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Comparative study with 2 years follow up on the functional outcome of subvastus versus medial parapatellar approach in total knee arthroplasty in a tertiary care center in South India

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ABSTRACT

Background: There are many approaches while performing a total knee arthroplasty, with the medial parapatellar and the subvastus approaches being the more common among surgeons. While there are many studies comparing both the approaches, there is a lacuna regarding their long term functional outcome in the Indian population. The study aimed to evaluate the functional outcome of TKA through subvastus approach and medial parapatellar approach by using the knee society score, at postoperative day 5, 2 weeks, 6 weeks, 3 months, 6 months, 12 months and 24 months postoperatively.
Methods: This randomized controlled prospective study included patients with advanced knee osteoarthritis who underwent elective primary TKA either through the subvastus or medial parapatellar approaches at a tertiary care center in South India from January 2021 to December 2024 .Knee Society Scores were compared in the two groups of patients on postoperative day 5, 2 weeks, 6 weeks, 3 months, 6 months, 12 months and 24 months postoperatively.
Results: 300 people were included in the study of which, of which 150 of them underwent a TKA via a medial parapatellar approach and the rest via the subvastus approach. There was an overall significant change over time in KSS scores but the results were comparable between the two groups. The subvastus group showed significantly quicker return of quadriceps function and shorter hospital stays. The medial parapatellar group has the shorter surgical time.
Conclusions: Both approaches are comparable in terms of functional outcome, with the subvastus approach showing a longer surgical duration but a quicker return of quadriceps function and shorter hospital stay.

Keywords: Functional outcome, Total knee arthroplasty, Subvastus approach, Medial parapatellar approach, Knee society score

INTRODUCTION

Total knee arthroplasty (TKA) is a successful intervention for patients with advanced knee osteoarthritis as it provides significant pain relief, functional improvement enhancing the quality of life. Various methods have been utilized and improved upon over the years, with different surgeons having their preferred methods. There is a lack of general consensus over the superiority of one method over the other. The most popular approach is the Medial parapatellar approach which was introduced in 1878 by Langenbeck et al.[1] It provides excellent exposure but violates the quadriceps mechanism and the vascular supply of patella.[2]

Subvastus approach, first described in German literature was brought to our attention by Hofmann in 1991, with the aim of maintaining the integrity of the extensor mechanism and decreasing the vascular damage of the patella.[3,4] The approach was associated with reduced soft tissue damage and pain, faster recovery, early movement of joints and increased joint function. Based on the available literature,

there has been no adequate research on the long-term effects of these two methods, especially in the Indian population. This study compares the conventional medial parapatellar and subvastus approaches in primary total knee arthroplasty with 2 years of follow-up to clarify which procedure has the better long-term results.

METHODS

This was a randomized controlled prospective study to compare the functional outcome of subvastus vs medial parapatellar approach in primary TKA at the Department of Orthopedics, at a tertiary care hospital in South India, conducted over a period of 3 years from 2021 to 2024. 300 TKAs were evaluated, split evenly between the medial parapatellar and subvastus group.

All willing adult patients with severe primary osteoarthritis of knee were included while those patients with conditions that may delay or restrict postoperative mobilization (neurological disorders, cardiac conditions, respiratory depression), prior surgeries or injuries in same lower limb within past 12 months or those with cognitive or language disorders were excluded. All the TKAs were performed with the same prosthesis (Triathalon Knee System, Stryker).

Surgical techniques

Of the 300 patients, 150 underwent the surgery via the medial parapatellar approach while 150 underwent it via the subvastus approach. In the medial parapatellar approach (Figure 1) a standard midline incision was made, continued between the vastus medialis and rectus femoris muscles and a medial parapatellar arthrotomy was performed by incising the medial patellar retinaculum and opening the joint capsule. In the subvastus approach (Figure 2) after the standard midline incision, the inferior edge of the vastus muscle was found and separated from the periosteum and intermuscular septum using gentle dissection, approximately 10 cm proximal to the adductor tubercle. The connection to the patella was exposed by pulling the muscle forward and an arthrotomy was performed by incising the synovium proximally and the capsule distally.

All procedures were performed under standard spinal epidural anesthesia with a tourniquet from the beginning of the skin incision to the end of the retinacular closure. Patellar resurfacing was done for all the cases. Drains were removed after 48 hours. Patients received intravenous antibiotics (Cefuroxime) for 2 days after the surgery and then oral antibiotics for 5 days.

Prophylactic low molecular weight heparin (LMWH) was used for around 2 weeks to prevent thromboembolism. Pain management was according to the standardized hospital protocol. A standardized physical therapy protocol began on postoperative day one and patients were encouraged to walk as much as possible with supervision from nursing staff.

Outcome measurement

The patients' basic demographic characteristics, operation time, total bleeding volume, length of the hospital stay, return of quadriceps function was compared. All potential surgical complications were also noted. Knee Society Score (KSS) was assessed at the following intervals - Preoperative day 1, Postoperative day 5, 2 weeks, 6 weeks, 3 months, 6 months, 12 months and 24 months postoperatively and the functional outcome in patients following total knee arthroplasty by the medial parapatellar and the subvastus approach was compared. To compare the return of quadriceps function Active Straight Leg Raising Test (SLRT) and ability in getting up from sitting position was assessed.

Statistical analysis

Statistical analysis was performed using SPSS version 25. Continuous variables were inspected for normality and a measure of association was used to identify the relationship between two or more variables. Mean±SD was used to describe the numerical data. Percentages and frequencies were used to describe categorical variables. Student's t-test and Mann–Whitney test was used to compare the patients' scores in both groups. The repeated measure analysis was used for both scores to determine if there was a significant change over time. A p value of less than 0.05 was considered as statistically significant.

RESULTS

In total, 300 patients were included in this study and assigned into two groups. 150 (40M/110F) underwent TKA via medial parapatellar approach, while 150 (58M/92F) underwent TKA via subvastus approach. The majority of the participants were females (67.33%). About one-third (34.33%) of the patients were aged 50–60 years, 42% were aged 61–70 years and 23.66 % were aged 71–80 years. The mean (SD) BMI was 31.52 (±4.8). There was no significant difference in BMI and age between the two groups ($p>0.05$) (Table 1). Both groups had similar preoperative pain and functional scores ($p>0.05$). Time taken for surgery was significantly more in subvastus approach (mean duration 108.7 minutes) than medial parapatellar approach (mean 96.64 minutes) (Table 2). The subvastus group had higher total blood loss than the MP group, but the difference was not statistically significant (602±85.9 vs. 586±98.4, p value=0.61). The duration of hospital stay was significantly less for the subvastus group (Table 3). Patients in the SV group performed the active straight leg raise (SLR) test significantly faster than the MP group ($p<0.001$), demonstrating quicker return of quadriceps function (Table 4). There was no difference in pre-operative Knee Society score (KSS) (objective and functional) between the two groups. The Knee society scores (both objective and functional score) significantly

improved post operatively on serial measurements but there was no significant difference (p>0.05) in scores (knee score and function score) between the groups on any point of measurement (Figure 3, 4) (Table 5). No patient was lost to follow-up and there were no significant complications related to the surgery reported postoperatively in either group.

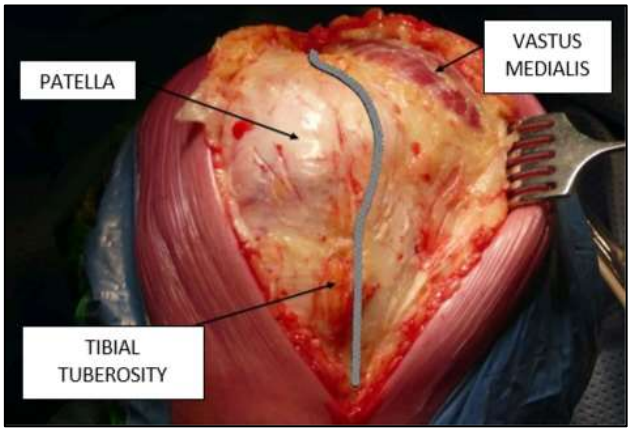

Figure 1: Medial parapatellar approach.

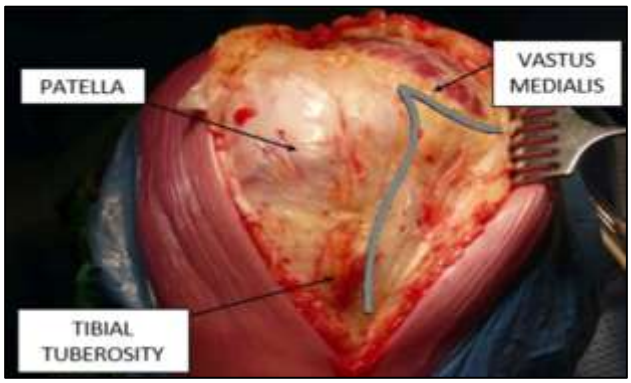

Figure 2: Subvastus approach.

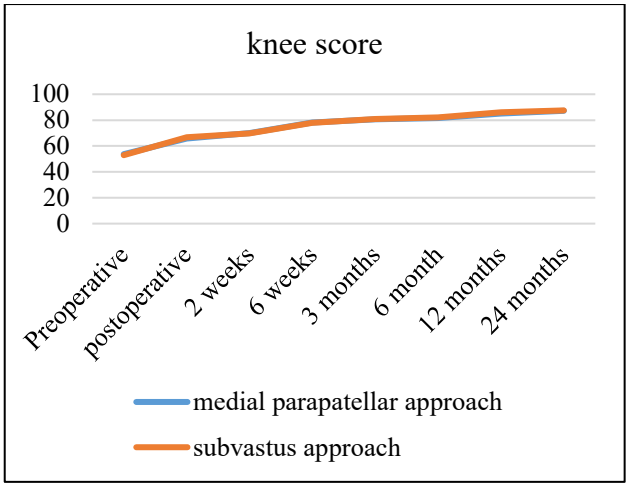

Figure 3: Knee score over time.

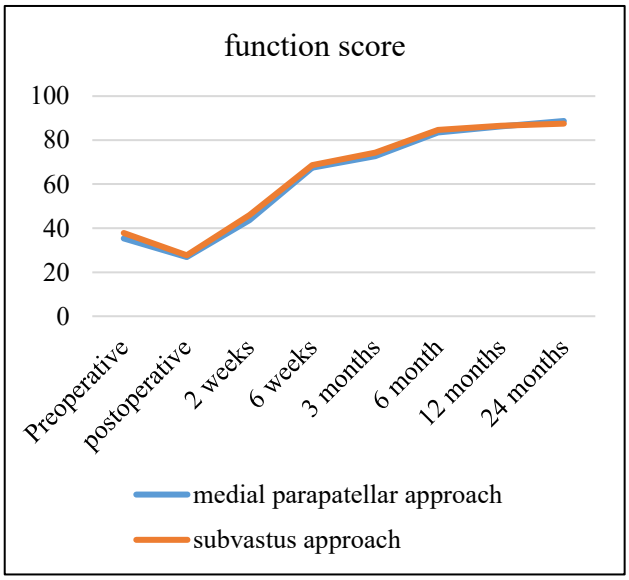

Figure 4: Function score over time.

Table 1: Comparison of patients' demographic characteristics based on the type of operation.

Variable	Total (N=300)	Medial parapatellar group (n=150)	Subvastus group (n=150)	P value
Age (in years), N (%)				0.195
50–60	103 (34.33)	51 (34)	52 (34.66)	
61–70	126 (42)	77 (51.33)	49 (32.66)	
71–80	71(23.66)	22(14.66)	49 (32.66)	
Gender, N (%)				0.043
Male	98 (32.66)	40 (26.66)	58 (38.66)	
Female	202(67.33)	110 (73.33)	92 (61.33)	
BMI, mean±SD	31.52±4.8	32.02±4.59	30.69±5.18	0.19

Table 2: Comparison of mean duration of surgery (in minutes) based on the type of operation.

Type of surgery	Time taken for surgery (mean-minutes)	S.D.	P value
Medial parapatellar approach	96.64	5.30	<0.001
Subvastus approach	108.79	7.36	

Table 3: Comparison of mean duration of hospital stay (in days) based on the type of operation.

Type of surgery	Duration of hospital stay (mean-days)	S.D.	P value
Medial parapatellar approach	6.36	0.74	<0.001
Subvastus approach	5.29	0.61	

Table 4: Comparison of the mean duration for return of quadriceps function (in days) based on the type of operation.

Type of surgery	Return of quadriceps function (mean-days)	S.D.	P value
Medial parapatellar approach	6.07	0.73	<0.001
Subvastus approach	5.07	0.61	

Table 5: Comparison of the Knee Society Scores (Knee Score and Functional Score) based on the type of operation.

Time period	Mean±SD					
	Knee score			Functional score		
	Medial parapatellar group	Subvastus group	P value	Medial parapatellar group	Subvastus group	P value
Preoperative	53.7 (7.2)	52.57(SD 6.4)	0.29	35.29 (6.85)	37.86 (6.70)	0.57
5 days postop	65.75 (7.5)	66.87 (SD 6.3)	0.45	26.89 (5.56)	27.67 (5.81)	0.48
2 weeks	69.88 (6.3)	69.77 (5.9)	0.28	43.6 (6.81)	45.9 (6.34)	0.32
6 weeks	77.2 (6.2)	79.9 (6.6)	0.39	67.45 (7.27)	68.6 (6.92)	0.29
3 months	80.6 (5.4)	80.9 (5.5)	0.33	72.7 (6.69)	74.3 (7.13)	0.31
6 months	81.5 (5.9)	82.34 (6.3)	0.28	83.5 (7.54)	84.8 (7.68)	0.25
12 months	85.1 (6.9)	86.3 (5.8)	0.31	86.3 (7.13)	86.5 (6.84)	0.27
24 months	87.2 (6.8)	87.5 (6.5)	0.25	88.7 (7.51)	89.1 (7.28)	0.29

DISCUSSION

The research study analyzed the subvastus approach versus the medial parapatellar approach for TKA in patients with knee osteoarthritis. Functional outcome was compared using the knee society score. On comparing the two approaches, the medial parapatellar group had reduced surgical duration while, the benefits of the subvastus group included earlier restoration of quadriceps function and potential reduction in the length of hospital stay with cost associated.

Numerous studies indicate that preserving the quadriceps tendon can decrease post-operative pain for up to one month, coinciding with the healing period and restoration of quadriceps strength, with no significant differences observed between the two approaches at three months postoperatively.[5-9] Dutka et al, demonstrated that the subvastus approach yielded superior functional outcomes in comparison to the medial parapatellar approach, but only within the initial three months, while a randomized controlled trial found better functional outcomes for the medial parapatellar approach at 12 and 18 months.[10,12] Aladraii et al, showed superior functional outcomes in the MPT compared to the SV approach at 3 and 6 months, however, other studies indicate that the SV approach yields better short-term functional results.[5]The results were in contrast to the study which found no significant difference in functional outcomes between the two approaches at various time intervals over a period of 2 years. A study was conducted by Fauré et al, involving 20 patients who underwent one-stage bilateral knee arthroplasty where, one knee was operated on using the medial parapatellar approach, while the other knee was approached via the subvastus technique.[6] The Knee Society Score was utilized to assess functional outcomes at 1 week, 1 month and 3 months postoperatively. The findings indicated no significant difference between the two knees within the same patient, thereby reinforcing our interpretations.

Prior research indicated that although knee scores improved comparably in both cohorts, quadriceps strength was superior in the subvastus group at postoperative week 6, however, no significant difference was observed between the groups at 3 and 6 months.[13] While our study shows a significantly quicker return of quadriceps function in the subvastus group, there were no significant differences in further visits. The subvastus group also had a significantly lower mean duration of hospital stay, thereby lowering costs, a result comparable to previous studies.[5]

A limitation of the current study is the lack of comparison regarding patellar tracking, implant placement or sizing fitness, factors that may influence mid- and long-term functional outcomes. Also, the surgeries were performed

in a single center, by multiple surgeons hence variations could have occurred. A multicenter, randomized controlled study with a larger sample size and long follow up period would provide a more detailed understanding.

CONCLUSION

Both approaches show similar results with regard to the functional outcome. The subvastus approach may be more patient friendly owing to a lower duration of hospital stay with faster return of quadriceps function, the tradeoff being an increased surgical duration.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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