

Research Article

Clinical and Functional Outcomes of Total Knee Arthroplasty in Patients with Advanced Osteoarthritis

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ABSTRACT

Background: Knee osteoarthritis is a common degenerative joint disorder associated with chronic pain, restricted mobility, and functional disability. Total knee arthroplasty (TKA) is an effective surgical intervention for patients with advanced osteoarthritis who fail to respond to conservative treatment. The present study aimed to evaluate the clinical and functional outcomes following total knee arthroplasty.

Materials and Methods: This prospective observational study included 40 patients with advanced knee osteoarthritis who underwent primary total knee arthroplasty at a tertiary care hospital. Patients were evaluated preoperatively and at 6 weeks, 3 months, and 6 months postoperatively. Clinical and functional outcomes were assessed using the Visual Analogue Scale (VAS), knee range of motion, and Knee Society Clinical and Functional Scores. Postoperative complications were also evaluated.

Results: The majority of patients were aged 60-69 years (45.0%), and 65.0% were female. Mean VAS pain scores decreased from 7.8 ± 1.1 preoperatively to 1.5 ± 0.8 at six months. Mean knee flexion improved from $92.5 \pm 12.4^\circ$ to $116.8 \pm 8.9^\circ$. Knee Society Clinical Scores increased from 38.6 ± 9.4 to 85.6 ± 7.5 , while Functional Scores improved from 42.5 ± 10.6 to 82.8 ± 8.4 . Excellent or good clinical outcomes were observed in 90.0% of patients, and 80.0% achieved independent walking. No postoperative complications were reported in 80.0% of patients.

Conclusion: Total knee arthroplasty demonstrated favorable early clinical and functional outcomes, with substantial pain relief, improved knee mobility, and greater functional independence in patients with advanced osteoarthritis.

Keywords: Total Knee Arthroplasty, Knee Osteoarthritis, Clinical Outcomes, Functional Outcomes, Knee Society Score, Pain Relief.

INTRODUCTION

Osteoarthritis (OA) of the knee is one of the most common degenerative joint disorders and a leading cause of chronic pain, functional limitation, and physical disability worldwide, particularly among elderly individuals[1]. In India, increasing life expectancy, obesity, and lifestyle-related factors have contributed to the growing burden of knee osteoarthritis. The disease is characterized by progressive deterioration of articular cartilage, subchondral bone remodeling, osteophyte formation, synovial inflammation, and joint space narrowing. However, the severity of clinical

symptoms and functional impairment does not always correlate directly with radiological findings, reflecting the heterogeneous nature of osteoarthritis [2,3]. Advanced knee osteoarthritis is associated with persistent pain, stiffness, deformity, restricted range of motion, and difficulty performing daily activities such as walking, climbing stairs, and squatting. Although conservative management, including analgesics, physiotherapy, weight reduction, and intra-articular injections, may provide symptomatic relief, these measures are often insufficient in advanced disease. Consequently, surgical intervention becomes necessary when

pain and functional disability significantly impair quality of life [4]. Total knee arthroplasty (TKA) is an established and effective surgical procedure for patients with advanced osteoarthritis who fail to respond adequately to conservative treatment. The primary objectives of TKA are to relieve pain, correct deformity, restore joint alignment, improve mobility, and enhance functional independence. Advances in prosthetic design, surgical techniques, perioperative management, and rehabilitation have substantially improved postoperative outcomes and implant longevity [5,6]. Successful outcomes following TKA depend on several patient-related, implant-related, and surgical factors. Age, body mass index, preoperative functional status, comorbidities, severity of deformity, component positioning, and soft-tissue balancing may influence postoperative recovery. Restoration of appropriate lower limb mechanical alignment is traditionally considered important for balanced load distribution, joint stability, and prosthetic survival. However, satisfactory radiological alignment does not always translate into optimal functional recovery or patient satisfaction [7–9]. Clinical and functional outcomes following TKA are commonly evaluated through improvements in pain, knee stability, range of motion, walking ability, and stair-climbing capacity. Standardized assessment tools, particularly the Knee Society Score (KSS), provide a systematic method for evaluating postoperative clinical improvement and functional recovery. Despite the established effectiveness of TKA, variations in postoperative outcomes emphasize the importance of systematic evaluation to identify factors associated with satisfactory recovery [10–13]. Therefore, the present study aims to evaluate the clinical and functional outcomes of total knee arthroplasty in patients with advanced knee osteoarthritis, with particular emphasis on pain relief, knee range of motion, functional improvement, and postoperative recovery.

MATERIALS AND METHODS

The present study was conducted as a prospective observational study to evaluate the clinical and functional outcomes of total knee arthroplasty (TKA) in patients with advanced knee osteoarthritis. The study was carried out in the Department of Orthopaedics at a tertiary care teaching hospital. Patients diagnosed with advanced knee osteoarthritis who underwent

primary total knee arthroplasty were included in the study. The study was conducted over a period of 18 months, during which eligible patients were enrolled, operated upon, and followed up for assessment of clinical and functional outcomes. A total of 40 patients with advanced knee osteoarthritis who underwent primary total knee arthroplasty were included in the study.

Inclusion Criteria

1. Patients aged 40 years and above.
2. Patients diagnosed with advanced primary knee osteoarthritis (Kellgren–Lawrence grade III or IV).
3. Patients experiencing persistent knee pain and functional disability despite adequate conservative treatment.
4. Patients undergoing primary unilateral total knee arthroplasty.
5. Patients who provided written informed consent and agreed to participate in postoperative follow-up assessments.

Exclusion Criteria

1. Patients with inflammatory arthritis, including rheumatoid arthritis.
2. Patients with post-traumatic or secondary knee osteoarthritis.
3. Patients with a history of previous knee replacement surgery.
4. Patients with active infection involving the knee joint or surrounding tissues.
5. Patients with severe neurological or neuromuscular disorders affecting lower limb function.
6. Patients with significant medical comorbidities that contraindicated surgical intervention.
7. Patients who were unwilling to participate or unable to complete the scheduled follow-up assessments.

Preoperative Assessment

All enrolled patients underwent a detailed clinical evaluation, including documentation of demographic characteristics such as age, sex, body mass index (BMI), and affected knee. A comprehensive medical history was obtained, including duration of knee symptoms, severity of pain, previous treatment, associated comorbidities, and limitations in daily activities. Clinical examination included assessment of knee deformity, tenderness, swelling, ligamentous stability, and range of motion. Preoperative pain intensity was assessed using the Visual Analogue Scale

(VAS). Clinical and functional status was evaluated using the Knee Society Score (KSS). Standard anteroposterior and lateral radiographs of the affected knee were obtained, and the severity of osteoarthritis was classified according to the Kellgren–Lawrence grading system. Additional radiographic assessment was performed when required for surgical planning.

Surgical Procedure

All patients underwent primary total knee arthroplasty using a standardized surgical approach under appropriate anesthesia. Patients were positioned supine, and routine antiseptic preparation and sterile draping were performed. A standard midline skin incision with a medial parapatellar arthrotomy was used to expose the knee joint. Damaged articular surfaces of the distal femur and proximal tibia were resected using appropriate instrumentation. Bone cuts were performed to achieve satisfactory component positioning, joint alignment, and ligamentous balance. Trial components were inserted to assess knee stability, range of motion, patellar tracking, and soft-tissue balance. Following satisfactory trial assessment, the definitive prosthetic components were implanted. The joint was irrigated, hemostasis was achieved, and the wound was closed in layers using standard surgical techniques.

Postoperative Management and Rehabilitation

All patients received routine postoperative care, including analgesics, antibiotic prophylaxis, venous thromboembolism prevention as indicated, and regular wound assessment. Early mobilization and physiotherapy were initiated according to patient tolerance and postoperative clinical condition. Rehabilitation included quadriceps strengthening exercises, ankle pump exercises, active and assisted knee range-of-motion exercises, and progressive weight-bearing with walking support. Patients were encouraged to perform regular physiotherapy exercises to improve muscle strength, knee mobility, walking ability, and functional independence.

Follow-Up Assessment

Patients were evaluated preoperatively and at scheduled postoperative follow-up visits at 6 weeks, 3 months, and 6 months.

At each follow-up visit, clinical and functional recovery was assessed using the following parameters:

- Pain assessment: Pain intensity was evaluated using the Visual Analogue Scale (VAS).
- Range of motion: Knee flexion and extension were measured using a standard goniometer.
- Clinical outcome: Knee pain, stability, and range of motion were assessed using the clinical component of the Knee Society Score.
- Functional outcome: Walking distance, stair-climbing ability, and functional independence were evaluated using the functional component of the Knee Society Score.
- Radiological assessment: Postoperative radiographs were reviewed to assess prosthetic component positioning and joint alignment.
- Complications: Postoperative complications, including wound infection, stiffness, instability, thromboembolic events, and implant-related complications, were documented.

Outcome Measures

Primary Outcome

The primary outcome was improvement in clinical and functional status following total knee arthroplasty, assessed by comparing preoperative and postoperative Knee Society clinical and functional scores.

Secondary Outcomes

Secondary outcomes included improvement in pain intensity, knee range of motion, walking ability, stair-climbing capacity, postoperative joint alignment, and the incidence of postoperative complications.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using SPSS.26 statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. The normality of continuous data was assessed using the Shapiro–Wilk test. Preoperative and postoperative clinical parameters, including VAS scores, knee range of motion, and Knee Society Scores, were compared using the paired Student's t-test for normally distributed data or the Wilcoxon signed-rank test for non-normally distributed data. Changes across multiple follow-up visits were assessed using repeated-measures analysis of variance or the Friedman test, as appropriate. Categorical variables were

analyzed using the Chi-square test or Fisher's exact test wherever applicable. A p-value of less than 0.05 was considered statistically significant.

RESULTS

As shown in Table 1, the majority of patients belonged to the 60–69 years age group (45.0%), followed by 50–59 years (25.0%), ≥70 years (20.0%), and 40–49 years (10.0%). Female patients constituted 65.0% of the study population, while males accounted for 35.0%. Regarding body mass index, 50.0% of patients were overweight, 30.0% were obese, and 20.0% had a normal BMI. The right knee was operated on in 55.0% of patients, whereas the left knee was operated on in 45.0%. Table 2 presents the preoperative clinical characteristics of the study population. Most patients (52.5%) had experienced knee symptoms for 5–10 years, followed by 25.0% with symptoms for less than 5 years and 22.5% for more than 10 years. According to the Kellgren–Lawrence grading system, 60.0% of patients had Grade IV osteoarthritis, while 40.0% had Grade III osteoarthritis. Varus deformity was the most common preoperative deformity (80.0%), followed by valgus deformity (15.0%). Severe preoperative pain (VAS 7–10) was reported in 70.0% of patients, whereas 30.0% experienced moderate pain. As presented in Table 3, progressive improvement in pain scores and knee range of motion was observed following total knee arthroplasty. The mean VAS pain score decreased from 7.8 ± 1.1 preoperatively to 4.2 ± 1.0 at 6 weeks, 2.6 ± 0.9 at 3 months, and 1.5 ± 0.8 at 6 months. Mean knee flexion improved from $92.5 \pm 12.4^\circ$ preoperatively to $116.8 \pm 8.9^\circ$ at 6 months. Similarly, the mean knee extension deficit decreased from $8.4 \pm 4.2^\circ$ preoperatively to $1.1 \pm 1.4^\circ$ at 6 months. These findings demonstrated progressive reduction in pain and improvement in knee mobility during the postoperative follow-up period. Table 4 and

Figure 1 illustrate the progressive improvement in Knee Society Clinical and Functional Scores following total knee arthroplasty. The mean Knee Society Clinical Score increased from 38.6 ± 9.4 preoperatively to 62.4 ± 8.8 at 6 weeks, 76.8 ± 8.2 at 3 months, and 85.6 ± 7.5 at 6 months. Similarly, the mean Knee Society Functional Score improved from 42.5 ± 10.6 preoperatively to 59.8 ± 9.7 at 6 weeks, 73.4 ± 9.1 at 3 months, and 82.8 ± 8.4 at 6 months. The overall improvement at 6 months was 47.0 points in the Clinical Score and 40.3 points in the Functional Score, indicating substantial improvement in clinical and functional outcomes. As demonstrated in Table 5 and Figure 2, the majority of patients achieved favorable functional outcomes at 6 months following total knee arthroplasty. According to the Knee Society Clinical Score classification, 67.5% of patients achieved excellent outcomes, 22.5% had good outcomes, 7.5% had fair outcomes, and 2.5% had poor outcomes. Overall, 90.0% of patients achieved excellent or good clinical outcomes. Regarding walking ability, 80.0% of patients were able to walk independently without support, while 20.0% required assistance. Independent stair climbing was achieved by 65.0% of patients, whereas 30.0% required support and 5.0% were unable to climb stairs. Table 6 and Figure 3 present the distribution of postoperative complications among the study participants. Most patients (80.0%) experienced no postoperative complications. Knee stiffness was the most frequently reported complication, occurring in 7.5% of patients, followed by superficial wound infection and persistent knee pain, each affecting 5.0% of patients. Deep vein thrombosis was observed in 2.5% of patients. No cases of implant loosening or deep prosthetic joint infection were reported during the 6-month follow-up period. Overall, postoperative complications were recorded in 20.0% of patients, with knee stiffness being the most common complication.

Table 1. Distribution of Patients According to Demographic Characteristics (N = 40)

Parameter	Number (n)	Percentage (%)
Age group (years)		
40–49	4	10.0
50–59	10	25.0
60–69	18	45.0
≥70	8	20.0
Sex		
Male	14	35.0
Female	26	65.0

BMI category (kg/m ²)		
Normal (18.5–24.9)	8	20.0
Overweight (25.0–29.9)	20	50.0
Obese (≥30)	12	30.0
Operated knee		
Right	22	55.0
Left	18	45.0

Table 2. Distribution of Patients According to Preoperative Clinical Characteristics (N = 40)

Parameter	Number (n)	Percentage (%)
Duration of knee symptoms		
Less than 5 years	10	25.0
5–10 years	21	52.5
More than 10 years	9	22.5
Kellgren–Lawrence grade		
Grade III	16	40.0
Grade IV	24	60.0
Preoperative knee deformity		
Varus	32	80.0
Valgus	6	15.0
No significant deformity	2	5.0
Preoperative pain severity (VAS)		
Moderate (4–6)	12	30.0
Severe (7–10)	28	70.0

Table 3. Comparison of Preoperative and Postoperative Pain Scores and Knee Range of Motion (N = 40)

Parameter	Preoperative	6 weeks	3 months	6 months
VAS pain score, mean ± SD	7.8 ± 1.1	4.2 ± 1.0	2.6 ± 0.9	1.5 ± 0.8
Knee flexion (degrees), mean ± SD	92.5 ± 12.4	101.2 ± 10.8	110.6 ± 9.7	116.8 ± 8.9
Knee extension deficit (degrees), mean ± SD	8.4 ± 4.2	4.6 ± 3.1	2.3 ± 2.0	1.1 ± 1.4

Table 4. Comparison of Preoperative and Postoperative Knee Society Scores (N = 40)

Parameter	Preoperative	6 weeks	3 months	6 months
Knee Society Clinical Score, mean ± SD	38.6 ± 9.4	62.4 ± 8.8	76.8 ± 8.2	85.6 ± 7.5
Knee Society Functional Score, mean ± SD	42.5 ± 10.6	59.8 ± 9.7	73.4 ± 9.1	82.8 ± 8.4

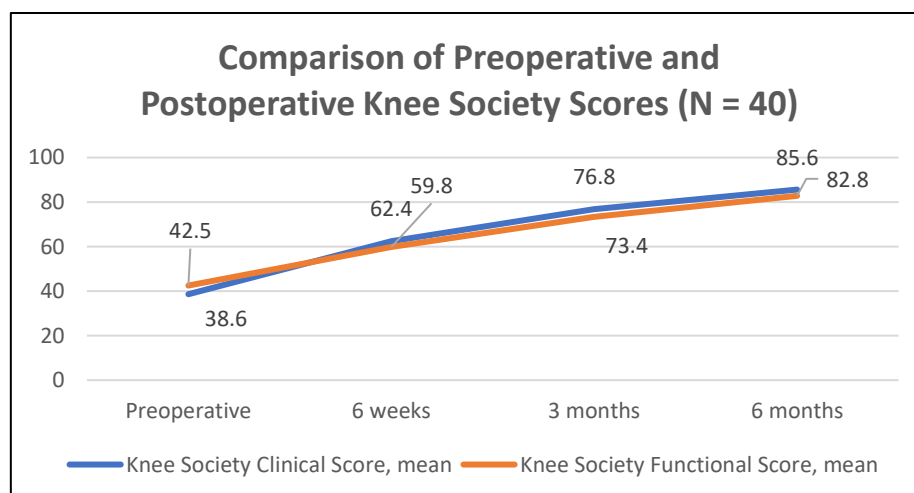


Figure 1 Comparison of Preoperative and Postoperative Knee Society Scores (N = 40)
Table 5. Distribution of Patients According to Functional Outcomes at 6 Months (N = 40)

Parameter	Number (n)	Percentage (%)
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Knee Society Clinical Score category		
Excellent (80–100)	27	67.5
Good (70–79)	9	22.5
Fair (60–69)	3	7.5
Poor (less than 60)	1	2.5
Walking ability		
Independent without support	32	80.0
Walking with support	8	20.0
Stair-climbing ability		
Independent	26	65.0
With support	12	30.0
Unable	2	5.0

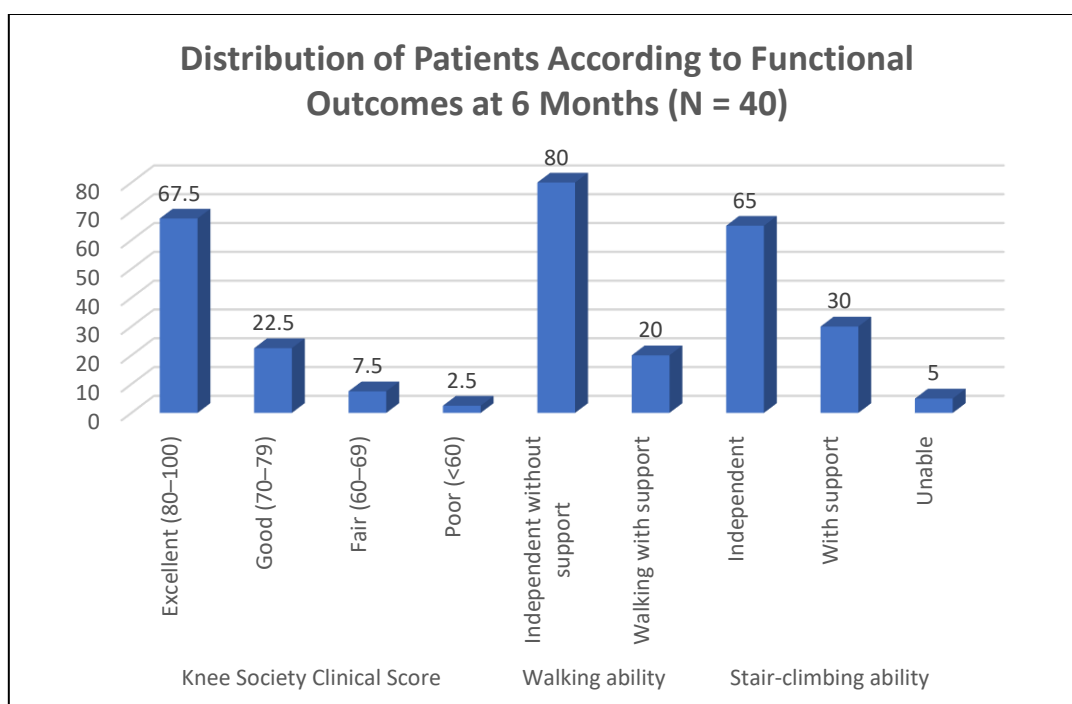


Figure 2 Distribution of Patients According to Functional Outcomes at 6 Months (N = 40)

Table 6. Distribution of Postoperative Complications Following Total Knee Arthroplasty (N = 40)

Postoperative complication	Number (n)	Percentage (%)
Superficial wound infection	2	5.0
Knee stiffness	3	7.5
Persistent knee pain	2	5.0
Deep vein thrombosis	1	2.5
Implant loosening	0	0.0
Deep prosthetic joint infection	0	0.0
No postoperative complication	32	80.0
Total	40	100.0

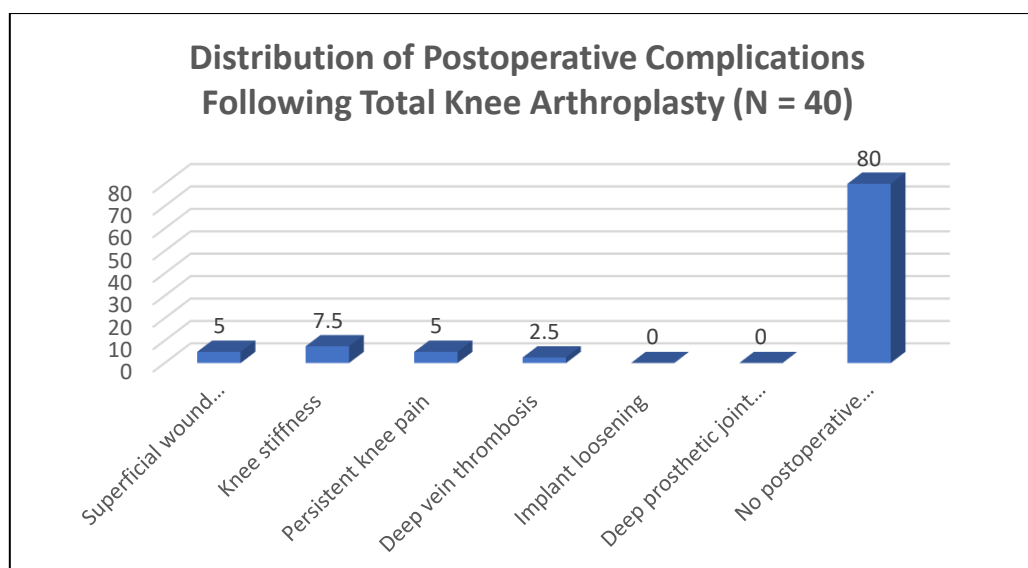


Figure 3 Distribution of Postoperative Complications Following Total Knee Arthroplasty (N = 40)

DISCUSSION

The present study evaluated the clinical and functional outcomes of total knee arthroplasty in 40 patients with advanced knee osteoarthritis. The findings demonstrated considerable improvement in pain relief, knee mobility, clinical scores, and functional independence during the six-month postoperative follow-up period. These findings were broadly consistent with previously published studies reporting favorable outcomes following total knee arthroplasty. In the present study, the majority of patients belonged to the 60–69-year age group (45.0%), followed by 50–59 years (25.0%). Females constituted 65.0% of the study population, while 80.0% were overweight or obese. Comparable demographic findings were reported by Bourne et al. (2010)[14], who evaluated 1,703 patients undergoing primary total knee arthroplasty and observed a mean age of 69 ± 9 years, with females constituting 60.0% of the population. The mean BMI in their study was 32 ± 6 kg/m². These findings highlighted the predominance of older individuals and females among patients undergoing knee replacement surgery. Regarding preoperative characteristics, 60.0% of patients had Kellgren–Lawrence grade IV osteoarthritis, while 40.0% had grade III disease. Varus deformity was observed in 80.0% of patients, and 70.0% reported severe preoperative pain. Bourne et al. (2010)[14] similarly documented varus deformity in 71.0% and valgus deformity in 12.0% of patients, supporting the predominance of varus alignment abnormalities in advanced knee disease. Pain reduction was an important finding, with mean VAS scores decreasing from

7.8 ± 1.1 preoperatively to 1.5 ± 0.8 at six months. Similarly, mean knee flexion improved from $92.5 \pm 12.4^\circ$ to $116.8 \pm 8.9^\circ$. A South Indian prospective study reported improvement in average knee flexion from 78° preoperatively to 106.33° postoperatively. These findings supported the effectiveness of total knee arthroplasty in relieving pain and restoring joint mobility. The mean Knee Society Clinical Score increased from 38.6 ± 9.4 preoperatively to 85.6 ± 7.5 at six months, while the functional score improved from 42.5 ± 10.6 to 82.8 ± 8.4 . Similarly, a prospective study published in the International Journal of Research in Orthopaedics reported improvement in clinical scores from 49.40 ± 13.79 to 86.08 ± 5.64 and functional scores from 32.75 ± 11.79 to 84.43 ± 9.59 at six months. These comparable improvements indicated substantial recovery in knee function following surgery. At six months, 67.5% of patients achieved excellent clinical outcomes, while 22.5% achieved good outcomes, resulting in a combined favorable outcome rate of 90.0%. Additionally, 80.0% walked independently without support, and 65.0% climbed stairs independently. Chaudhary et al. (2024)[15], in a study involving 47 knees from 40 patients, reported excellent Knee Society Scores in 57.4%, very good scores in 25.5%, and good scores in 17.0%, further supporting favorable functional recovery following total knee arthroplasty. Postoperative complications were relatively limited, with 80.0% of patients experiencing no complications. Knee stiffness occurred in 7.5%, superficial wound infection in 5.0%, and deep vein thrombosis in 2.5%. Similarly, a prospective study involving 33 patients

reported restricted knee motion in 9.1% and superficial infection in 3.0%, with no major complications reported. These findings suggested that total knee arthroplasty could provide favorable early outcomes with manageable postoperative morbidity.

CONCLUSION

The present study demonstrated favourable clinical and functional outcomes following total knee arthroplasty in patients with advanced osteoarthritis. Mean VAS pain scores decreased from 7.8 to 1.5, while knee flexion improved from 92.5° to 116.8° at six months. Knee Society Clinical and Functional Scores improved from 38.6 to 85.6 and 42.5 to 82.8, respectively. Excellent or good clinical outcomes were reported in 90.0% of patients, with 80.0% achieving independent walking. These illustrative findings suggest that total knee arthroplasty can provide substantial pain relief, improved mobility, and functional independence with relatively low postoperative complication rates, subject to verification against actual patient data

Limitations

The present study was limited by its relatively small sample size of 40 patients, which may restrict the generalizability of the findings. The short follow-up period of six months did not allow assessment of long-term functional outcomes, implant survival, or delayed complications. The absence of a comparative control group limited the ability to evaluate outcomes against alternative treatment approaches. Additionally, the single-center study design and potential influence of patient-related factors may have affected the observed clinical and functional outcomes.

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