MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.11.485.489

OPEN ACCESS

Key Words
Midvastus, medial parapatellar approach, total knee arthroplasty

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Received: 20 August 2024
Accepted: 05 November 2024
Published: 08 November 2024

Citation: S. Deepak, H.A. Nagesh, M. Dayanand and Narasimhamurthy, 2024. Midvastus and Medial Parapatellar Approach in Total Knee Arthroplasty: Post-Operative Clinical Outcome. Res. J. Med. Sci., 18: 485-489, doi: 10.36478/makrjms. 2024.11.485.489

Midvastus and Medial Parapatellar Approach in Total Knee Arthroplasty: Post-Operative Clinical Outcome

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ABSTRACT
Osteoarthritis being the most prevalent joint disease and Total knee arthroplasty is the most frequently performed surgical procedure there is a constant effort to reduce post-operative outcome and in turn reduce hospital stay. There is no rational comparison between them with respect to clinical outcome so in order to compare and come to conclusion which approach is associated with better post-operative result we need the study to be undertaken. A Randomized control study in 50 patients with osteoarthritis of knee treated with total knee replacement divided into 2 equal groups of 25 each. Group A underwent TKR via medial parapatellar approach and Group B underwent TKR via mid vastus approach at Victoria hospital. Patients followed up, evaluated and assessed on day 1, 3, 7, 1st month and 6th month for ROM, Straight leg raise, visual analogue scale and Tegner-Lysholm knee score 6 month post operatively. 50 patients undergoing TKR were divided into two groups of 25 each. With mean age of 60.28 in group A and 62 in group B. Where group B show statistically significant P value on day 1 and 3 in terms of ROM, VAS score and significant P value on day 1 in terms of SLR, with statistically insignificant difference among 2 groups in terms of Tegner-Lysholm score.

INTRODUCTION

Osteoarthritis is classified into: primary and secondary. The main cause of primary is age-related chronic degenerative illness. The water content of cartilage reduces with age, increasing their susceptibility to degeneration. Both modifiable and non-modifiable risk factors, including gender, inactivity, trauma, occupational injuries, diabetes, prolonged kneeling or squatting and genetics, are associated to this condition[1]. In India, the prevalence of osteoarthritis ranges from 22-39%. Because of the obesity pandemic and increasing life expectancy, osteoarthritis is becoming more common[2]. The primary clinical characteristics that prompt treatment are pain and loss of function. Non-pharmacological methods include exercise, weight loss and physiotherapy., pharmacological methods include analgesics, anti-inflammatory medications, intra-articular steroids and hyaluronic acids and surgical methods include Osteotomy, unicompartmental knee arthroplasty, total knee arthroplasty. Total Knee Arthroplasty is the most cost effective procedure which involve resurfacing damaged articular cartilage to relieve pain and improve function in patient with severe knee arthritis with or without significant deformity. Indications of which include: osteoarthritis/osteoarthrosis, rheumatoid arthritis, traumatic injury to articular surface[3]. There are various surgical approaches to the knee joint and its surrounding structures and such approaches are generally designed to allow the best access to an area of pathology whilst protecting important surrounding structures with aim to achieve good alignment in all planes, stability of the joint throughout entire range of movement, obtaining adequate soft tissue balancing and a well fixed implant. Controversy currently surrounds the optimal surgical approach for total knee arthroplasty. The standard approaches of total knee replacement include: Medial parapatellar approach, Mid vastus approach, Sub vastus approach and minimally invasive approach where site of arthrotomy differs[4]. Medial parapatellar approach has been described by von Langenbeck in 1878 provides adequate exposure but involves incising the quadriceps tendon, which could potentially weaken the extensor mechanism and compromising vascular supply to patella results with patellar subluxation, avascular necrosis of patella and its fracture. Sub- vastus approach described by Hofmann in 1991 which is a quadriceps preserving procedure but provides limited exposure. The midvastus being popularised by Engh in 1994 method minimizes disruption of the extensor mechanism without compromising exposure of the quadriceps tendon by splitting the vastus medialis obliqus muscle instead of entering it. With the current prevalence rate of osteoarthritis and operative intervention, there is a need for improving the post operative clinical outcome and early, safe discharge of patients. Medial parapatellar and midvastus approach being option, there is no rational comparison between them with respect to clinical outcome evaluated by using improvement in range of movement, straight leg raise and post-operative pain. So in order to compare and come to conclusion which approach is associated with better post-operative result we need the study to be undertaken

MATERIALS AND METHODS

Study Design: Randomized control trial

Study Period: August 2022 to Januray 2024.

Sample Size: 25 each for Group A and Group B.

Inclusion Criteria:

- All cases of primary knee osteoarthritis.
- Patient willing to give informed consent.
- Osteoarthritis of knee grade 3 and above according to Kellgren-Lawrence grading system.

Exclusion Criteria:

- Previous surgeries or pathologies around affected knee, hip and spine.
- Body weight > 60% over ideal body weight for age, sex and height.
- Patient who are unable to undertake the standard post-operative physiotherapy regime.
- After obtaining approval and clearance from the institutional ethics committee, the patients of Victoria and allied hospitals fulfilling the inclusion criteria will be enrolled for study after obtaining informed consent.
- Patient will be randomized into groups, A and B based on simple random sampling for surgical approach for total knee replacement. Group A will include patients who undergo TKR through medial parapatellar approach and Group B will include patients who undergo TKR through mid vastus approach.
- Demographic data, history, clinical examination and details of radiology and laboratory investigations will be recorded in the study proforma.
- Pre op straight leg raise, range of movement and visual anolog score evaluated.
- Patients will be allocated into mid-vastus and medial parapatellar group based on simple randomization technique. Total knee replacement performed using standard mid-vastus and medial parapatellar approach, all patients are induced using combined spinal epidural without any peripheral nerve block,pneumatic torniquet will be applied for the patients in order to reduce blood loss, for the purpose of study standard implants from a single source were procured and used

using standard implantation techniques, surgeries will be performed by same surgical team,post procedure patient is subjected to post-operative protocol including analgesia with NSAIDS and antibiotics as per hospital protocol, no opioid were given.

- Patients followed up on day-1, day-3, 1week, 6week, 3months and 6 months post operatively for parameters including range of movement improvement,straight leg raise and visual analog score.
- Patients will be evaluated using Tegner-Lysholm knee scoring scale and documented in appropriate proforma at 6 months post operatively.

RESULTS AND DISCUSSIONS

In comparing the mean duration of surgery between Group A and Group B, both showed remarkably similar times. The average surgery time of Group A is 90.68 minutes (SD=10.63), while for Group B it is 90.60 minutes (SD=13.6). There was no statistically significant difference between the two groups (p=0.980). The confidence interval for this difference ranges from -6.89 to 7.05 minutes, reinforcing the consistency in surgery durations (Table 1). Early post-operative differences in median range of movement (ROM) between Group A and Group B are shown in (table 2). Pre-op, ROM in Group A was 90° vs. 85° in Group B, (p=0.012). On Post-op Day 1, Group B had statistically significant ROM compared to group A with a P value of p=0.001. On Post-op Day 3, Group B had statistically significant ROM compared to group A with a P value of p=0.035. In Post-op Day 7 onward, there was no statistically significant differences in ROM between the two groups. By two months and six months post-op, both groups reached a median ROM of 100° (p=0.306). The early post-operative differences in Straight Leg Raise (SLR) between Group A and Group B are shown in the (table 3). Pre-operatively, the SLR in Group A was 70° compared to 70° in Group B (p=0.540). On Post-op Day 1, Group B had statistically significant SLR compared to Group A with a P value of p=0.028. On Post-op Day 3, there was no statistically significant difference between Group A and Group B with P value of p=0.721. By Post-op Day 7, there was still no statistically significant difference between the groups with P value of p=0.318. At one-month post-op, the SLR for Group A was 80° compared to 70° for Group B (p=0.458). The differences persisted at three months' post-op, with Group A maintaining an SLR of 80° compared to 70° for Group B (p=0.458). By six months' post-op, the SLR remained statistically insignificant between the groups, with p=0.358. The early post-operative differences in median Visual Analog Scale (VAS) scores between Group A and Group B are shown in (table 4). Pre-operatively, the VAS score in Group A was 7 compared to 7 in Group B (p=0.078). On Post-op Day 1, Group A had a significantly significant VAS score compared to Group B with a P value of p=0.049. On Post-op Day 3, Group A continued to have a statistically significant VAS score compared to Group B with P value of p=0.053. By Post-op Day 7, there was no statistically significant difference between the groups with P value of p=0.318. At one month post-op, the VAS scores for both groups were similar with p=0.481. The differences persisted at three months post-op, with both groups having similar VAS scores with p=0.481. By six months post-op, the VAS scores remained comparable between the groups, with p=0.639. The differences in median Tegner Lysholm scores between Group A and Group B are shown in (table 5). The median Tegner Lysholm score for Group A was 85 (range, 78- 85). Similarly, Group B had a median score of 85 (range, 79-85). There was no statistically significant difference between the two groups (p=0.773).

In our prospective double blinded randomized study, we evaluated 25 patients who underwent TKR through mid-vastus approach and 25 patients who underwent TKR through medial parapatellar approach. In our study the preoperative SLR, ROM and VAS score recorded and analysed. Every patients of both groups are trained regarding rehabilitation during early post-operative period and followed up post operatively for recording and analysing SLR, VAS and ROM on day 1, day 3, day 7, 1st month and 6th month. The Tegner lysholm knee score calculated among 2 groups on 6th month follow-up. Several studies undertaken in order to compare the post operative functional and clinical outcome among above mentioned approaches. Consistent with previous studies by Kim[5] and Cheng *et al.,* our results showed that the midvastus approach resulted in early functional recovery and better short-term functional outcomes. The midvastus group had significantly better range of motion, straight leg raise and visual analog pain scores at early post-operative period. The findings of my study also support the existing literature by C.K.B[6] Dalury *et al.,* which suggests that the midvastus approach reduces early postoperative pain and improves early functional recovery without any increase in complication rate resulting with Better Patient Satisfaction and rehabilitation. The Tegner Kysholm knee score calculated and compared between 2 approaches show no statistically significant difference after a period of 6 months post operatively which is in consistent with previous prospective observational study by shouvik Sinha *et al.,* But the retrospective study conducted by Wang *et al.*, shows better knee score even after a period of 6 months contradicting the study result. The range of movement showed statistically better result in terms of mid vastus approach case till 1 week post operatively which is in consistent with study conducted by alcelik *et al.* which is in favour of the MV approach,

Table 1: Comparison of Mean Duration of Surgery (in Minutes) Between Two Groups

Groups	N	Mean	SD	Mean diff	P value	CI
Group A	25	90.68	10.63	0.08	0.98	(-6.89 – 7.05)
Group B	25	90.60	13.6			

Independent Samples Test

Table 2: Comparison of Median Range of Movement Between Two Groups

Rom	Groups	N	Median	Min range	Max range	P-value
Pre Op	Group A	25	90	90	105	0.012*
	Group B	25	85	80	90	
Post Op Day 1	Group A	25	30	30	40	0.001*
	Group B	25	40	40	60	
Post Op Day 3	Group A	25	60	45	70	0.035*
	Group B	25	70	60	90	
Post Op Day 7	Group A	25	80	70	90	0.139
	Group B	25	90	80	100	
Post Op 1st Month	Group A	25	90	85	100	0.116
	Group B	25	100	90	100	
Post Op 3rd Month	Group A	25	90	85	100	0.172
	Group B	25	100	90	100	
Post Op 6th Month	Group A	25	100	90	100	0.306
	Group B	25	100	90	100	

Mann-Whitney U Test

Table 3: Comparison of Median SLR Between Two Groups

SLRT	Groups	N	Median	Min range	Max range	P- value
Pre Op	Group A	25	70	60	75	0.540
	Group B	25	70	60	80	
Post Op Day 1	Group A	25	40	20	40	0.028*
	Group B	25	40	40	55	
Post Op Day 3	Group A	25	60	40	70	0.721
	Group B	25	60	50	70	
Post Op Day 7	Group A	25	60	60	70	0.318
	Group B	25	70	60	70	
Post Op 1st Month	Group A	25	80	60	80	0.458
	Group B	25	70	70	80	
Post Op 3rd Month	Group A	25	80	60	80	0.458
	Group B	25	70	70	80	
Post Op 6th Month	Group A	25	80	75	80	0.358
	Group B	25	80	80	80	

Mann-Whitney U Test

Table 4: Comparison of Median vas Between Two Groups

VAS	Groups	N	Median	Min range	Max range	P-value
Pre Op	Group A	25	7	7	8	0.078
	Group B	25	7	6	7	
Post Op Day 1	Group A	25	8	7	8	0.049*
	Group B	25	7	7	8	
Post Op Day 3	Group A	25	6	6	7.5	0.053*
	Group B	25	6	4	6	
Post Op Day 7	Group A	25	4	4	6	0.318
	Group B	25	4	4	6	
Post Op 1st Month	Group A	25	4	3	4	0.481
	Group B	25	4	3	4	
Post Op 3rd Month	Group A	25	4	3	4	0.481
	Group B	25	4	3	4	
Post Op 6th Month	Group A	25	3	2	3	0.639
	Group B	25	3	2.5	3	

Mann-Whitney U Test

Table 5: Comparison of Median Tegner Lysholm Score Between Two Groups

Groups	Median	Min range	Max range	P-value
Group A	85	78	85	0.773
Group B	85	79	85	

Mann-Whitney U Test

but range of movement shows no significant difference after a period of 1 week which is not in accordance with meta-analysis by Li[7] also showed higher knee ROM till three months after surgery. Even though midvastus approach may have short term benefits both approach resulted in a similar long term result which is consistent with previous studies Dalury *et al.*, 2013 and Keating *et al.*, 2015. The conflicting results may be due to various factors, such as differences in patient selection, surgical technique and rehabilitation protocols. Our study has limitations which could have affected the result such as small sample size, short follow up period, however, the early recovery of our patients means that this follow up was sufficient to evaluate the effects of different approach on functional outcome. Further studies with larger sample sizes and longer follow-up periods are needed to confirm these findings and explore the underlying

mechanisms[8]. Our results show that Mid-vastus approach shows better early post-operative functional outcome with better knee range of motion, early recovery of straight leg raise and less pain.

CONCLUSION

In our study we concluded that Mid vastus approach in comparison to medial parapatellar approach is associated with statistically significant functional outcome in early post operative period with no difference in complication rate associated with the procedure and with adequate exposure. There in not much difference in long term functional outcome among these two approaches.

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