotherapy, or not ready to undergo lifestyle modification required after arthroplasty,
- Associated severe hip / ankle deformities,
- Significant limb length discrepancies,
- Any previous knee surgery.

Results

Demographics

After considering the inclusion and exclusion criteria 88 patients were included in the study. Females constituted majority of the selected patient population with males constituting 17.05%. Grade 4 OA changes were noted in 119 knees out of 138 knees which were included in the study. 43 patients were managed with MPP approach which included 71 knees in comparison to MV approach which included 45 patients which accounted for 67 knees. Bilateral total knee arthroplasty was done in 50 patients while 38 patients underwent unilateral TKA. Among the patient who underwent bilateral TKA 28 patients underwent MPP approach while 22 patients underwent MV approach (Table 1).

Approaches	Number of Patients	Number of Knees
MPP	43 (49%)	71 (51%)
MV	45 (51%)	67 (49%)

Table 1: Comparison of distribution of patients and knees for MPP and MV approaches.

Clinical Data

Tourniquet time was standardised as time taken from skin incision to cemented implantation. The tourniquet was deflated before arthrotomy closure. A mean tourniquet time of 28.6 ± 0.97 minutes was noted with MPP approach while 32.5 ± 1.18minutes was noted with MV approach. This data was not found to be significant (Table 2).

	MPP (n=71)	**MV** (n=67)	**p-value**
Mean Tourniquet Time (Minutes)	28.66 ± 0.97	32.55 ± 1.18	<0.05
Data shown as mean ± standard deviation			

Table 2: Comparison of tourniquet time between two approaches.

SLR was encouraged in patients from POD1. Patients who underwent MV approach were able to perform SLR significantly earlier than those who underwent MPP approach. Mean time for SLR with MV approach was 1.12 ± 0.32 days while for MPP approach was 4.31 ± 0.52 days (Table 3).

	MPP (n=71)	**MV** (n=67)	**p-value**
Mean POD for SLR (in days)	4.31 ± 0.52	1.12 ± 0.32	<0.001
Data shown as mean ± standard deviation			

Table 3: Comparison between mean days of SLR in MPP versus MV approach.

Extension lag was looked for at 1 week and 6 weeks post-operatively. MV approach showed extension lag of 6.51 ± 1.53 degrees and 2.45 ± 0.72 degrees at 1 week and 6 weeks respectively. The data when compared with MPP approach showed significantly lesser extension lag in patients who had undergone MV approach. Extension lag of 13.41 ± 2.62 and 5.61 ± 1.53 were noted at 1 week and 6 weeks in patients who underwent MPP approach (Table 4).

	MPP (N=71)	MV (n=67)	p-value
Extension lag 1 week (in degrees)	13.41 ± 2.62	6.51 ± 1.53	<0.001
Extension lag 1.5 month or 6 week (in degrees)	5.61 ± 1.53	2.45 ± 0.72	<0.001
Data are shown as mean ± standard deviation			

Table 4: Comparison of extension lag after 1 week and 1.5 month of TKA.

MV group had significantly lesser hospital stay when compared to MPP group (Table 5).

Group	**Number of patients**	**Duration of hospital stay (Post OP to Discharge) in days**					
		Mean	**SD**	**Minimum**	**Maximum**	**Median**	**IQR**
MPP	43	5.69	1.47	4	11	6	5-6
MV	45	4.90	1.02	3	8	5	4-5
P<0.001							

Table 5: Comparison of duration of hospital stay (in days) for each surgical approach.

Functional Scores

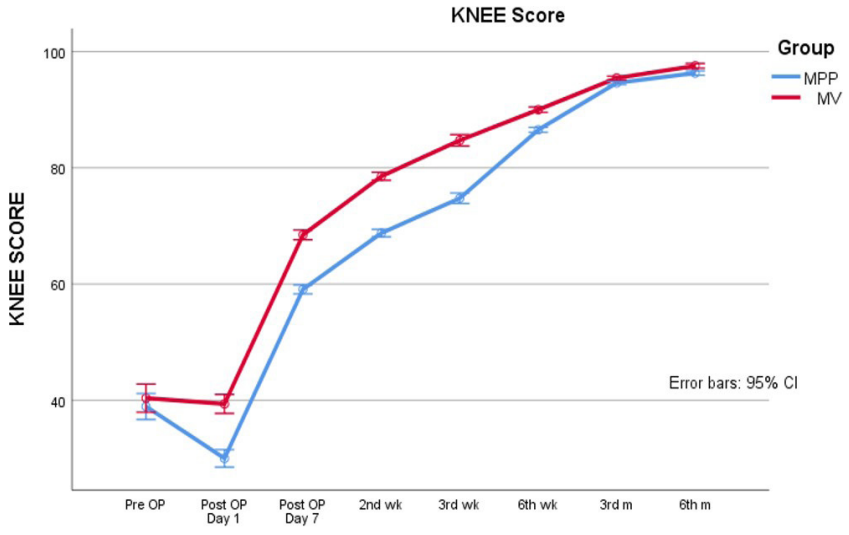

Figure 1: Comparison of KSS knee score between two approaches of TKA.

Knee Society Knee Score and Knee Society Function Score were calculated pre-operatively and post-operatively. The patients were followed up for a period of 6 months. The Knee Society Knee Score was found significantly better in patients who had undergone MV approach up to 6 weeks post- operative. From 3 months to 6 months post- operative period even though a higher Knee Society Knee Score was noted with MV approach, the data was not significant. I week post-operatively 80.5% and 19.5% of the patients with MV approach showed fair and good results respectively in comparison to MPP approach (Figure 1).

Table 6 which showed 60.5 % patients with poor and 39.5 % patients with fair results. By the 3rd post operative week 98.2% of patients with MV approach showed excellent results while all the patients with MPP approach reported good results.

KSS Grade (mean Knee score)	At POD 7		At 2nd week		At 3rd week	
	MPP	MV	MPP	MV	MPP	MV
Poor (<60)	43 (60.5%)					
Fair (60-69)	28 (39.5%)	54 (80.5%)	54 (76%)			
Good (70-79)		13 (19.5%)	17 (24%)	48 (71.6%)	64 (100%)	1 (1.8%)
Excellent (>80)				19 (28.4%)		57 (98.2%)
Total number of knees	71	67	71	67	64	58

Table 6: Comparison of KSS knee score grade between MPP and MV approaches at POD 7; 2nd week and 3rd week on basis of number of knees.

The Knee Society Function Score during postoperative period 1- 6 weeks was noted to be significantly better in patients that underwent MV approach compared to those with MPP approach. Even though the MV Knee Society Function Score was better at the 3rd and 6th month post operatively no significant difference was noted with the MPP approach (Figure 2).

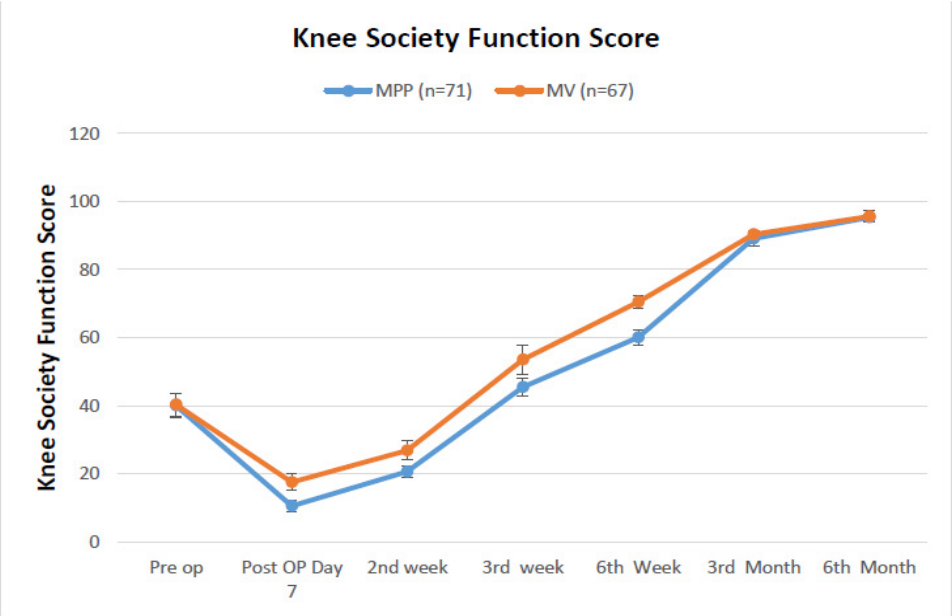

Figure 2 : Comparison of KSS function score between two approaches of TKA.

Discussion

The surgical technique used for arthrotomy is an important factor in providing a painless, stable, and functional knee joint. The medial parapatellar arthrotomy has generally been the standard surgical approach from earlier days of TKA. However, due to its intra-tendinous incision and the incidences of abnormal patellar tracking with the approach concerns were raised regarding the disruption of extensor function, which in turn can cause severe complications including patellar dislocation or subluxation, fracture of patella, osteonecrosis, and component erosion [15]. To deal with the above concerns, subvastus (southern) approach was proposed by Hofmann, et al. [4] in 1991 for primary TKA, which resulted in better patellar tracking and preservation of the quadriceps mechanism. However, it also had its own share of problems, including difficult exposure, increased chances of postoperative hematoma, muscle ischemia, risk of neurovascular damage in the 'Hunters canal' and apprehension with detachment of patellar tendon from its insertion [16].

In 1997, the midvastus or vastus-splitting approach was introduced by Engh, et al. [7] as a compromise between the medial parapatellar and subvastus approaches. It represented an effort to maintain the benefits of the medial parapatellar as well as the subvastus approach and preserving the integrity of the extensor mechanism and patellar blood supply without compromising exposure [7]. There is a paucity of literature comparing the early functional and clinical outcomes of medial parapatellar and midvastus approach in Indian population. The study noted that the post operative Knee Society Knee and Function scores up until 6 weeks were significantly better in the Mid Vastus group. However, the difference in the scores gradually became insignificant at 3-month follow-up. The prospective studies by Mekherjee, et al. [17] Bäthis H, et al. [18] Robertinas J, et al. [19] concluded that midvastus approach resulted in better short term functional outcome which coincides with the results of our study. Meta-analysis, such as the studies by Alcelik I, et al. [20] Xiaochun Peng, et al. [21] and Fu-Zhen Yuan, et al. [22] also came to the same conclusion.

A prospective randomized study by Karachalios, et al. [23] concluded significant differences in functional outcome even up to 9 months of postoperative period and it favours midvastus approach over medial parapatellar approach. Patients achieved SLR significantly earlier in the MV group as compared with those of MPP group. This finding was in accordance with similar previous studies by White RE, et al. [24] Song MH, et al. [25] Mukherjee P, et al. [17], Nutton RW, et al. [26] However, Keating, et al. [27] and Zhang Z, et al. [28] did not find any significant differences in SLR between two groups.

There was significant difference in extension lag at the1st week and 6th week follow-up, favouring the MV group over MPP group. Maestro A, et al. [29] found significant extension lag in MPP group in his study, whereas Keating EM, et al. [27] found no significant differences between both the groups. We found that the patients of the midvastus group were discharged from the hospital significantly earlier than those in the medial parapatellar group. This aspect has been very rarely compared between the two groups. Mukherjee, et al. [17] concluded that although the midvastus approach resulted in earlier SLR, it did not result in a shorter hospital stay, contrary to our study. The main limitations to our study include a relatively small sample, lack of kinematic and radiological assessment

Conclusion

This study was conducted to determine if the midvastus approach results in early recovery, faster mobilization, shorter hospital stay, and improved function when compared with medial parapatellar approach. Even though the KSS knee score and KSS functional score were significantly higher in the midvastus group at 1st week and 6th week as compared with medial parapatellar group; though it became statistically insignificant at the 3rd month and 6th month follow up. Patients with midvastus approach were able to perform SLR significantly earlier; had less mean extensor lag at 1 week and had shorter hospital stay. Midvastus approach to TKA results in quicker functional recovery with early discharge and rehabilitation as compared with medial parapatellar approach.

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