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Research Article

Clinical Profile and Functional Outcomes of Patients Undergoing Total Knee Replacement

Dr. Shadrack N Y[1], Dr. Christina Sherley N S[2] and Dr. Sheeba M[3*]

Article Info:

[1]Senior Specialist, Department of Orthopaedics, Ballari Medical College and Research Centre, Ballari, Karnataka, India.

[2]Senior Resident, Department of Radiology, Ballari Medical College and Research Centre, Ballari, Karnataka, India

[*3]Senior Resident, Department of General Medicine, Ballari Medical College and Research Centre, Ballari, Karnataka, India

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***Corresponding Author:**
Dr. Sheeba M,
Senior Resident, Department of General Medicine, Ballari Medical College and Research Centre, Ballari, Karnataka, India
sheeba.m.1996@gmail.com

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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 replacement (TKR) is an established surgical procedure for patients with advanced osteoarthritis who do not respond adequately to conservative treatment. It aims to relieve pain, restore joint function and improve quality of life.

Objectives: To evaluate the clinical profile and functional outcomes of patients undergoing total knee replacement.

Materials and Methods: This prospective observational study was designed to include 100 patients undergoing primary total knee replacement for advanced knee osteoarthritis in the Department of Orthopaedics at a tertiary care teaching hospital over a period of one year from July 2024 to June 2025. Demographic details, clinical presentation, body mass index, comorbidities and operative characteristics were recorded. Functional outcomes were assessed preoperatively and at six months postoperatively using the Knee Society Score (KSS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and knee range of motion. Appropriate statistical tests were used for analysis, and a p-value of less than 0.05 was considered statistically significant.

Results: The mean age of the patients was 66.4 ± 7.8 years, with female predominance (68%). Overweight and obesity were observed in 46% and 30% of patients, respectively. Hypertension was the most common comorbidity (42%). The mean Knee Society Knee Score improved from 42.6 ± 9.8 preoperatively to 82.4 ± 8.6 postoperatively, while the functional score increased from 39.8 ± 10.5 to 76.5 ± 9.2 ($p<0.001$). The mean WOMAC score decreased from 68.2 ± 11.4 to 24.6 ± 8.7 ($p<0.001$). Knee flexion improved from 88.5 ± 10.6 degrees to 112.4 ± 9.8 degrees ($p<0.001$). Good to excellent functional outcomes were observed in 80% of patients. Postoperative complications were recorded in 12% of patients.

Conclusion: Total knee replacement resulted in substantial improvement in pain, knee mobility and functional ability among patients with advanced knee osteoarthritis. The favourable improvement in clinical and functional scores indicates that TKR is an effective surgical intervention for improving functional independence and quality of life.

Keywords: Total knee replacement, Knee osteoarthritis, Functional outcomes, Knee Society Score, WOMAC, Range of motion.

Introduction:

Knee osteoarthritis (OA) is one of the most common degenerative musculoskeletal disorders and a major cause of pain, disability and reduced quality of life, particularly among the elderly population. It is characterized by progressive degeneration of articular cartilage, subchondral bone remodelling, osteophyte formation and

changes involving the synovium and other joint structures. The disease commonly presents with pain during movement, joint stiffness, restricted range of motion and difficulty performing daily activities [1,2]. The prevalence of knee osteoarthritis increases with advancing age and is influenced by several risk factors, including female gender, obesity, previous joint injuries, genetic predisposition and occupational activities [2,3].

As the disease progresses, patients may develop severe joint-space narrowing, deformity, instability and significant functional impairment. These changes can interfere with routine activities such as walking, climbing stairs, sitting and standing, thereby affecting functional independence [1,2]. Conservative treatment modalities, including weight reduction, physiotherapy, lifestyle modification, analgesics, non-steroidal anti-inflammatory drugs and intra-articular injections, are generally recommended for symptomatic management during the initial stages of the disease [4,5]. However, patients with advanced osteoarthritis who continue to experience persistent pain and functional limitations despite adequate conservative management may require surgical intervention [4,5].

Total knee replacement (TKR), also known as total knee arthroplasty (TKA), is an established surgical procedure for the management of advanced knee osteoarthritis. It involves replacing the damaged articular surfaces of the femur and tibia, with or without patellar resurfacing, using prosthetic components. The primary objectives of this procedure are to relieve pain, correct deformity, restore joint stability, improve mobility and enhance the overall quality of life. Long-term observational studies have demonstrated sustained improvements in pain, functional ability and quality of life following primary total knee arthroplasty [6,7].

The clinical success of total knee replacement depends on several factors, including patient-related characteristics, preoperative functional status, severity of joint degeneration, surgical technique, implant positioning and postoperative rehabilitation. Age, gender, body mass index and associated comorbidities may also influence functional recovery. Identification of these factors is important for appropriate patient selection, preoperative counselling and optimization of postoperative outcomes. Previous systematic reviews have highlighted the importance of preoperative physical function and patient-related characteristics in determining functional outcomes following TKA [8].

Assessment of functional outcomes following total knee replacement is essential to determine the effectiveness of surgery. The Knee Society Score (KSS) is widely used to evaluate clinical knee status and functional ability, including pain, stability, range of motion and the ability to perform daily activities. The revised Knee Society Scoring System provides a comprehensive assessment of both clinician-based and patient-reported outcomes [9].

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is another commonly used assessment tool that evaluates three important domains: pain, stiffness and physical function. It provides a standardized method for assessing the severity of osteoarthritis symptoms and monitoring improvement following surgical intervention. Bellamy et al. established the validity of the WOMAC index for evaluating clinically important outcomes in patients with hip and knee osteoarthritis [10].

Although total knee replacement is associated with substantial improvement in pain and functional ability, the degree of recovery may vary among individuals. Some patients may continue to experience residual pain, stiffness, reduced range of motion or difficulty performing certain activities despite technically successful surgery. Therefore, structured postoperative functional assessment is important for identifying the extent of recovery and evaluating the effectiveness of surgical intervention [7,8].

Therefore, evaluating both the clinical profile and functional outcomes of patients undergoing total knee replacement is important to understand the effectiveness of the procedure in routine clinical practice. The present study was undertaken to assess the demographic and clinical characteristics of patients undergoing total knee replacement

Materials and Methods:

Study design

A prospective observational study was conducted to evaluate the clinical profile and functional outcomes of patients undergoing total knee replacement.

Study setting

The study was conducted in the Department of Orthopaedics at Ballari Medical College and Research Centre, Ballari, India

Study duration

The study was conducted over a period of 12 months from July 2024 to June 2025

Sample size

A total of 100 patients undergoing primary total knee replacement for advanced knee osteoarthritis were included in the study.

Study population

Patients diagnosed with advanced primary knee osteoarthritis and undergoing primary total knee replacement during the study period were considered eligible for inclusion.

Inclusion criteria

1. Patients aged 50 years and above.
2. Patients diagnosed with advanced primary knee osteoarthritis.
3. Patients undergoing primary total knee replacement.
4. Patients willing to participate in the study and provide informed consent.
5. Patients available for postoperative follow-up for six months.

Exclusion criteria

1. Patients undergoing revision total knee replacement.
2. Patients undergoing TKR for fractures, malignancies or inflammatory arthritis.
3. Patients with previous major reconstructive surgery of the affected knee.
4. Patients with severe neurological or musculoskeletal disorders affecting functional assessment.
5. Patients unwilling to participate or unable to complete the follow-up.

Data collection

After obtaining informed consent, eligible patients were enrolled in the study. Detailed demographic and clinical information was collected using a structured proforma. The recorded parameters included age, gender, occupation, body mass index (BMI), duration of symptoms, laterality of knee involvement and associated comorbidities such as hypertension, diabetes mellitus and cardiovascular disorders.

Clinical examination and radiological assessment

All patients underwent a detailed clinical examination before surgery. The assessment included evaluation of knee pain, joint tenderness, swelling, deformity, joint stability and range of motion. Standard weight-bearing anteroposterior and lateral radiographs of the affected knee were obtained to assess joint-space narrowing, osteophyte formation, subchondral sclerosis and the severity of osteoarthritis.

Surgical procedure

All patients underwent primary total knee replacement under appropriate anaesthesia using standard surgical techniques. The damaged articular surfaces of the femur and tibia were prepared, and appropriate prosthetic components were implanted. Patellar resurfacing was performed according to the surgeon's clinical decision. Perioperative antibiotic prophylaxis and thromboprophylaxis were administered according to institutional protocols.

Postoperative rehabilitation

Postoperative rehabilitation was initiated according to the institutional protocol. It included early mobilization, quadriceps strengthening exercises, active and passive knee range-of-motion exercises and progressive weight-bearing as tolerated. Patients were encouraged to participate in regular physiotherapy to improve joint mobility, muscle strength and functional recovery.

Assessment of functional outcomes

Functional outcomes were assessed before surgery and at six months following total knee replacement using the following parameters:

1. Knee Society Score (KSS)

The Knee Society Score was used to evaluate clinical knee status and functional ability. The assessment included pain, stability, range of motion and functional activities such as walking and stair climbing. Higher scores indicated better clinical and functional outcomes.

2. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

The WOMAC index was used to assess pain, stiffness and physical function. The total score was normalized to a 0–100 scale, with higher scores indicating greater symptom severity and functional limitation.

3. Range of motion

Active knee flexion was measured in degrees using a standard goniometer. Measurements were recorded during the preoperative assessment and at six months postoperatively to evaluate improvement in knee mobility.

Assessment of postoperative complications

Patients were monitored for postoperative complications, including wound infection, knee stiffness, deep vein thrombosis, persistent knee pain and implant-related complications. Complications occurring during the follow-up period were documented.

Statistical analysis

The collected data were entered into Microsoft Excel and analysed using Statistical Package for Social Sciences (SPSS). Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as mean and standard deviation. Preoperative and postoperative functional scores were compared using the paired Student's t-test for normally distributed data. Associations between categorical variables were assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrolment. Patient confidentiality was maintained throughout the study.

Results:

A total of 100 patients undergoing primary total knee replacement were included in this study.

The majority of patients belonged to the 61–70 years age group (42%), followed by the 71–80 years age group (32%). The mean age of the study population was 66.4 ± 7.8 years.

Table 1. Age distribution of the study population

Age group (years)	Number	Percentage
50–60	20	20.0
61–70	42	42.0
71–80	32	32.0
Above 80	6	6.0
Total	100	100

Female patients constituted the majority of the study population, accounting for 68%, while males accounted for 32%.

Table 2. Gender distribution

Gender	Number	Percentage
Male	32	32.0
Female	68	68.0
Total	100	100

Overweight patients formed the largest group (46%), followed by obese patients (30%). The remaining 24% had a normal BMI.

Table 3. Distribution according to body mass index (BMI)

BMI (kg/m²)	Number	Percentage
Normal (18.5–24.9)	24	24.0
Overweight (25–29.9)	46	46.0
Obese (≥30)	30	30.0
Total	100	100

Knee pain was reported by all patients (100%). Difficulty in walking (84%), joint stiffness (76%) and difficulty climbing stairs (72%) were also commonly reported.

Table 4. Clinical presentation of patients

Clinical presentation	Number	Percentage
Knee pain	100	100.0
Difficulty in walking	84	84.0
Joint stiffness	76	76.0

Difficulty climbing stairs	72	72.0
Knee deformity	38	38.0
Joint swelling	31	31.0

Hypertension alone was recorded in 42% of patients, diabetes mellitus alone in 28%, both conditions in 18%, and other comorbidities in 12%.

Table 5. Distribution according to comorbidities

Comorbidity category	Number	Percentage
Hypertension alone	42	42.0
Diabetes mellitus alone	28	28.0
Both hypertension and diabetes	18	18.0
Other comorbidities	12	12.0
Total	100	100

Right-sided total knee replacement was performed in 54% of patients, while 46% underwent left-sided surgery.

Table 6. Distribution according to side of surgery

Side of surgery	Number	Percentage
Right knee	54	54.0
Left knee	46	46.0
Total	100	100

Before surgery, patients had impaired knee function, with a mean Knee Society Knee Score of 42.6 ± 9.8 and a mean WOMAC score of 68.2 ± 11.4. The mean preoperative knee flexion was 88.5 ± 10.6 degrees.

Table 7. Preoperative clinical and functional characteristics

Parameter	Mean ± SD
Duration of symptoms (years)	4.8 ± 2.1
Knee Society Knee Score	42.6 ± 9.8
Knee Society Function Score	39.8 ± 10.5
WOMAC score (0–100)	68.2 ± 11.4
Knee flexion (degrees)	88.5 ± 10.6

At six months, the mean Knee Society Knee Score increased from 42.6 ± 9.8 to 82.4 ± 8.6. The function score improved from 39.8 ± 10.5 to 76.5 ± 9.2. Both changes were statistically significant ($p<0.001$).

Table 8. Comparison of preoperative and postoperative Knee Society Scores

Parameter	Preoperative Mean ± SD	Postoperative Mean ± SD (6 months)	Mean improvement	p-value
Knee Society Knee Score	42.6 ± 9.8	82.4 ± 8.6	39.8	<0.001
Knee Society Function Score	39.8 ± 10.5	76.5 ± 9.2	36.7	<0.001

The total WOMAC score decreased from 68.2 ± 11.4 preoperatively to 24.6 ± 8.7 at six months. Reductions were observed in pain, stiffness and physical function scores, indicating improvement in symptoms and daily functioning ($p<0.001$ for all comparisons).

Table 9. Comparison of preoperative and postoperative WOMAC scores

WOMAC parameter	Preoperative Mean ± SD	Postoperative Mean ± SD	Mean reduction	p-value
Pain	69.4 ± 12.1	23.8 ± 9.2	45.6	<0.001
Stiffness	65.2 ± 13.5	25.6 ± 10.1	39.6	<0.001
Physical function	68.8 ± 11.8	24.5 ± 8.9	44.3	<0.001
Total WOMAC	68.2 ± 11.4	24.6 ± 8.7	43.6	<0.001

Mean knee flexion improved from 88.5 ± 10.6 degrees before surgery to 112.4 ± 9.8 degrees at six months, with a mean increase of 23.9 degrees ($p<0.001$).

Table 10. Comparison of knee range of motion before and after surgery

Parameter	Preoperative Mean ± SD	Postoperative Mean ± SD	Mean improvement	p-value
Knee flexion (degrees)	88.5 ± 10.6	112.4 ± 9.8	23.9	<0.001

Based on the Knee Society Knee Score categories, 42% of patients achieved good outcomes and 38% achieved excellent outcomes. Overall, 80% were classified as having good or excellent outcomes.

Table 11: Distribution of patients according to postoperative functional outcome

Functional outcome	KSS range	Number	Percentage
Excellent	90–100	38	38.0
Good	80–89	42	42.0
Fair	70–79	14	14.0
Poor	Below 70	6	6.0
Total	—	100	100

No complications were recorded in 88% of patients. Postoperative stiffness was observed in 5%, superficial wound infection in 3%, persistent knee pain in 3% and deep vein thrombosis in 1%.

Table 12. Postoperative complications

Complication	Number	Percentage
Postoperative stiffness	5	5.0
Superficial wound infection	3	3.0
Deep vein thrombosis	1	1.0
Persistent knee pain	3	3.0
No complications	88	88.0
Total	100	100

Discussion:

Total knee replacement (TKR) is an established surgical procedure for patients with advanced knee osteoarthritis who experience persistent pain and functional disability despite conservative management. The present study evaluated the clinical profile and functional outcomes of 100 patients undergoing primary total knee replacement, with particular emphasis on postoperative improvement in Knee Society Score (KSS), WOMAC score and knee range of motion.

In the present study, the mean age of patients was 66.4 ± 7.8 years, with the majority belonging to the 61–70 years age group (42%). This finding reflects the higher occurrence of degenerative joint disease with advancing age. Sebastia-Forcada et al. reported a mean age of 69.2 ± 7.3 years among patients undergoing primary total knee arthroplasty in their prospective longitudinal cohort study. The comparable age distribution suggests that TKR is commonly performed among older adults with advanced degenerative knee disease [11].

Female patients constituted 68% of the study population, indicating female predominance. This observation may be related to differences in joint biomechanics, hormonal influences, body composition and other risk factors associated with knee osteoarthritis. Chaudhary et al. reported that females constituted 67.5% of their study population undergoing total knee arthroplasty, which is comparable to the present study [12].

Regarding body mass index, 46% of patients were overweight and 30% were obese. Increased body weight places additional mechanical stress on the knee joint and may contribute to the progression of osteoarthritis. Obesity is also associated with functional limitations and may influence postoperative rehabilitation. Shah et al., in a large prospective cohort study, identified higher BMI among the factors associated with postoperative morbidity and poorer functional outcomes following total knee arthroplasty [13].

Knee pain was the predominant presenting complaint, reported by all patients (100%), followed by difficulty in walking (84%) and joint stiffness (76%). Difficulty climbing stairs was observed in 72% of patients. These findings demonstrate the considerable impact of advanced knee osteoarthritis on daily activities

and functional independence. Berghmans et al. highlighted that patients with end-stage knee osteoarthritis experience substantial functional limitations before surgery, involving mobility, muscle strength and daily activities [14].

Hypertension was the most common associated comorbidity, observed in 42% of patients, followed by diabetes mellitus alone in 28%. Both hypertension and diabetes were present in 18% of patients. The presence of comorbid conditions is clinically important because these patients may require additional perioperative evaluation and optimization before surgery. Shah et al. demonstrated that diabetes mellitus and higher comorbidity burden were associated with increased postoperative morbidity following elective total knee arthroplasty [13].

The mean knee flexion improved from 88.5 ± 10.6 degrees preoperatively to 112.4 ± 9.8 degrees postoperatively. Improved knee mobility is important for performing daily activities such as walking, sitting, standing and climbing stairs. Chaudhary et al. also reported improvement in knee range of motion following total knee arthroplasty, supporting the role of surgery in restoring joint mobility and functional ability [12].

In the present study, 38% of patients achieved excellent outcomes and 42% achieved good outcomes based on postoperative Knee Society Knee Score categories. Thus, 80% of patients demonstrated good or excellent clinical outcomes. These findings are comparable to the favourable functional outcomes reported by Chaudhary et al., in which the majority of patients achieved excellent or very good postoperative results [12]. However, the interpretation of outcome categories should be based on the scoring system and classification criteria specified in the study protocol.

Postoperative complications were observed in 12% of patients, while 88% had an uncomplicated recovery. Postoperative stiffness was the most frequently observed complication (5%), followed by superficial wound infection (3%), persistent knee pain (3%) and deep vein thrombosis (1%). Shah et al. reported an overall complication rate of approximately 3.95% during the first 90 days following elective primary total knee arthroplasty [13]. Differences in complication rates may be related to variations in patient characteristics, follow-up duration and definitions of postoperative complications.

Limitations

This study has several limitations that should be considered when interpreting the findings. It was conducted at a single tertiary care centre, which may limit the generalizability of the results to other healthcare settings or patient populations. The follow-up period of six months, while sufficient to capture early functional recovery, is relatively short for evaluating the durability of outcomes after total knee replacement; longer-term data would be needed to assess sustained improvement and late complications. The observational design without a concurrent comparator group (for example, patients managed conservatively or with alternative interventions) precludes direct causal inference regarding the magnitude of benefit attributable solely to surgery. Details regarding specific implant designs, variation in surgical technique (including the use of navigation or robotic assistance, if any), and patient adherence to the prescribed rehabilitation protocol were not systematically recorded, which may have influenced functional recovery. Finally, as a prospective observational series of patients who consented to participate and completed follow-up, the study is subject to potential selection bias. Future multicentre studies with longer follow-up, more detailed surgical and rehabilitation data, and inclusion of a comparator arm would help address these limitations.

Declarations

Ethical approval

The study was approved by the Institutional Ethics Committee of Ballari Medical College and Research Centre, Ballari, Karnataka, India. The study was conducted in accordance with the Declaration of Helsinki.

Informed consent

Written informed consent was obtained from all participants prior to enrolment in the study.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Data availability

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

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AI-assisted language editing

AI tools were used for language editing and formatting assistance. The authors take full responsibility for the scientific content, accuracy of data, and final approval of the manuscript.

Conclusion:

Total knee replacement is an effective surgical intervention for patients with advanced knee osteoarthritis associated with persistent pain and functional disability. The study demonstrated considerable improvement in Knee Society Scores, WOMAC scores and knee range of motion following surgery. A majority of patients achieved good to excellent functional outcomes, indicating significant improvement in mobility and the ability to perform daily activities. Although minor postoperative complications were observed, most patients had an uncomplicated recovery. Overall, total knee replacement provides substantial pain relief and functional improvement, contributing to better quality of life among patients with advanced knee osteoarthritis**.**

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