



Original Research Article

Short-Term Functional Outcomes of Total Knee Arthroplasty in Patients with Obesity: A Prospective Cohort Study

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ABSTRACT

Background: Total knee arthroplasty (TKA) is a definitive treatment for end-stage knee osteoarthritis. Obesity is a prevalent comorbidity that may influence postoperative recovery. This study aims to compare short-term (6-week) functional outcomes and complication rates between obese and non-obese patients undergoing primary TKA.

Methods: A prospective cohort study was conducted with 40 patients undergoing unilateral primary TKA. Patients were stratified into two groups based on body mass index (BMI): Obese (BMI ≥ 30 kg/m², n=20) and Non-Obese (BMI < 30 kg/m², n=20). Functional outcomes were assessed using the Knee Society Score (KSS), which includes a Knee Score (objective measures) and a Function Score (subjective activity), and range of motion (ROM) preoperatively and at 6 weeks postoperatively. Complication rates and length of hospital stay (LOS) were also recorded.

Results: Both groups demonstrated significant improvement in KSS and ROM from baseline to 6 weeks ($p < 0.001$ for all). However, the improvement was less pronounced in the obese group. The mean 6-week KSS Function Score was significantly lower in the obese group (68.2 ± 8.1) compared to the non-obese group (78.5 ± 6.3) ($p = 0.02$). The obese group also had a smaller mean gain in active ROM (28.5° vs. 35.2° , $p = 0.04$). The rate of minor complications (superficial wound erythema, prolonged drainage) was higher in the obese cohort (25% vs. 5%, $p = 0.08$), and the mean LOS was longer (3.8 ± 0.9 days vs. 2.9 ± 0.7 days, $p = 0.01$).

Conclusion: While TKA provides significant functional benefit to patients with obesity within 6 weeks, their short-term functional gains and activity levels are inferior to those of non-obese patients. Obesity is associated with a longer hospital stay and a trend towards higher minor complication rates. These findings underscore the need for tailored preoperative counseling and optimized perioperative management for obese TKA patients.

Keywords: Total Knee Arthroplasty, Obesity, Functional Outcomes, Short-Term, Complications, Body Mass Index.

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INTRODUCTION

Total knee arthroplasty (TKA) stands as a pinnacle of modern orthopaedic success, representing the definitive surgical solution for end-stage knee osteoarthritis (OA).¹ By reliably abolishing debilitating pain and restoring functional mobility, TKA significantly enhances quality of life and remains one of the most cost-effective and clinically successful interventions in all of medicine.^{2,3} Its utilization continues to rise in parallel with an aging global population and the increasing prevalence of degenerative joint disease.⁴ However, this expanding demand intersects with another profound public health crisis: the global obesity epidemic. Obesity, defined by a body mass index (BMI) ≥ 30 kg/m², is a dominant, modifiable risk factor for the development and rapid progression of knee OA, driven by a deleterious combination of chronic excessive mechanical load and a state of systemic, metabolically-driven inflammation.^{5,6} Consequently,

orthopaedic surgeons are now performing TKA on an increasingly obese patient demographic, necessitating a nuanced understanding of how this comorbidity influences the entire surgical journey, particularly its earliest phase.⁷

The clinical dialogue surrounding obesity and TKA has historically been dominated by concerns over long-term implant survivorship and the risk of catastrophic complications, such as periprosthetic joint infection and aseptic loosening.⁸ While recent meta-analyses suggest that modern surgical techniques and implant designs have mitigated some of the long-term survivorship disparities, a critical knowledge gap persists regarding the immediate postoperative recovery landscape.⁹ The short-term period—conventionally defined as the first six weeks post-surgery—constitutes a vulnerable and pivotal window.¹⁰ It is during this time that patients navigate acute postoperative pain, engage in foundational physiotherapy, and strive to achieve basic functional milestones necessary for safe, independent living. Their success in this initial phase is a powerful determinant of overall satisfaction, sustained engagement in rehabilitation, and the trajectory of their longer-term functional outcome.¹¹

Physiologically, obesity imposes a formidable burden on this early recovery process.¹² The technical challenges of surgery are amplified, including difficult surgical exposure, compromised visualization, and challenges in obtaining optimal implant alignment and soft-tissue balance.¹³ Beyond the operating room, the pathophysiological hallmarks of obesity—including altered vascular perfusion, increased subcutaneous adipose tissue tension, and a pro-inflammatory state—directly heighten the risk of wound healing complications, such as delayed closure, superficial surgical site infections, and prolonged serous drainage.¹⁴ Furthermore, the increased metabolic demand and cardiopulmonary strain associated with obesity can impede early mobilization, while potential neuro-muscular inhibition and higher perceived pain levels may slow progress in physiotherapy, particularly in regaining critical knee range of motion and strength.¹⁵

Despite these well-understood physiological hurdles, prospective, comparative data focusing exclusively on the short-term functional convalescence of obese TKA patients remain limited.¹⁶ Much of the existing literature either amalgamates short- and mid-term outcomes or prioritizes long-term endpoints, thereby potentially diluting the identification of specific early-stage challenges.¹⁷ A detailed, prospective analysis of this initial six-week period is therefore essential. It moves beyond the question of whether TKA works in obese patients—it is established that it does—to address the more nuanced question of how their recovery differs in pace, pattern, and potential pitfalls.¹⁸

This study was therefore designed to conduct a focused, prospective comparison of short-term functional outcomes between obese and non-obese patients undergoing primary, unilateral TKA. By employing validated functional scoring systems and objective physical measures at a standardized 6-week postoperative point, we aim to rigorously quantify disparities in early recovery.

MATERIALS AND METHODS

Study design, setting & population

A prospective comparative cohort study was conducted. Patients were allocated into two cohorts based on their preoperative Body Mass Index (BMI): an Obese group (BMI ≥ 30 kg/m²) and a Non-Obese control group (BMI < 30 kg/m²). Functional outcomes and complications were then compared between these groups at a predefined short-term endpoint of 6 weeks postoperatively. The study was carried out at the Department of Orthopaedic Surgery and Joint Replacement Centre for the period of 1 year (January 2025 to December 2025). The target population consisted of adult patients diagnosed with primary tricompartmental osteoarthritis of the knee who were scheduled to undergo elective, primary unilateral total knee arthroplasty.

Inclusion Criteria:

1. Age between 50 and 80 years.
2. Diagnosis of primary knee osteoarthritis (Kellgren-Lawrence grade 3 or 4).
3. Scheduled for primary, unilateral, cemented TKA.
4. Willing and able to provide informed consent and comply with follow-up.

Exclusion Criteria:

1. Inflammatory arthritis (e.g., rheumatoid arthritis).
2. Previous major knee surgery (e.g., osteotomy, arthrodesis) or significant trauma.
3. Active local or systemic infection.
4. Neurological or musculoskeletal disorders severely impairing ambulation or rehabilitation (e.g., stroke, Parkinson's disease).
5. Revision TKA surgery.
6. BMI < 18.5 kg/m² (underweight).

Sample Size Calculation

A formal sample size calculation was performed prior to patient recruitment. Using G*Power software (version 3.1), with an alpha error of 0.05 and a power of 80%, and based on a pilot study indicating an estimated mean difference of 10 points in the primary outcome (Knee Society Function Score) with a standard deviation of 8 points, a minimum of 17 patients per group was required. To account for potential attrition, the sample size was increased to 20 patients per group, resulting in a total sample size of **40 patients**.

Procedure for Data Collection

1. **Preoperative Phase:** Eligible patients were identified from the surgical waiting list. After informed consent, baseline data were collected, including demographics, BMI, preoperative KSS (Knee and Function scores), and preoperative active knee ROM.
2. **Perioperative Phase:** Details of the surgery, including duration and any intraoperative events, were recorded. The length of hospital stay was calculated from the day of surgery to the day of discharge.

Postoperative Follow-up: All patients were scheduled for a dedicated research follow-up visit at 6 weeks (± 3 days) post-surgery. At this visit, a blinded research physiotherapist who was not involved in the patient's routine care administered the KSS questionnaire and measured active knee ROM using a standard long-arm goniometer. Complications occurring between discharge and the 6-week visit were meticulously documented from hospital readmission records, outpatient clinic notes, and direct patient inquiry.

RESULTS

Data analysis

All data were recorded on standardized, anonymized case report forms (CRFs) identified by a unique study code. Data were subsequently entered into a password-protected electronic database (Microsoft Excel). Statistical analysis was performed using IBM SPSS Statistics (Version 26.0), with data integrity verified before final analysis.

Table 1: Baseline Demographic and Preoperative Clinical Characteristics

Characteristic	Obese Group (n=20) Mean \pm SD or n (%)	Non-Obese Group (n=20) Mean \pm SD or n (%)	p-value
Age (years)	66.5 \pm 5.2	68.1 \pm 4.8	0.32
Gender			0.52
Female	14 (70%)	12 (60%)	
Male	6 (30%)	8 (40%)	
Body Mass Index (kg/m²)	34.8 \pm 3.1	26.4 \pm 2.3	<0.001
ASA Physical Status			0.04
ASA II	8 (40%)	14 (70%)	
ASA III	12 (60%)	6 (30%)	
Preoperative KSS Knee	42.3 \pm 10.1	45.1 \pm 9.4	0.38
Preoperative KSS Function	45.5 \pm 11.2	48.2 \pm 10.5	0.43
Preoperative ROM ($^{\circ}$)	105.5 \pm 12.8	108.2 \pm 10.5	0.45
Surgical Time (minutes)	98.5 \pm 15.2	91.8 \pm 12.4	0.13

The two groups were well-matched for age, gender distribution, and preoperative functional status. The mean age was 66.5 years in the obese group and 68.1 years in the non-obese group ($p=0.32$), with a majority of female patients in both cohorts. As defined by the study design, the mean Body Mass Index (BMI) was significantly higher in the obese group ($34.8 \pm 3.1 \text{ kg/m}^2$) compared to the non-obese group ($26.4 \pm 2.3 \text{ kg/m}^2$) ($p<0.001$). Notably, a significantly larger proportion of obese patients were classified as ASA (American Society of Anesthesiologists) physical status III (60% vs. 30%, $p=0.04$), indicating a greater overall burden of systemic disease. Preoperative Knee Society Scores (KSS) for both knee-specific and function domains, as well as active range of motion (ROM), showed no statistically significant differences, confirming comparable baseline levels of disability prior to surgery.

Table 2: Postoperative Outcomes at 6 Weeks

Outcome Measure	Obese Group (n=20) Mean \pm SD or n (%)	Non-Obese Group (n=20) Mean \pm SD or n (%)	p-value
KSS Knee Score	75.4 \pm 7.8	79.8 \pm 6.5	0.06
KSS Function Score	68.2 \pm 8.1	78.5 \pm 6.3	<0.001
Absolute Active ROM ($^{\circ}$)	134.0 \pm 9.5	138.4 \pm 7.2	0.10
Gain in Active ROM ($^{\circ}$)*	28.5 \pm 10.1	35.2 \pm 8.8	0.04
Length of Hospital Stay (days)	3.8 \pm 0.9	2.9 \pm 0.7	<0.01
Achieved 90$^{\circ}$ ROM by Day 3	12 (60%)	18 (90%)	0.03

At the 6-week endpoint, both groups demonstrated marked improvement from their preoperative baselines. However, the magnitude of functional recovery differed substantially. While the postoperative KSS Knee Score showed a trend toward being lower in the obese group (75.4 vs. 79.8, $p=0.06$), the **KSS Function Score was significantly inferior** in obese patients (68.2 vs. 78.5, $p<0.001$), representing a clinically meaningful 10-point deficit in self-reported walking and stair-climbing ability. Although the final absolute ROM at 6 weeks was similar between groups, the **net gain in ROM was significantly smaller** for obese patients (28.5 $^{\circ}$ vs. 35.2 $^{\circ}$, $p=0.04$). Furthermore, significantly fewer obese patients achieved the critical rehabilitation milestone of 90 $^{\circ}$ of knee flexion by postoperative day 3 (60% vs. 90%, $p=0.03$). **Hospital resource utilization was also greater in the obese cohort, with a mean length of stay nearly one full day longer** (3.8 days vs. 2.9 days, $p<0.01$).

Table 3: Postoperative Complications within 6 Weeks

Complication Type	Obese Group (n=20) n (%)	Non-Obese Group (n=20) n (%)	p-value
Any Minor Complication	5 (25%)	1 (5%)	0.08
Prolonged Wound Drainage (>48h)	3 (15%)	1 (5%)	
Superficial Wound Erythema*	2 (10%)	0 (0%)	
Any Major Complication	0 (0%)	0 (0%)	-
Deep Infection	0 (0%)	0 (0%)	

Complication Type	Obese Group (n=20) n (%)	Non-Obese Group (n=20) n (%)	p-value
Manipulation Under Anesthesia	0 (0%)	0 (0%)	
Thromboembolic Event	0 (0%)	0 (0%)	

The safety profile in the short term revealed notable trends. The incidence of **any minor complication was 25% (5/20) in the obese group compared to 5% (1/20) in the non-obese group**, a fivefold difference that approached but did not reach statistical significance in this sample ($p=0.08$). All minor complications were related to wound healing, including prolonged drainage and superficial erythema managed with oral antibiotics. Critically, **no major complications**—such as deep periprosthetic joint infection, manipulation under anesthesia, or thromboembolic events—were recorded in either group during the 6-week observation period.

DISCUSSION

This prospective comparative cohort study provides a granular analysis of the early recovery trajectory following TKA, revealing that obesity ($BMI \geq 30 \text{ kg/m}^2$) is a significant determinant of short-term functional and clinical outcomes. The central finding—those obese patients achieved a statistically and clinically meaningful 10-point deficit in the KSS Function Score at 6 weeks—underscores a tangible delay in their ability to resume basic daily activities such as walking and stair climbing. This aligns with the physiological rationale that greater body mass imposes increased mechanical and metabolic demands on the healing limb and recovering patient. Our results are consistent with the work of Dowsey et al.¹⁹, who, in a larger cohort, reported significantly slower improvements in the Oxford Knee Score and 6-minute walk test for obese patients up to three months postoperatively. They similarly attributed this to the compounded challenges of pain, stiffness, and reduced neuromuscular efficiency in this population.

Beyond subjective function, the objective measure of mobility gain further illustrates the slower pace of recovery. The significantly smaller improvement in active ROM (28.5° vs. 35.2°) and the lower rate of achieving 90° flexion by day 3 in the obese group highlight a more challenging rehabilitation process. This impediment in early motion is clinically critical, as early ROM is a strong predictor of final flexion and patient satisfaction. Our findings corroborate those of Lozano et al.²⁰, who identified obesity as an independent risk factor for poorer early ROM and slower functional progression, noting that increased peri-articular adipose tissue may contribute to greater postoperative swelling and pain, thereby creating a biomechanical and physiological barrier to aggressive physiotherapy.

The observed increase in length of hospital stay (LOS) and the trend toward higher minor wound complication rates represent the tangible clinical and economic consequences of these recovery challenges. The prolonged LOS in our obese cohort (3.8 vs. 2.9 days) is a direct reflection of the slower achievement of discharge criteria, primarily safe ambulation and adequate pain control. This aligns with large database studies, such as that by Wagner et al.¹², which consistently identify obesity as a key driver of increased LOS and higher in-hospital costs following joint arthroplasty. While our study's sample size limited the statistical power to confirm a significantly higher complication rate, the observed fivefold increase in minor wound issues (25% vs. 5%) echoes the well-established literature linking obesity to surgical site complications due to poor vascularity of subcutaneous fat and increased tissue tension.¹⁴

Importantly, our study also offers a note of cautious optimism. No major complications, such as deep infection or thromboembolism, occurred in either group within the 6-week window. This suggests that with modern surgical protocols, standardized perioperative care (including antimicrobial and thromboprophylaxis), and vigilant monitoring, the most severe early risks can be mitigated even in obese patients. This finding supports the practice of offering TKA to obese patients while simultaneously mandating optimized, risk-aware management.

CONCLUSION

In conclusion, this study confirms that patients with obesity experience a demonstrably slower and more complicated early recovery after TKA compared to their non-obese counterparts. They exhibit inferior short-term functional gains, achieve key mobility milestones less frequently, and require a longer initial hospitalization. These findings are not a contraindication to surgery but a crucial guide for evidence-based practice. They underscore the imperative for tailored preoperative counseling to set realistic expectations, the potential benefit of preoperative optimization programs (e.g., weight management, nutritional intervention), and the implementation of enhanced recovery pathways specifically designed to address the unique challenges of wound care, pain management, and early mobilization in the obese patient. Future research should focus on evaluating targeted interventions aimed at bridging this early recovery gap for this large and growing segment of the TKA population.

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