

Original Research Article

Functional outcome assessment of total knee arthroplasty using the knee society score: a prospective single-centre study from a tertiary care hospital in Lucknow, Uttar Pradesh

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ABSTRACT

Background: Knee osteoarthritis (OA) is a leading cause of chronic pain and functional disability, disproportionately affecting elderly individuals in low- and middle-income countries. Total knee arthroplasty (TKA) is the definitive treatment for end-stage disease, yet outcome data from tertiary care hospitals in Uttar Pradesh using validated scoring tools remain limited. Objectives were to assess the preoperative and postoperative functional outcomes of patients undergoing primary TKA using the Knee Society Score (KSS), and to examine associations between functional outcome and patient-level demographic variables.

Methods: A hospital-based prospective observational study was conducted in the Department of Orthopaedic Surgery, Balrampur Hospital, Lucknow, from September 2024 to August 2025. Sixty-five consecutive patients with primary knee OA undergoing primary TKA were enrolled. Patients with inflammatory or post-traumatic arthritis, revision surgery, active infection, or neuromuscular disorders were excluded. Functional outcome was assessed using the two-component KSS (Knee score and functional score) preoperatively and at 12-month follow-up. Preoperative-postoperative comparison was performed using paired t-test; associations between functional outcome category and demographic variables were assessed using the chi-square test ($p < 0.05$ considered significant).

Results: Mean patient age was in the sixth decade, with female predominance (63.1%). The mean Knee Score improved from 41.6 ± 8.9 preoperatively to 86.9 ± 6.7 at 12 months (mean difference 45.3; $p < 0.001$), and the mean functional score from 38.2 ± 9.4 to 82.4 ± 7.9 (mean difference 44.2; $p < 0.001$). Excellent outcomes were achieved in 73.8% of patients and good outcomes in 18.5%, yielding a combined excellent-to-good rate of 92.3%. Patients aged ≥ 60 years demonstrated significantly better functional outcomes than younger patients ($p = 0.024$). Gender and body mass index did not independently influence postoperative functional scores. No cases of deep infection or revision surgery were recorded during follow-up.

Conclusions: Primary TKA produces significant, sustained improvement in knee function and mobility at one year, achieving excellent-to-good outcomes in over 90% of patients. The KSS is a reliable and responsive instrument for routine outcome audit. Appropriate patient selection, structured rehabilitation, and targeted expectation management—particularly in younger patients—are key determinants of optimised postoperative results.

Keywords: Total knee arthroplasty, Knee society score, Functional outcome, Knee osteoarthritis, Tertiary care hospital, Patient-reported outcomes, Prospective study

INTRODUCTION

Osteoarthritis (OA) of the knee is one of the most prevalent degenerative joint disorders worldwide and a leading cause of chronic pain, functional limitation, and disability-adjusted life-year loss across all age groups.¹ The Global Burden of Disease Study 2021 demonstrated a substantial increase in the prevalence and burden of knee OA over the past three decades, with disproportionate impact in low- and middle-income countries.¹ In India, demographic transition, increasing life expectancy, rising obesity prevalence, sedentary occupational patterns, and delayed health-seeking behaviour collectively accelerate disease progression and late clinical presentation.²

Community-based and hospital-based Indian studies report a high prevalence of knee OA, particularly among elderly women and individuals engaged in physically demanding occupations.³ Patients frequently present at advanced stages with severe pain, fixed deformity, and markedly restricted mobility, by which time surgical intervention is the only viable option. In this context, knee OA represents a major contributor to loss of independence, reduced quality of life, and escalating healthcare utilisation in tertiary care settings across North India.

Total knee arthroplasty (TKA) is universally accepted as the definitive surgical intervention for end-stage knee OA when conservative management fails.⁴ Improvements in implant design, surgical technique, anaesthesia, and perioperative rehabilitation over the past three decades have collectively enhanced postoperative outcomes and implant survivorship.⁵ The annual global volume of TKA continues to rise; projected United States data indicate primary joint arthroplasty volumes will exceed 1.26 million procedures annually by 2030.⁵ In India, the growing availability of joint replacement services in tertiary hospitals has led to a parallel increase in TKA volume, particularly in metropolitan and urban centres.

Standardised outcome assessment is a cornerstone of surgical audit and quality improvement. Validated scoring instruments enable comparison of results across surgeons, institutions, and studies; guide patient counselling and expectation management; and identify modifiable determinants of recovery.⁶ In the Indian context, where patient expectations, functional demands, and rehabilitation compliance may differ from Western populations, standardised outcome measurement is particularly important.

The KSS, originally introduced by Ewald in 1989, is one of the most widely adopted clinician-based tools for evaluating TKA outcomes, assessing pain, stability, range of motion, walking distance, and stair-climbing ability.⁷ A revised KSS was introduced in 2011 by Scuderi et al separating objective knee assessment from patient-reported satisfaction, expectations, and functional activity domains, thereby offering a more comprehensive outcome evaluation aligned with contemporary PROMs-based

practice.⁸ Validation studies confirm the revised KSS demonstrates good reliability, construct validity, and responsiveness to clinical change following TKA.⁹

Despite an increasing volume of TKA procedures in northern India, published functional outcome data from tertiary care hospitals in Uttar Pradesh remain limited. Single-centre studies are particularly valuable as they provide institution-specific benchmarks, reflect real-world surgical and rehabilitation practice, and enable internal audit against national and international standards.

The present prospective single-centre study was therefore designed to assess pre- and postoperative functional outcomes of patients undergoing primary TKA using the KSS at Balrampur Hospital, Lucknow. Secondary objectives were to determine the distribution of outcome categories, and to examine the association of functional outcome with patient age, sex, and body mass index.

METHODS

Study design and setting

This was a hospital-based, prospective, observational study conducted in the Department of Orthopaedic Surgery at Balrampur Hospital, a tertiary care teaching institution in Golaganj, Lucknow, Uttar Pradesh, India. The hospital serves a large urban and rural catchment area and performs a high volume of joint replacement procedures. The study was conducted from September 2024 to August 2025. Institutional ethics committee approval was obtained prior to commencement (IEC Ref. No. 18|18{-1}|HB|2023), and the study adhered to the ethical principles of the declaration of Helsinki (revised 2013). Written informed consent was obtained from all participants before enrolment.

Participants

All patients diagnosed with primary knee OA and scheduled for primary unilateral or bilateral TKA during the study period were considered for inclusion. Eligibility required age ≥ 40 years, confirmed primary OA on clinical and radiological grounds, willingness to participate with written consent, and ability to comply with the postoperative follow-up schedule. Patients were excluded if they had: revision TKA; inflammatory arthritis (e.g., rheumatoid arthritis); post-traumatic arthritis; active or prior knee joint infection; severe neuromuscular disorder affecting lower-limb function; or failure to complete postoperative functional assessment at 12 months.

Sixty-five consecutive eligible patients were enrolled using a convenience sampling strategy. Sample size was determined by the volume of eligible patients presenting during the study window and is consistent with comparable single-centre prospective outcome studies reported in the literature.

Preoperative evaluation

All patients underwent standardised preoperative assessment comprising: demographic data (age, sex); anthropometric measurements (height, weight, body mass index [BMI]); clinical evaluation of the affected knee including pain, deformity, stability, and range of motion; weight-bearing anteroposterior and lateral radiographs of the knee; and baseline KSS assessment. Routine pre-anaesthetic and haematological investigations were performed per institutional protocol.

Surgical technique

All procedures were performed by experienced orthopaedic surgeons using a standardised medial parapatellar approach. Cemented posterior-stabilised (PS) or cruciate-substituting prostheses were selected based on surgeon preference and intraoperative findings. Intraoperative protocols were uniform and included pneumatic tourniquet application, prophylactic intravenous antibiotics administered 30–60 minutes before skin incision, standardised bone cuts, meticulous soft-tissue balancing, component alignment optimisation, haemostasis, and layered wound closure.

Postoperative management and rehabilitation

Postoperative care included: continuation of intravenous antibiotics for 24–48 hours; pharmacological thromboprophylaxis per institutional protocol; multimodal analgesia; and early mobilisation with weight-bearing as tolerated from the first postoperative day. A structured physiotherapy programme was initiated on day one, encompassing range-of-motion exercises, quadriceps strengthening, and gait training. Follow-up assessments were conducted at 6 weeks, 3 months, 6 months, and 12 months postoperatively.

Outcome assessment

The primary outcome measure was the KSS, comprising two independently scored components: (i) the Knee score (0–100), evaluating pain, stability, and range of motion; and (ii) the Functional score (0–100), evaluating walking distance and stair-climbing ability. Higher scores indicate better outcomes. Postoperative outcome was categorised as excellent (KSS ≥ 80), good (70–79), fair (60–69), or poor (< 60). KSS was recorded preoperatively and at each follow-up visit, with 12-month data serving as the final outcome assessment. Complications-including wound events, infection, and revision surgery-were documented throughout the follow-up period.

Statistical analysis

Data were entered into Microsoft excel 2019 and analysed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean $\pm$ standard

deviation (SD). Categorical variables are presented as frequencies and percentages. Normality of distribution was confirmed by the Shapiro-Wilk test. Preoperative and 12-month postoperative KSS components were compared using the paired-samples t test. The association between postoperative outcome category and demographic variables (age, sex, BMI) was assessed using the chi-square test. All tests were two-tailed; a $p < 0.05$ was considered statistically significant.

RESULTS

Sixty-five patients with radiologically and clinically confirmed primary knee OA were enrolled. Baseline demographic and anthropometric characteristics are presented in Table 1. The majority of patients were aged ≥ 60 years (62.1%), female (63.1%), and overweight or obese (70.8%), consistent with well-characterised epidemiological risk factors for advanced knee OA. Bilateral TKA was performed in 21 patients (32.3%).

Preoperative KSS values confirmed substantial functional impairment and pain burden at baseline, consistent with end-stage OA (Table 2).

At 12-month follow-up, both KSS components demonstrated marked and clinically meaningful improvement, as shown in Table 3.

Paired t test analysis confirmed statistically highly significant improvement in both KSS components following TKA (Table 4). The mean Knee Score increased by 45.3 points and the mean functional score by 44.2 points (both $p < 0.001$).

The distribution of postoperative functional outcome categories is shown in Table 5. Excellent outcomes were achieved in 73.8% of patients; combining excellent and good outcomes yielded an overall success rate of the 92.3%.

The association between patient age and postoperative functional outcome category is presented in Table 6. Patients aged ≥ 60 years demonstrated significantly better outcomes compared to younger patients ($\chi^2 = 5.12$; $p = 0.024$).

No statistically significant association was observed between postoperative outcome category and sex ($p > 0.05$) or BMI category ($p > 0.05$).

The complication profile was favourable. No intraoperative complications were recorded. Superficial wound complications occurred in three patients (4.6%), all resolving with conservative management.

No cases of deep periprosthetic infection, aseptic loosening, or revision surgery were documented during the 12-month follow-up period.

Table 1: Baseline demographic and anthropometric characteristics of study participants, (n=65).

Variables	Category	N	Percentages (%)
Age (in years)	40-49	6	9.2
	50-59	18	27.7
	60-69	27	41.5
	≥70	14	21.6
Sex	Male	24	36.9
	Female	41	63.1
Body mass index (kg/m ²)	Normal (<25)	19	29.2
	Overweight (25-29.9)	31	47.7
	Obese (≥30)	15	23.1
Laterality of surgery	Unilateral TKA	44	67.7
	Bilateral TKA	21	32.3

Table 2: Preoperative KSS components at baseline, (n=65).

KSS components	Mean±SD	Minimum	Maximum
Knee score (0-100)	41.6±8.9	26	58
Functional score (0-100)	38.2±9.4	22	56

Table 3: KSS components at 12-month postoperative follow-up, (n=65).

KSS components	Mean±SD	Minimum	Maximum
Knee score (0-100)	86.9±6.7	70	96
Functional score (0-100)	82.4±7.9	65	95

Table 4: Comparison of preoperative and 12-month postoperative KSS (paired analysis, n=65).

KSS components	Preoperative	Postoperative	Mean difference	P value
Knee score	41.6±8.9	86.9±6.7	45.3	<0.001
Functional score	38.2±9.4	82.4±7.9	44.2	<0.001

*Statistical test: paired-samples t-test

Table 5: Distribution of postoperative functional outcome categories based on KSS at 12 months, (n=65).

Outcome category	Criterion (KSS)	N	Percentages (%)
Excellent	≥80	48	73.8
Good	70-79	12	18.5
Fair	60-69	4	6.2
Poor	<60	1	1.5
Total		65	100.0

Table 6: Association between age group and postoperative functional outcome, (n=65).

Age group (in years)	Excellent/good, N (%)	Fair/poor, N (%)	Total	χ ² value	P value
<60	20 (83.3)	4 (16.7)	24	5.12	0.024
≥60	40 (97.6)	1 (2.4)	41		
Total	60	5	65		

*Statistical test: chi-square test

DISCUSSION

This prospective single-centre study evaluated functional outcomes following primary TKA at a tertiary care hospital in Lucknow using the KSS and demonstrated statistically significant and the clinically meaningful improvement in both the knee and functional score

components at 12-month follow-up. An overall excellent-to-good outcome rate of 92.3% was achieved, with a low complication burden. These findings are consistent with contemporary Indian and international literature and affirm that standardised surgical technique and structured rehabilitation can deliver outcomes comparable to global benchmarks within a public tertiary care setting in North India.

Functional improvement following TKA

The mean knee score improved from 41.6 ± 8.9 to 86.9 ± 6.7 (mean gain 45.3 points) and the functional score from 38.2 ± 9.4 to 82.4 ± 7.9 (mean gain 44.2 points), both with $p < 0.001$. These gains are consistent with published Indian data. Shukla et al reported a comparable improvement in mean KSS from 42.1 preoperatively to 85.6 at one year following TKA in an Indian cohort.¹⁰ Chaudhary et al similarly observed significant postoperative improvement in KSS, with the majority of patients achieving excellent or good outcomes.¹² Internationally, Scuderi et al in the validation study of the revised KSS system, documented substantial postoperative gains across all domains, reinforcing both the responsiveness of the KSS and the effectiveness of TKA as an intervention.⁸

From a biomechanical perspective, the magnitude of functional improvement reflects the combined effect of pain elimination through resurfacing of damaged articular cartilage, restoration of mechanical alignment, and improved joint kinematics afforded by posterior-stabilised implant design. The use of cemented fixation in all cases provides the long-term stability required for durable functional gain, as supported by survivorship data extending beyond two decades in multiple registry-based studies.⁴

Distribution of functional outcome categories

Excellent outcomes were achieved in 73.8% and good outcomes in 18.5% of patients, yielding a combined excellent-to-good rate of 92.3%. This closely mirrors results from comparable Indian studies-Hossain et al reported an excellent-to-good outcome rate of approximately 90% using KSS, and Shukla et al documented a similar distribution.^{10,11} Global series from high-income settings report comparable or marginally higher success rates; Carr et al noted that more than 90% of TKA recipients experience substantial improvement in pain and function.⁴ The concordance between our institutional results and international benchmarks suggests that protocol-driven surgical care in an Indian public tertiary hospital can achieve outcomes on par with established global standards.

Influence of age on functional outcome

A statistically significant association was observed between age group and functional outcome: patients aged ≥ 60 years demonstrated superior postoperative results compared to younger patients ($p = 0.024$). Noble et al have proposed that older patients tend to report higher satisfaction after TKA, attributable in part to more calibrated preoperative expectations and greater relative improvement from a lower functional baseline.⁶ Indian studies by Pal et al and Singh et al have reinforced this observation, noting that elderly patients perceive proportionally greater benefit following joint replacement despite advanced disease severity at presentation.^{2,3}

Younger patients, by contrast, typically impose higher functional demands on the prosthetic joint and may benchmark recovery against pre-morbid high-activity levels, contributing to comparatively lower satisfaction scores despite objectively equivalent or superior articular function. This finding has direct clinical implications for preoperative counselling: realistic expectation management is particularly critical in patients below 60 years of age.

Effect of sex and body mass index

Female patients constituted 63.1% of the study population, consistent with the known female preponderance of knee OA in Indian epidemiological data.³ Postoperative functional scores did not differ significantly between sexes, mirroring findings by Chaudhary et al and Dinjens et al who reported no independent gender effect on KSS outcomes when standardised surgical and rehabilitation protocols are applied.^{9,12} Obesity was prevalent (23.1% of patients classified as obese), and a negative-though statistically non-significant-trend between BMI and postoperative functional score was noted. This aligns with data from Sloan et al who demonstrated that despite potential elevation of perioperative risk, functional gains after TKA remain substantial across BMI categories.⁵

Complications and safety profile

The complication profile in this series was favourable: superficial wound complications occurred in 4.6% of patients and resolved with conservative management; no cases of deep periprosthetic infection, aseptic loosening, or revision surgery were recorded during the 12-month follow-up. This complication burden is comparable to Indian series reported by Shukla et al and international data collated by Carr et al and affirms the safety of TKA performed under standardised protocols in a controlled tertiary care environment.^{4,10} Patient-reported satisfaction data were not formally captured in this study; however, the high prevalence of excellent-to-good KSS outcomes serves as a proxy indicator of satisfaction, consistent with observations by Bourne et al who demonstrated strong concordance between objective KSS results and patient satisfaction following TKA.¹³

Limitations

Several limitations must be acknowledged. First, the prospective single-centre design limits generalisability; the patient population, surgical volume, and implant selection at Balrampur Hospital may not be representative of all tertiary care settings in Uttar Pradesh. Second, the 12-month follow-up period precludes assessment of long-term implant survivorship, late mechanical complications, and outcome trajectory beyond the first year, which are critical for evaluating prosthetic durability. Third, formal sample size calculation was not performed; the study enrolled all eligible patients presenting during the study window. Fourth, the study employed the original two-

component KSS rather than the 2011 revised KSS, which incorporates patient-reported satisfaction and expectations—a recognised limitation in contemporary outcome literature. Fifth, quality-of-life measures (e. g., SF-36 or EQ-5D) and patient satisfaction instruments were not administered alongside the KSS, limiting the breadth of outcome characterisation. Future multi-centre studies with a minimum five-year follow-up, formal sample size planning, revised KSS, and supplementary PROMs would substantially strengthen this evidence base.

CONCLUSION

Primary total knee arthroplasty produces significant, clinically meaningful improvement in both knee-specific and functional outcomes at 12-month follow-up in patients with end-stage knee OA. In this prospective single-centre study, KSS-measured outcomes improved by approximately 45 points in each component, with 92.3% of patients achieving excellent or good results. Age ≥ 60 years was a significant positive predictor of functional outcome, reinforcing the importance of appropriate patient selection and structured preoperative expectation management—particularly for younger patients. Sex and body mass index did not independently influence postoperative results. A low complication rate supports the safety of TKA within a standardised tertiary care protocol. The KSS remains a reliable and responsive instrument for institutional outcome audit. These findings provide institution-specific evidence supporting the continued application of evidence-based surgical and rehabilitation protocols to achieve outcomes comparable with national and international benchmarks in an Indian public hospital setting.

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