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Clinical And Functional Outcomes Following the Total Knee Arthroplasty: A Prospective Short Term Analysis Study

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Abstract: ***Introduction: Knee osteoarthritis (OA) is a progressive degenerative disease-causing pain, stiffness, and functional limitations, significantly impacting patients' quality of life. Total Knee Arthroplasty (TKA) is the gold-standard surgical treatment for end-stage OA, offering pain relief and improved mobility. This study evaluates the short-term clinical and functional outcomes of TKA using validated scoring systems. Aims and Objectives: This study aims to assess postoperative pain relief, functional recovery, and complications following TKA in patients with advanced knee OA. Outcomes were evaluated using the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Visual Analogue Scale (VAS) preoperatively and at 1, 6, and 9 months postoperatively. Study Design & Methods: This prospective study was conducted at the Department of Orthopedics between November 2023 and January 2024. It included 20 patients (12 females, 8 males) with advanced knee OA who underwent TKA. The mean age of participants was 64 years (range: 58–72 years), and 24 knees were operated on, including 16 unilateral and 4 bilateral TKA cases. Postoperative rehabilitation followed early mobilization protocols. Data were analyzed for functional improvement, pain relief, and complications. Results: The mean KOOS score improved from 18.7% preoperatively to 91.2% postoperatively, demonstrating significant functional recovery. The mean VAS score decreased from 8.4 to 1.4, confirming substantial pain relief. Complications occurred in four patients (20%): two cases of superficial wound infection, one deep infection requiring prolonged antibiotics, and one case of delayed wound healing. No cases of implant failure, thromboembolism, or mortality were reported. Bilateral TKA cases had slightly higher complication rates but comparable functional outcomes to unilateral cases. Discussion: The findings align with global literature, reinforcing the effectiveness of TKA in pain relief and functional restoration. Gender and BMI had minimal impact on functional recovery, while early rehabilitation enhanced outcomes. Limitations include the small sample size and short follow-up duration. Conclusion: TKA significantly improves pain relief, mobility, and quality of life in advanced knee OA. With proper surgical techniques and postoperative care, complications are minimal, and outcomes are excellent. Future research should explore long-term implant durability and the role of robotic-assisted TKA.***

Keywords: Knee Osteoarthritis; TKA; KOOS Score

1. Introduction

Knee osteoarthritis (OA) is a common chronic disorder that causes pain and functional limitations with difficulties in walking, stair climbing and other lower-extremity tasks. It reduces quality of life [(1)], work ability, and work participation. [(2, 3)] OA is a complex condition that involves the entire joint, with progressive loss of articular cartilage, synovitis, and changes in the subchondral bone.[(4)] The incidence of knee OA is higher among women than men, and it increases with age and increasing relative weight of the population [(5,6)]. Thus, the occurrence of knee OA is likely to rise due to population aging and the obesity epidemic. Total knee arthroplasty (TKA) are increasing worldwide. [(7)] The rates have almost increased to 60% more in the last decade in the elderly. TKR is an end-of-line treatment for patients with severe pain and functional limitations. Total knee replacement or Knee arthroplasty has made a revolution the field of orthopaedics as the earlier thought of painful conditions like osteoarthritis or rheumatoid arthritis could now be solved by replacing the damaged joint with an artificial joint which dramatically improves the pain of the patient and the person who could barely walk due to pain starts walking again pain free. The Knee Replacement surgery had been life changing for the patients suffering from osteoarthritis of knee joint which improves their quality of daily living and helps them to get a pain free and function knee joint.

Aim of the Study

The aim of the study is to evaluate the short term clinical and functional outcomes after the total knee arthroplasty in patients with knee osteoarthritis. The outcomes will be assessed using the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Visual Analogue Score (VAS) score Pre and post operatively.

2. Materials and Methods

Study Design:

This is a Prospective study conducted at the Department of Orthopaedics at our hospital from November 2023 to January2024. The study included 20 patients with advanced knee osteoarthritis who underwent TKA during the study period. The patients were followed for an average of 9 months post-surgery, with outcomes evaluated at 1, 6& 9 months

Demographics:

- Patient Characteristics: The study included 20 patients

(12 females, 6 males), with an average age of 64 years (range: 58-72 years).

- Surgical Distribution: We operated on total 24 knees in that, 16 patients underwent Unilateral TKA, while 4 patients underwent bilateral TKA (with a 3-6 month interval).

Inclusion Criteria:

- Patients aged 50-75 years.
- Diagnosis of advanced knee osteoarthritis (Grade 3& 4)
- Functional impairment due to knee pain and loss of mobility.
- No history of prior knee surgeries (except for non-surgical treatments such as physical therapy, medication& Intra articular injections).
- Patients who consented to participate in the study.

Exclusion Criteria:

- Patients with severe systemic comorbidities (e.g., uncontrolled diabetes, cardiovascular disease, pulmonary disease, renal insufficiency, CLDs).
- Patients with a history of deep vein thrombosis or other thromboembolic disorders.
- Patients with contraindications for general anesthesia or prolonged surgery (ASA class 3).
- Morbid Obesity >40 BMI

3. Study Procedure

Once patients agreed to participate, informed consent was obtained before their inclusion in the study. A detailed medical history was recorded for each patient. Clinical and functional assessments were conducted using the KOOS (Knee injury and Osteoarthritis Outcome Score) and VAS (Visual Analogue Scale) scores preoperatively. Knee radiographs – standing anteroposterior view and a lateral view were taken and medical evaluations were performed to identify any potential life-threatening or limb-threatening complications.

Limb length discrepancies, hip and foot deformities, and the integrity of the extensor mechanism were assessed. Additionally, knee deformities, including fixed varus, valgus, or flexion contractures, were carefully examined. A comprehensive preoperative evaluation was conducted for all patients. Total knee arthroplasty was performed under spinal and epidural anesthesia, patient in supine position with knee flexed to 90 degrees. Medial parapatellar incision was taken for all the patients. A pneumatic tourniquet was used for all the patients to stop blood flow during the surgery.

4. Surgical Technique

The incision begins at the medial border of the quadriceps tendon, 7–10 cm proximal to the patella, curving around the medial patella and extending distally to or beyond the tibial tuberosity. A standard medial parapatellar approach is used for all patients, ensuring a thick medial skin flap for optimal healing. The medial capsule and deep medial collateral ligament are elevated to improve access to the knee joint. The patella is then either everted (flipped) or moved laterally to provide a clear view of the joint structures.

Figure A: Showing skin incision, from 5-7cm proximal to superior pole of the patella to tibial tuberosity.

Once exposed, bone preparation begins with the removal of osteophytes (bone spurs) and meniscal remnants. The distal femur is cut at a 5–7° valgus angle, based on preoperative X-rays and femoral rotation is determined using bony landmarks or the gap balancing technique. The tibial cut is made perpendicular to the mechanical axis for proper alignment. Soft-tissue balancing is achieved through ligament releases and adjustments, ensuring equal movement in flexion and extension. If the knee is too stiff (flexion contracture), a posterior capsule release or additional bone resection is performed. In all patients, a posterior-stabilized implant is used, and for those with varus deformities (bow-legged knees), the medial soft tissues are selectively released.

During implantation and closure, the tibial tray is cemented first, followed by the femoral and patellar components. The intramedullary (bone marrow) canals are sealed, and the bone surfaces are carefully prepared to enhance cement bonding. A trial spacer is used to confirm knee stability before placing the final polyethylene insert. All cement debris is meticulously removed to prevent future wear and implant failure. Throughout the procedure, surgeons take extra care to protect the extensor mechanism and prevent complications like patellar tendon injury. By ensuring proper soft-tissue balancing, precise bones cuts, and secure cementation, the surgery results in a stable, durable implant and improved knee function for the patient.

Figure B: Showing Final implants fixation in TKA

Post- Op care

Postoperatively, the patient's knee was immobilized using a Jones compressive bandage and a long knee immobilizer. Routine IV antibiotics were administered, and DVT prophylaxis was initiated with subcutaneous low molecular weight heparin. On the first post-operative day, patients were advised to perform static quadriceps exercises. On the second post-operative day, the wound was inspected after dressing debulking, and patients were encouraged to walk full weight-bearing within their pain tolerance while using the knee immobilizer, continuing static quadriceps exercises

Figure C: Showing Reference patient's Pre operative (a) and immediate Post operative X-ray (b).

By the fourth post-operative day, knee flexion and dynamic quadriceps exercises were introduced. IV antibiotics were continued until the fifth post-operative day, after which they were switched to oral antibiotics for an additional five days. On the twelfth post-operative day, sutures were removed, and patients were advised to continue regular physiotherapy along with full weight-bearing exercises to promote recovery and optimize knee function.

5. Follow Up

Functional recovery was evaluated using the KOOS and Visual Analogue Score (VAS) postoperatively. Complications such as infection, DVT, wound healing issues, blood transfusions, and mortality were recorded. Clinical and functional outcomes, along with joint alignment, prosthetic positioning, and complications, were assessed at 1, 6, and 9 months

Figure D: Showing (a) post operative 1 month; (b) 6 months; (c) 9 months X-rays respectively

6. Results

This study evaluated the clinical and functional outcomes of total knee arthroplasty (TKA) in 20 patients with advanced osteoarthritis (OA) using preoperative and postoperative assessments. The key parameters analyzed were pain relief using the Visual Analogue Scale (VAS), functional improvement using the Knee injury and Osteoarthritis Outcome Score (KOOS), and postoperative complications.

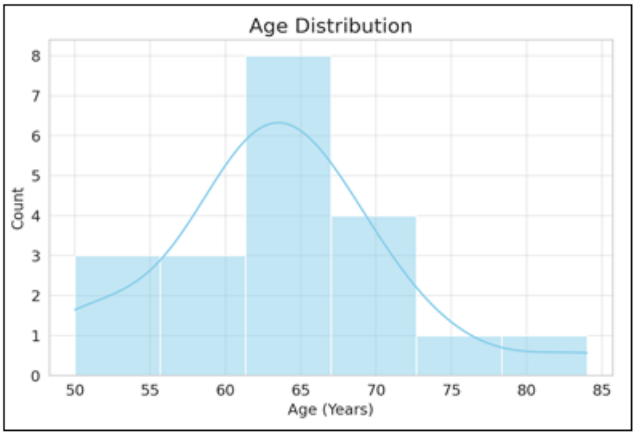

Figure 1: A bar graph displaying the number of patients in different age groups.

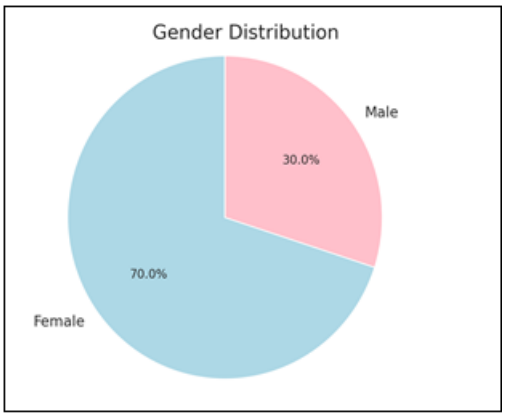

Figure 2: Graph displaying the gender distribution

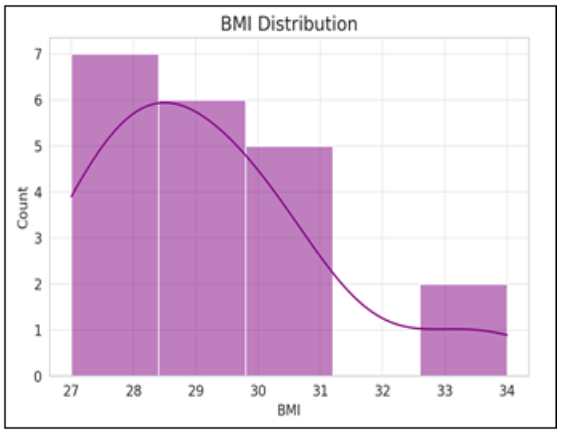

Figure 3: Graph displaying the BMI (Body Mass Index) distribution

The study included 20 patients (7 males, 13 females) aged between 50 to 84 years (in Fig.1&2). The mean BMI of the cohort was 28.9 kg/m² (in Fig.3) indicating a predominance of overweight patients. All patients had Grade 4 OA, and the most common comorbidities were hypertension (HTN) and diabetes mellitus (DM)

Functional Improvement (KOOS Score)

The KOOS score, which evaluates pain, function, and quality of life, showed significant improvement. The mean preoperative KOOS score was 18.7%, while the postoperative score increased to 91.2% (in Fig. 4), indicating substantial enhancement in knee functionand daily activity performance.

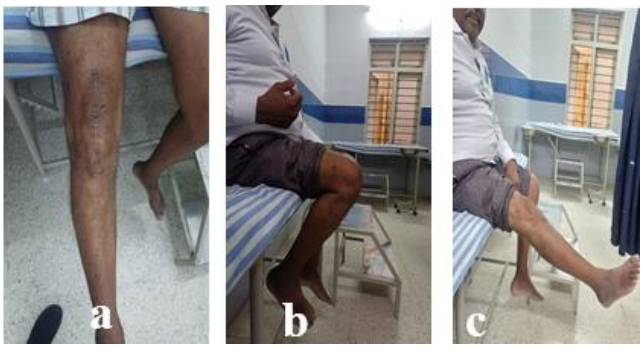

Figure E: Showing (a) post operative 1 month healed surgical scar; (b) flexion of knee; (c) extension of knee respectively

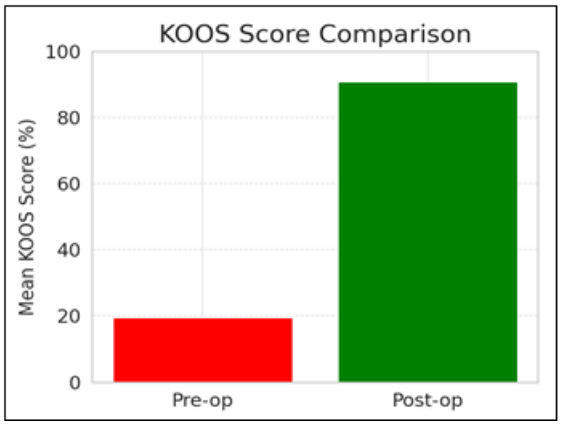

Figure 4: A bar graph demonstrating KOOS score improvement.

Pain Relief (VAS Score)

The VAS score, which measures pain on a scale of 0 (no pain) to 10 (severe pain), showed a significant reduction postoperatively. The mean preoperative VAS score was 8.4, while the postoperative mean was 1.4 (in Fig. 5), indicating substantial pain relief

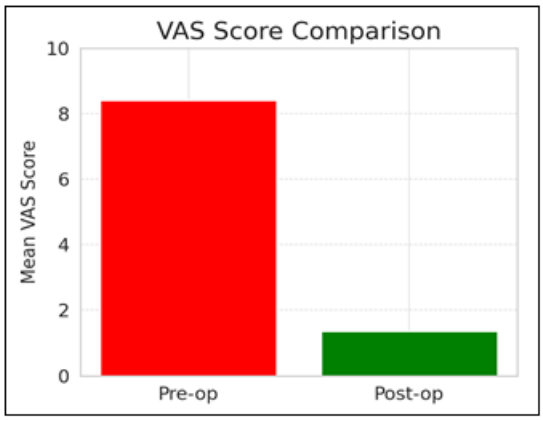

Figure 5: A bar graph comparing mean pre-op and post-op Pain Score

Complications in Unilateral vs. Bilateral TKA

Postoperative complications were recorded in four patients (20%), including two cases of superficial wound infection and one case each of deep infection and delayed healing (in Fig. 7).

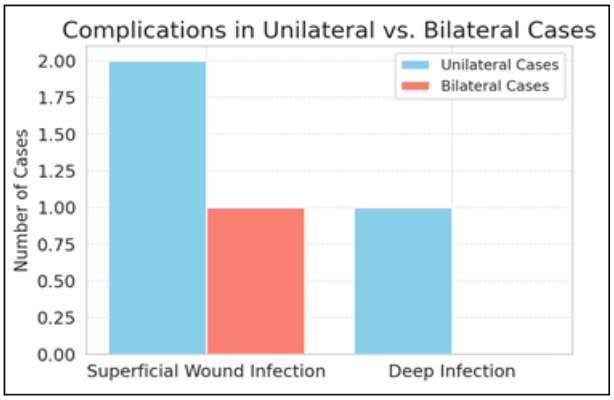

Figure 7: Graph comparing complications in unilateral and bilateral surgeries.

Superficial wound infection: 2 cases (1 unilateral, 1 bilateral)

- Deep infection requiring intervention: 1 case (unilateral)
- Delayed wound healing: 1 case (bilateral)

Overall Surgical Outcome

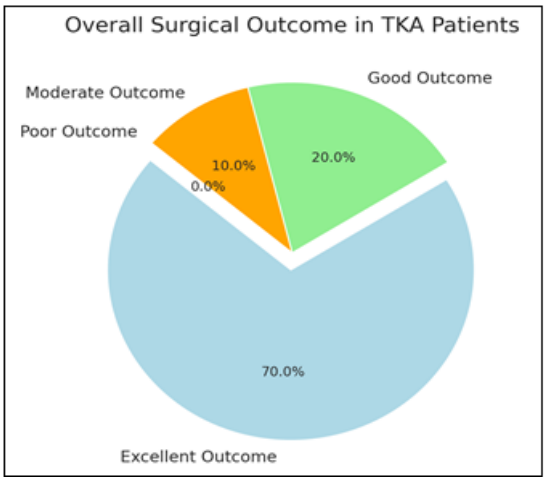

Figure 6: A pie chart representing the percentage of patients with good, moderate, and poor outcomes.

A majority of patients experienced excellent functional recovery, with successful weight-bearing by day 2 postoperatively and progressive rehabilitation (in Fig. 6). No cases of implant failure, thromboembolism, or mortality were reported.

7. Discussion

Total Knee Arthroplasty (TKA) has proven to be a highly effective surgical intervention for advanced knee osteoarthritis (OA), significantly improving patients 'pain levels and functional mobility. This study aimed to evaluate the short-term clinical and functional outcomes of TKA in 20 patients using the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Visual Analogue Score (VAS). The results demonstrate substantial improvements in pain relief, functional recovery, and overall patient satisfaction.

Clinical and Functional Outcomes

The KOOS score improved significantly from a preoperative mean of 18.7% to 91.2% postoperatively, demonstrating substantial restoration of knee function. Similarly, the VAS score decreased from 8.4 to 1.4, confirming effective pain relief. These findings highlight the positive impact of TKA on quality of life and daily activities in patients with severe OA. [8, 9]

Our results align with Bourne et al. [10], who reported that over 85% of patients experience significant pain relief and functional improvement within the first year post-surgery. Additionally, a meta-analysis by Si et al. [11] confirmed that TKA leads to consistent pain reduction and enhanced joint mobility, with functional scores improving significantly within six months.

Gender and Age Influence on Outcomes

In this study, 65% of participants were female, consistent with reports that OA is more prevalent in women [12, 13]. Postmenopausal hormonal changes may contribute to increased susceptibility [14]. While no significant gender differences were observed in KOOS and VAS scores, some studies suggest women may experience slightly higher postoperative pain but comparable functional recovery [15].

Age also plays a role in outcomes. With a mean age of 64 years, our findings align with research indicating older patients may take longer to regain function due to reduced muscle strength and comorbidities [16]. However, consistent improvement across age groups suggests that age alone should not be a contraindication for TKA when patients are medically optimized.

Influence of BMI on Outcomes

With an average BMI of 28.9 kg/m², our study reflects the well-established link between obesity and knee OA. Higher BMI has been associated with increased perioperative risks, delayed recovery, and implant loosening [17, 18]. However, our results showed no direct correlation between BMI and functional recovery, as all patients exhibited significant KOOS and VAS score improvements. This aligns with findings by Sloan et al. [19], suggesting that while obesity may present surgical challenges, it does not necessarily impede post-TKA functional outcomes.

Postoperative Complications

Our study observed a 20% complication rate, including two cases of superficial wound infection, one deep infection, and one instance of delayed wound healing. These results align with previous studies reporting TKA infection rates between 1% and 3% [20, 21]. Deep infections pose a significant risk, often requiring aggressive management. In our study, the affected patient required prolonged antibiotics and debridement but avoided implant removal. Complication rates were slightly higher in bilateral TKA cases, consistent with research indicating increased wound healing challenges and infection risks in simultaneous bilateral procedures [22, 23]. Despite this, functional recovery remained comparable between unilateral and bilateral cases, supporting bilateral TKA as a viable option for well-selected patients.

Comparison with Other Studies

Our findings align with global literature on TKA outcomes. A systematic review by Price et al. [24] reported significant

pain relief and functional improvement within six months, consistent with our results. Similarly, Scott et al. [25] found that over 90% of patients experience long-term satisfaction post-TKA. Early mobilization, a key component of our study, has been shown to enhance recovery and reduce complications such as deep vein thrombosis [26]. Our rehabilitation approach, initiating weight-bearing exercises from postoperative day two, aligns with ERAS protocols that emphasize early recovery strategies [27].

8. Study Limitations

This study's limitations include a small sample size (20 patients) and a follow-up period limited to nine months, restricting the assessment of long-term implant longevity and complications. Additionally, factors such as psychological well-being and socioeconomic status, which may influence recovery, were not analyzed. Future research with larger cohorts and extended follow-up is recommended to further validate these findings.

9. Conclusion

Total Knee Arthroplasty (TKA) significantly improves pain relief, functional mobility, and overall quality of life in patients with advanced knee osteoarthritis. Our study demonstrated substantial improvements in KOOS and VAS scores postoperatively, with most patients achieving excellent functional recovery. While minor complications were observed, they were effectively managed, and no major adverse events such as thromboembolism or implant failure occurred.

The findings reinforce the effectiveness of TKA as a definitive treatment for end-stage knee OA, particularly when combined with early rehabilitation protocols. Future research should focus on long-term follow-up to assess implant durability, patient-reported satisfaction, and the impact of emerging surgical techniques such as robotic-assisted TKA.

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