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Clinical and Functional Outcomes of Total Knee Arthroplasty in Patients with Knee Osteoarthritis: A Prospective Study

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Abstract

Background: Knee osteoarthritis (OA) is one of the leading causes of pain and disability that significantly impacts mobility, independence, and quality of life. Total knee arthroplasty (TKR) is considered the gold standard treatment for end-stage knee OA, with proven benefits in pain relief and functional restoration. This study aimed to evaluate the clinical and functional outcomes of TKA in patients with advanced knee OA treated at our institution.

Methods: This was a prospective study conducted at Manipal Teaching Hospital from March 1, 2021, to March 30, 2024. A total of 74 patients with severe knee OA, unresponsive to conservative management, underwent TKA and were followed up for 6 months. Clinical and functional outcomes were assessed using the Knee Society Score (KSS), Visual Analog Scale (VAS) for pain, and range of motion (ROM). Data were analyzed using SPSS v20, with $p < 0.05$ considered statistically significant.

Results: The mean age of patients was 72.07 ±5.54 years, with females comprising 66.2% of cases. Pre-operative mean knee flexion improved significantly from 89.07° ±15.17 to 113.74° ±8.25 postoperatively ($p = 0.000$). Mean extension improved from 10.26° ±7.44 to –0.80° ±1.95. The mean KSS improved from 42.54 ±4.95 to 87.76 ±3.44, while functional KSS improved from 35.28 ±4.38 to 82.89 ±2.83 (both $p = 0.000$). VAS decreased from 6.99 ±1.06 to 0.35 ±0.65 ($p = 0.000$). Post-operative complications included superficial infection in two patients (2.7%) and deep infection in one patient (1.35%) requiring prosthesis removal and arthrodesis. No cases of deep vein thrombosis were recorded.

Conclusion: TKA provides significant improvements in pain relief, ROM, and functional outcomes in patients with advanced knee OA. With low complication rates, it remains a safe and effective surgical option in our setting.

Keywords: Knee joint, Osteoarthritis, Total knee arthroplasty

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Introduction

Osteoarthritis of the knee is a leading cause of pain and disability worldwide, particularly among the elderly population.[1] Patients typically present with severe pain, deformity, and inability to bear weight. Non-operative treatments, including analgesics, intra-articular injections, and physiotherapy, may provide symptomatic relief in the early stages but are often insufficient in advanced disease.[2,3] Total knee replacement (TKR) is a well-established surgical procedure for end-stage knee osteoarthritis, providing significant pain relief, correction of deformity, and improvement in functional status and quality of life.[4,5] With improvements in prosthesis design and the introduction of newer techniques, such as robotic-assisted surgery, post-operative outcomes after TKR continue to improve. Long-term implant survivorship and high patient satisfaction following TKR have been consistently reported.[6]

Although numerous studies on TKR outcomes exist globally, variability in patient demographics, implant selection, rehabilitation protocols, and outcome measures can influence results across regions.[7,8] In Nepal, literature on functional and clinical outcomes following TKR remains limited and largely institution-based.[9,10]

This prospective study aims to evaluate the clinical and functional outcomes of total knee replacement in patients with primary knee osteoarthritis at a tertiary care center in Nepal, contributing region-specific evidence to guide patient care and outcome assessment.

Methods

This was a prospective observational study conducted at Manipal Teaching Hospital. Ethical clearance was obtained from the institutional review committee before the study (Ref. no.: MEMG/IRC/203/GA). The study lasted 3 years, from March 25, 2021, to March 30, 2024. Patients diagnosed with primary knee osteoarthritis undergoing primary total knee replacement and providing consent for the study were included. Patients with a history of knee joint infection, active infection, revision TKR, or loss of follow-up were excluded.

All patients were evaluated clinically and radiologically. Skin condition, deformities, instability, ROM, fixed flexion deformity, and extensor lag were noted. Varus and valgus stress tests were done to assess the lateral and medial collateral ligaments, respectively. A bilateral knee X-ray in standing was performed. All pre-operative investigations were completed, and clearance from the anesthesia team was obtained.

Surgical Procedure

A single surgeon performed all surgeries. A tourniquet was used in all cases. A midline skin incision was made, and a medial parapatellar approach was used. Patella was everted. A medial release was performed, protecting the MCL. Anterior and posterior ligaments were excised, and the tibia was dislocated anteriorly. The tibial cut was made perpendicular to the mechanical axis with a posterior slope of 5° using an extramedullary jig. Distal femoral cut was done using intramedullary zig at $5\text{-}7^{0}$ of valgus. Soft-tissue balancing was performed in extension. Femoral sizing was done using anteroposterior referencing. Chamfer cuts, femoral notch cut, peg hole, and tibial notch cut were done. Flexion and extension gaps were checked. The appropriate size of the tibial component and its alignment were checked. Patellar tracking was performed after the trial prosthesis was placed. The operating site was washed with normal saline, and the appropriate-sized prosthesis was placed. A polyethylene liner was placed. A suction drain was placed in all cases, and the wound was closed in standard fashion.

Post-operative Protocol

All patients followed a standardized post-operative protocol including intravenous antibiotics, early mobilization, physiotherapy, and thromboprophylaxis. Patient was allowed to stand on the first POD. Quadriceps and hamstring exercises were started on the same day. Knee ROM was started. A low-dose Aspirin tablet (75mg) was started from the 2^{nd} POD. Dressing was done on the 3^{rd} POD, and sutures were removed on the 14^{th} POD. The patients were advised to wear the knee braces for 4-6 weeks during mobilization, and home exercises were taught.

Follow-up and Outcome Measures

Patients were followed at 2 weeks, 4 weeks, 6 weeks, and 6 months. Clinical and functional outcomes were assessed at each visit.

Statistical Analysis

Data were analyzed using statistical software SPSS version 20. The descriptive and inferential statistics were used. Pre- and post-operative scores were compared using paired t-tests; $p < 0.05$ was considered statistically significant.

Results

A total of 79 patients underwent total knee replacement during the study period. Among these patients, we lost follow-up in 5, so the total number of patients in our study was 74. The demographic variation is shown in Table 1. The mean age of the patients was 72.07 $\pm$5.54 (57-82) years. A gross deformity of the knee was seen in 45 patients (60.8%); of these; 91.89% had varus deformity (as shown in Table 2).

The most common cause of knee osteoarthritis was primary OA (83.78%). Post-traumatic OA was seen in eight patients (10.81%), and an inflammatory cause was

seen in four patients (5.4%). Walking aids were used by 43 patients (58.1%), whereas 8 patients (10.8%) were wheelchair-bound.

The mean operative time in patients with gross deformity was 112.71 ± 10.33 minutes, whereas the mean operative time in patients without deformity was 89.72 ± 11.01 minutes, which was statistically significant ($p < 0.0001$). The mean knee flexion preoperatively and postoperatively was 89.07 ± 15.17 (45-110) and 113.74 ± 8.25 (95-126), respectively. There was a significant improvement in knee flexion after replacement (p-value =0.00). The mean pre-operative knee extension was 10.26 ± 7.44 (0-30). The mean knee extension postoperatively was −0.80 ± 1.95 (- 10-0). The mean Knee Society Score preoperatively and postoperatively was 42.54 ± 4.95 (31-55) and 87.76 ± 3.44 (78-94), respectively, which was statistically significant (p value = 0.00). The mean functional knee society score pre-operative and post-operative was 35.2 ± 84.38 (28-46) and 82.89 ± 2.83 (77-91), respectively, indicating significant improvement in knee function after knee replacement ($p<0.001$). There was a significant improvement in pain after knee replacement. At final follow-up, the mean Visual Analog Scale (VAS) score improved significantly from 6.99 ±1.06 preoperatively to 0.35 ±0.65 at 6 months postoperatively ($p < 0.001$). Table 3 demonstrates the pre- and post-operative comparisons of outcomes.

In our study, we had three cases with post-operative infection. Two of the patients responded with wound debridement and polyethylene liner change with intravenous and oral antibiotics, but one patient had severe infection for which we planned for two-stage revision arthroplasty, but the patient refused it, so we had to remove the prosthesis and performed knee arthrodesis. These two patients had good results with antibiotics and were kept on regular follow-up. None of our patients developed deep vein thrombosis. 8 patients reported numbness around the anterior aspect of the knee joint, and 2 patients complained of on-and-off swelling of the lower limb at final follow-up. Other complications are shown in Table 4.

Table 1: Demographic Characteristics of Patients (n = 74)

Variable	Value
Mean age (years)	72.07 ± 5.54
Male	25 (33.8%)
Female	49 (66.2%)
Unilateral TKA	40 (54.05%)
Bilateral TKA (same sitting)	5 (13.51%)
Staged bilateral TKA	24 (32.4%)

Table 2: Distribution of Knee Deformities

Deformity Type	Number (%)
Varus	68 (91.89%)
Valgus	6 (8.11%)
Fixed flexion deformity	10 (13.5%)

Table 3: Comparison of Pre-operative and Post-operative Outcomes

Parameter	Pre-operative	Post-operative (6 months)	p-value*
Knee flexion (°)	89.07 ±15.17	113.74 ±8.25	<0.001
Knee extension (°)	10.26 ±7.44	−0.80 ±1.95	<0.001
Clinical KSS	42.54 ±4.95	87.76 ±3.44	<0.001
Functional KSS	35.28 ±4.38	82.89 ±2.83	<0.001
VAS score	6.99 ±1.06	0.35 ±0.65	<0.001

**Paired t Test, KSS knee society score, VAS visual analogue scale*

Table 4: Post-operative Complications

Complication	Number (%)
Superficial infection	2 (2.7%)
Deep infection	1 (1.35%)
DVT	0
Patellar clunk	0
Thigh pain	0
Residual pain	0
Anterior knee numbness	8 (10.8%)

DVT Deep vein Thrombosis

Discussion

Total knee arthroplasty is one of the emerging surgical procedures performed worldwide for osteoarthritis of the knee. TKR not only relieves pain but also improves the quality of life of the patient. With improvements in surgical technique and good results, TKR surgery is increasing globally.

TKR is usually done in patients with end-stage OA when the symptoms don't improve with other treatment methods. The mean age group in our study was 72 years. The mean age in other studies was 67 years in Hooper et al., 67 in Pourmoghaddam et al., and 64 in Sharma et al.[14-16]. The increase in the age

group in our study might be because patients in our region still have less knowledge about the procedure and avoid operative management early.
Most of the patients in our study group were female, accounting for 66.2% of cases. Similar results were observed across studies. In the study done by done by Chand et al., the female population was 66.66%, similarly in the study done by Thapa et al., it was 60% and 63.18% in the study done by Figueroa et al.[8,17,18] The global increase incidence in female population maybe due to postmenopausal osteoporosis and in our region may be added by females involving in agricultural activities requiring squatting.

We used the Knee Society Scoring System at the final follow-up, i.e., at 6 months, to assess the final outcome in our patient. The mean pre-operative and post-operative clinical knee scores in our patient were 42.54 and 87.76, respectively, which were similar to those reported by Shihora et al., who reported 49.4 preoperatively and 86 postoperatively.[19] In the study done by Kim et al., the mean pre-operative and post-operative clinical knee score was 35.3 and 94.[20] The mean pre-operative and post-operative functional knee score in our study was 35.28 and 82.89, which was similar to the study done by Arun et al., which was 35 pre-operative and 83.5 post-operative.[21] Similarly, in the study done by Shihora et al., it was 32.75 and 84.4 pre- and post-operative, respectively.[19]

In our study, the mean VAS pain score improved significantly from 6.99 ± 1.06 preoperatively to 0.35 ± 0.65 at 6 months following total knee arthroplasty, indicating excellent pain relief. Comparable improvements in VAS have been reported in other studies. A prospective analysis by Chakravarthy et al. in 30 patients showed a decrease from 7.2 ±1.5 preoperatively to 2.1 ±1.0 at 6 months postoperatively.[22] Another observational study done by Mekkawy et al., in 112 patients, documented progressive pain reduction up to 6 months, with mean VAS declining from 5.8 ±2.4 on day 0 to 3.8 ±2.7 at 6 months.[23]
Infection is one of the complications that not only affects joint function but also the overall outcome in patients with TKR. The 2015 Australian hip and knee replacement report showed that the revision surgery rate was 1% at 1 year, increasing to 5.5% at 10 years.[24] Sharkey et al. studied the revision rate in 718 patients who underwent TKA during 2003 to 2012 and found that the rate was 7.8% at 1 year.[25] In our study, the rate of infection was 4.05%, out of which 1.35% was deep infection requiring revision surgery and 2.7% was superficial infection requiring debridement, liner change, and use of antibiotics. All patients who developed post-operative infection had diabetes mellitus, highlighting the importance of strict perioperative glycemic control and infection surveillance in high-risk patients. Early detection of infection and aggressive management can help halt its progression.

Conclusion

Total knee arthroplasty is an effective and reliable procedure for managing advanced knee osteoarthritis, resulting in significant improvement in pain relief, knee range of motion, and functional outcomes. This study provides region-specific evidence supporting the use of TKA in the Nepalese population. It emphasizes the importance of standardized perioperative care and long-term follow-up to optimize outcomes.

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