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Clinical and Functional Outcomes of Total Knee Arthroplasty in Varus Knee Osteoarthritis: A Prospective Study from Eastern India

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ABSTRACT

Background: Total knee arthroplasty (TKA) is an effective surgical intervention for patients with advanced osteoarthritis and varus knee deformity, aimed at relieving pain, correcting deformity, and improving joint function. This study was conducted to assess the clinical, functional, and radiological outcomes of TKA using the Knee Society Score (KSS) and to analyze correlations with age, body mass index (BMI), and patellar resurfacing.

Methods: A prospective study was carried out in the Department of Orthopaedic Surgery, MKCG Medical College and Hospital, Berhampur, Odisha, from February 2021 to July 2022. A total of 72 patients with osteoarthritis and varus knee deformity underwent TKA after fulfilling the inclusion criteria. All patients were evaluated clinically and radiologically preoperatively and at 2, 6, and 24 weeks postoperatively using KSS and functional scoring. Statistical analysis was performed using R statistical software (version 4.3.0), with $p<0.05$ considered significant.

Results: The mean KSS improved from 49.8±8.4 preoperatively to 84.6±4.5 postoperatively, and the mean functional score increased from 48.6±7.1 to 83.2±4.8 ($p<0.0001$). No significant correlation was found between postoperative outcomes and age or BMI. Complications were minimal, including superficial wound infection (4.2%), anterior knee pain (2.8%), and popliteal thromboembolism (1.4%).

Conclusion: TKA significantly improves pain relief, knee function, and mobility in patients with varus deformity due to osteoarthritis. Outcomes were consistent across age and BMI groups, reaffirming TKA as a safe and effective surgical option with a low complication rate.

Key-words: Total knee arthroplasty, Osteoarthritis knee, Varus deformity, Knee Society Score, Functional outcome, MKCG Medical College, R statistical software

INTRODUCTION

Total knee replacement (TKR) is one of the most frequently performed orthopaedic procedures for the management of advanced knee arthritis, whether due to osteoarthritis or inflammatory arthropathy. In such cases, progressive cartilage damage affecting the medial, lateral, or patellofemoral compartments leads to pain and deformity, ultimately requiring total joint replacement. Osteoarthritis is the most prevalent chronic joint disorder, characterized by degeneration of the articular cartilage. TKR becomes essential for patients with tricompartmental osteoarthritis when pain and disability are no longer relieved by conservative measures such as analgesics, physiotherapy focusing on quadriceps strengthening, or intra-articular injections [1].

The primary goal of TKA is to restore normal mechanical alignment with a stable, well-fixed prosthesis [2]. Since its introduction, continuous advancements in surgical techniques, implant design, and perioperative care have significantly enhanced patient satisfaction, implant longevity, and overall outcomes, providing effective pain relief, restoration of range of motion (ROM), stability, and improved joint function [3].

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Knee osteoarthritis (OA) is a leading cause of chronic pain and functional impairment, significantly diminishing quality of life (QoL) and limiting the performance of activities of daily living (ADLs) [4,5]. The fundamental objectives of knee replacement surgery include achieving pain relief, improving functional capacity, and ensuring long-term durability of the implant.

In the early stages of OA, patients are typically managed conservatively through a stepwise approach that includes pharmacological treatment with analgesics or nonsteroidal anti-inflammatory drugs (NSAIDs), shoe inserts, muscle-strengthening exercises, and intra-articular corticosteroid injections. These interventions may provide temporary symptom relief and prolong satisfactory knee function. Pre- and postoperative rehabilitation programs involving coordinated efforts between orthopaedic surgeons and physiotherapists can further enhance postoperative muscle strength and functional recovery [6]. When conservative therapy fails to control symptoms adequately, surgical options are considered.

For younger patients with significant varus or valgus deformities, proximal tibial or distal femoral osteotomies may be performed to correct limb alignment and unload the affected compartment, thereby delaying the need for arthroplasty [7]. In cases of unicompartmental OA, unicompartmental knee arthroplasty (UKA)—targeting the medial, lateral, or patellofemoral compartment—can be considered. However, total knee arthroplasty (TKA) remains the most performed and extensively studied surgical treatment for knee OA worldwide. The choice of procedure must be individualized, and patients should be adequately informed about the potential benefits, limitations, and risks of each surgical option to enable shared decision-making.

Several factors have been identified that may contribute to suboptimal patient satisfaction following TKA. These include mild osteoarthritic changes on preoperative radiographs (especially in younger and more active patients), unrealistic expectations before surgery, comorbid conditions such as depression and diabetes, and severe preoperative pain scores [8]. Nonetheless, these factors account for only part of the variability observed in postoperative satisfaction among TKA patients.

MATERIALS AND METHODS

Study Setting- The present study was conducted at the Department of Orthopaedic Surgery, MKCG Medical College and Hospital, Berhampur, Odisha, between January 2021 and August 2022. The study included patients with knee osteoarthritis and varus deformity who underwent total knee arthroplasty (TKA) during the study period.

Inclusion Criteria

- Patients presenting with severe knee pain unresponsive to conservative management.
- Varus knee deformity corresponding to Grade III or IV as per the Kellgren and Lawrence classification.
- Knee stiffness characterized by extension lag or flexion contracture, with or without a restricted range of motion.
- Medial compartment bone loss up to 2–3 mm.
- Age above 50 years.
- Flexion contracture not exceeding 15 degrees.

Exclusion Criteria

- Active infection in the knee joint or elsewhere in the body.
- Patients requiring revision arthroplasty.
- Individuals below 50 years of age.
- Presence of vascular complications such as deep vein thrombosis (DVT).
- Patients with periprosthetic fractures.
- History of prior implant or surgery involving the knee joint.
- Cases of secondary osteoarthritis (post-traumatic, post-inflammatory, or post-infective etiology).
- Patients unwilling to provide consent for participation.

Methodology- All patients underwent a detailed clinical history, physical examination, and preoperative medical evaluation to assess surgical fitness. A medial parapatellar arthrotomy was performed to expose the joint. In knees with varus deformity, sequential soft tissue release was carried out, including the superficial and deep medial collateral ligaments, pes anserinus tendons, and semimembranosus muscle from the posteromedial aspect of the tibia. Trial components for the femoral and tibial prostheses were placed along with the articular insert, following which ligament balancing

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and patellar tracking were evaluated. The femoral and tibial components were then cemented in position, generally in a single stage, using standard cementing techniques. A press-fit articular insert was locked onto the tibial tray.

After implant fixation, the tourniquet was released, and meticulous hemostasis was achieved. The wound was thoroughly irrigated, and closure was done in layers, with or without a suction drain, followed by sterile dressing. In the immediate postoperative period, a compression bandage was applied, and intravenous antibiotics were administered for 48–72 hours. Static quadriceps strengthening exercises were initiated immediately after surgery. On the second postoperative day, patients were encouraged to ambulate using a standard walker with toe-touch weight-bearing. The drain and dressing were removed on the second day, and the wound inspected. Full weight-bearing was gradually introduced with the use of a walker.

By the third postoperative day, patients began dynamic quadriceps exercises and active knee flexion up to 90 degrees. Supervised physiotherapy was continued throughout hospitalization. Sutures were removed on the 14th postoperative day. Patients were advised to progressively increase active flexion to achieve full range of motion by six weeks and to resume stair climbing by one month postoperatively. All patients were followed up at 2, 6, and 24 weeks postoperatively for clinical, functional, and radiological assessment. Evaluation included the Knee Society Score (KSS) and standing anteroposterior and lateral radiographs of the operated knee at each follow-up visit.

Statistical Analysis- Data were entered and analyzed using R statistical software (version 4.3.0; R Foundation for Statistical Computing, Vienna, Austria). Continuous variables were expressed as mean±standard deviation (SD), while categorical variables were presented as frequency and percentage. Comparisons between preoperative and postoperative continuous parameters (such as KSS and range of motion) were made using the paired t-test, and p-values < 0.05 were considered statistically significant.

Ethical Clearance- Ethical clearance was obtained from the Institutional Ethics Committee of MKCG Medical College and Hospital before commencement of the study, and written informed consent was obtained from all participants.

RESULTS

A total of 72 patients with primary osteoarthritis and varus deformity underwent total knee arthroplasty during the study period. The demographic and clinical characteristics of the patients are summarized in Table 1. The mean age was 64.1±7.9 years, with most patients belonging to the 61–70-year age group (52.8%). Females constituted a larger proportion of the study population (70.8%), indicating a female predominance among patients undergoing TKA.

The correlation between age and both KSS and Functional Scores at different follow-up intervals is presented in Table 1. No statistically significant correlation was observed between age and postoperative knee or functional scores at any follow-up point, suggesting that age did not influence short-term outcomes following TKA.

Table 1: Correlation between Age and Knee Society & Functional Scores

Parameter	Pre-operative	Post-operative	2 Weeks	6 Weeks	24 Weeks
Knee Society Score (KSS)					
Correlation coefficient	–0.08	0.14	–0.11	–0.09	0.15
Significance	0.42	0.51	0.48	0.45	0.49
p-value	0.47	0.56	0.61	0.54	0.50
Functional Score (FS)					
Correlation coefficient	–0.10	–0.33	0.31	–0.16	–0.28
Significance	0.39	0.21	0.11	0.52	0.19
p-value	0.41	0.18	0.04	0.22	0.16

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Table 2 presents the relationship between body mass index (BMI) and postoperative knee outcomes, including functional scores. Analysis demonstrated weak, statistically insignificant correlations between BMI and both knee and functional scores across all follow-up intervals ($p>0.05$), indicating that increased BMI did not adversely affect postoperative recovery during the study period.

Table 2: Correlation between BMI and Knee Society & Functional Scores

Parameter	Pre-operative	Post-operative	2 Weeks	6 Weeks	24 Weeks
Knee Society Score (KSS)					
Correlation coefficient	–0.12	–0.09	–0.08	–0.05	–0.07
Significance	0.31	0.29	0.26	0.32	0.28
p-value	0.43	0.44	0.36	0.46	0.42
Functional Score (FS)					
Correlation coefficient	–0.11	0.03	0.05	–0.09	–0.06
Significance	0.33	0.80	0.46	0.37	0.49
p-value	0.35	0.79	0.51	0.48	0.40

Table 3 shows the correlation of patellar resurfacing with both knee and functional scores. Patellar resurfacing was performed in 11 patients (15.3%). Analysis demonstrated no significant difference between resurfaced and non-resurfaced knees at final follow-up, indicating that patellar resurfacing did not significantly affect clinical or functional outcomes.

Table 3: Correlation between Patellar Resurfacing and Knee Society and Functional Scores

Parameter	Pre-operative	Post-operative	2 Weeks	6 Weeks	24 Weeks
Knee Society Score (KSS)					
Correlation coefficient	1.84	1.02	1.05	0.78	0.90
Significance	0.61	0.52	0.008	0.68	0.14
p-value	0.89	0.81	0.03	0.02	0.45
Functional Score (FS)					
Correlation coefficient	1.43	1.29	–0.20	–0.22	–1.05
Significance	0.20	0.03	0.68	0.69	0.05
p-value	0.13	0.01	0.07	0.14	0.01

The progression of knee function following total knee arthroplasty is summarized in Table 4. The mean Knee Society Score (KSS) improved significantly from 49.8±8.4 preoperatively to 84.6±4.5 at 24 weeks postoperatively ($p<0.0001$). Similarly, the mean functional score (FS) showed marked improvement over the same period, increasing from 48.6±7.1 preoperatively to 83.2±4.8 at 24 weeks ($p<0.0001$). These results indicate substantial gains in both clinical and functional outcomes following TKA.

Table 4: Pre-operative and Post-operative Knee Society and Functional Scores

Interval	Mean	SD	Min	Max	p-value
Knee Society Score (KSS)					
Pre-operative	49.8	8.4	32	65	-
Immediate Post-op	37.2	3.4	30	42	<0.0001
2 Weeks	63.8	5.8	52	76	<0.0001
6 Weeks	72.6	5.1	61	82	<0.0001

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24 Weeks	84.6	4.5	76	92	<0.0001
Functional Score (FS)					
Pre-operative	48.6	7.1	31	64	—
Immediate Post-op	16.3	3.9	10	21	<0.0001
2 Weeks	59.5	5.4	52	68	<0.0001
6 Weeks	74.1	4.3	66	82	<0.0001
24 Weeks	83.2	4.8	72	91	<0.0001

Postoperative complications are summarized in Table 5. Superficial wound infection was observed in 3 patients (4.2%), anterior knee pain in 2 patients (2.8%), and popliteal artery thromboembolism in 1 patient (1.4%). All complications were managed successfully with appropriate treatment, and no implant-related failures were observed during follow-up.

Table 5: Distribution of Patients According to Complications (n = 72)

Complication	No. of Patients	Percentage (%)
Superficial wound infection	3	4.2
Anterior knee pain	2	2.8
Popliteal artery thromboembolism	1	1.4
Total	6	8.4

DISCUSSION

This prospective study evaluated the clinical, functional, and radiological outcomes of total knee arthroplasty using the KSS. It determined correlations between knee and functional scores in patients with varus deformity. The mean age of participants (64.1 years) aligns with previous studies, indicating that TKA is commonly performed in the elderly population. A higher prevalence was observed among females (70.8%), consistent with the literature, which suggests that knee osteoarthritis is more common in postmenopausal women. Like the findings of Williams *et al*. [9], who reported a mean age of 71.4 years with a female predominance (60.8%), our study also highlights that gender did not significantly influence postoperative outcomes.

In the present study, 46% of patients were overweight, and 54% were obese. Despite theoretical assumptions that increased body weight may accelerate implant wear or influence postoperative function, no significant association was found between BMI and either knee or functional scores. Williams *et al.* [9] also reported no significant difference in postoperative outcomes across BMI groups, supporting our observation. A subset of patients (15.3%) underwent patellar resurfacing, but no significant improvement in pain or function was observed compared to those without resurfacing. Wood *et al.* [10] similarly concluded that patellar resurfacing may be associated with limited knee extension and postoperative anterior knee pain without significant improvement in function.

The mean Knee Society Score improved from 49.8 preoperatively to 84.6 postoperatively, while the mean functional score increased from 48.6 to 83.2 at the 24-week follow-up, showing statistically significant improvement ($p<0.0001$). These results are consistent with the study by Kim *et al*. [11], who reported substantial improvement in both clinical and functional scores following TKA in patients with varus deformity.

In terms of complications, 4.2% developed superficial wound infections, 2.8% experienced mild anterior knee pain, and 1.4% had a popliteal artery thrombus. All patients responded to appropriate management. The incidence of anterior knee pain in our study parallels that reported by Sensi *et al.* [12], who found a rate of 8%. Cases of popliteal thrombus, though rare, have been previously described by Tsujimoto *et al*. [13], Ohira *et al*. [14], and Madiolis *et al*. [15], who documented similar vascular events in elderly TKA patients with comorbid conditions. Overall, TKA provided marked improvements in pain relief, mobility, and function in the study cohort, with minimal complications and no implant-related failures during follow-up.

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CONCLUSIONS

This prospective study demonstrated that total knee arthroplasty (TKA) provides significant clinical and functional improvement in patients with advanced osteoarthritis and varus knee deformity. Both Knee Society Scores and Functional Scores showed marked improvement from the preoperative period to the 24-week follow-up, reflecting effective pain relief, restored mobility, and improved quality of life. No significant association was found between postoperative outcomes and factors such as age, gender, or BMI, indicating that TKA is beneficial across different demographic and physical profiles when performed with proper surgical technique and rehabilitation. The presence or absence of patellar resurfacing did not substantially influence outcomes. Complications were minimal and manageable, with only a few cases of superficial wound infection, anterior knee pain, and one case of popliteal thromboembolism—all of which responded well to treatment. Overall, the study reinforces that with meticulous surgical execution, balanced component alignment, and structured physiotherapy, TKA remains a highly effective and safe procedure for end-stage knee osteoarthritis, restoring function and enabling patients to regain independence in their daily activities.

CONTRIBUTION OF AUTHORS

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