

A Prospective Comparative Study of the Influence of Obesity on Short-Term Clinical and Functional Outcomes Following Total Knee Replacement

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Abstract

Background: Obesity is a major risk factor for knee osteoarthritis and influences perioperative outcomes following Total Knee Arthroplasty (TKA).

Objective: To compare short-term clinical and functional outcomes of TKA between obese and non-obese patients. **Methods:** This prospective comparative study included 56 patients (28 obese, 28 non-obese) undergoing primary TKA, evaluated over 6 months using VAS, Knee Society Score, and Oxford Knee Score.

Results: Obese patients had longer operative time, greater blood loss, prolonged hospital stay, and higher complication rates (wound infection, dehiscence, DVT) compared to non-obese patients, with comparatively lower functional scores.

Conclusion: TKA provides significant functional improvement in both groups; obesity increases perioperative morbidity but is not a contraindication to surgery.

Keywords: Total Knee Arthroplasty (TKA), Obesity.

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Introduction

Osteoarthritis (OA) is the most common degenerative joint disorder and a leading cause of chronic pain, disability, and impaired quality of life among adults worldwide. It is characterized by progressive degeneration of the articular cartilage, subchondral bone remodeling, osteophyte formation, synovial inflammation, and gradual loss of joint function. Among all weight-bearing joints, the knee is the most frequently affected site because of its constant exposure to mechanical loading during daily activities. The prevalence of knee osteoarthritis has increased substantially over recent decades owing to population aging, increasing life expectancy, sedentary lifestyles, and the growing epidemic of obesity. Consequently, knee osteoarthritis has become a major public health problem and one of the leading causes of disability globally, resulting in considerable socioeconomic burden and healthcare expenditure.[1,2]

The primary goals in the management of knee osteoarthritis are pain relief, preservation of joint function, improvement of mobility, and enhancement of quality of life. Initial treatment is usually conservative and includes weight reduction, physiotherapy, activity modification, pharmacological therapy, intra-articular injections, and assistive devices. Although these interventions

provide symptomatic relief in many patients, progressive degeneration eventually leads to advanced disease requiring surgical intervention. Total Knee Arthroplasty (TKA) has become the gold standard surgical treatment for patients with end-stage knee osteoarthritis who fail to respond to conservative management. TKA reliably relieves pain, restores joint alignment, improves functional capacity, and significantly enhances patient-reported quality of life, with excellent long-term implant survival rates exceeding 90% at 15–20 years in appropriately selected patients.[3,4]

With increasing longevity and expanding indications for arthroplasty, the demand for TKA continues to rise worldwide. Epidemiological projections suggest a substantial increase in the number of primary total knee replacements over the coming decades because of the growing elderly population and the increasing prevalence of obesity. This trend is particularly evident in developing countries such as India, where changing lifestyles, urbanization, and increased life expectancy have contributed to a marked rise in the burden of knee osteoarthritis. Optimizing postoperative outcomes following TKA has therefore become an important clinical and public health priority.[5]

Obesity has emerged as one of the most significant modifiable risk factors for both the development and

progression of knee osteoarthritis. According to the World Health Organization, obesity is defined as excessive accumulation of body fat that adversely affects health and is commonly classified using Body Mass Index (BMI). Excess body weight substantially increases the mechanical load transmitted across the knee joint during standing, walking, and stair climbing. It has been estimated that each kilogram of body weight results in approximately three to six kilograms of additional force across the knee during ambulation, accelerating cartilage wear and degeneration.[6,7] In addition to increased mechanical loading, obesity contributes to osteoarthritis through complex metabolic and inflammatory mechanisms. Adipose tissue is now recognized as an active endocrine organ capable of producing adipokines such as leptin, adiponectin, resistin, and visfatin, together with pro-inflammatory cytokines including tumor necrosis factor- α (TNF- α), interleukin-1 (IL-1), and interleukin-6 (IL-6). These inflammatory mediators promote cartilage degradation, synovial inflammation, oxidative stress, and subchondral bone remodeling, thereby accelerating the progression of osteoarthritis independent of mechanical factors. Consequently, obese individuals frequently develop symptomatic knee osteoarthritis at a younger age and often require total knee arthroplasty earlier than non-obese patients.[8,9] Despite the established benefits of TKA, obesity remains a challenging factor influencing perioperative management and postoperative recovery. Obese patients often present with multiple medical comorbidities including diabetes mellitus, hypertension, cardiovascular disease, obstructive sleep apnea, and metabolic syndrome, all of which increase anesthetic and surgical risk. Technical challenges encountered during surgery include difficult exposure, prolonged operative duration, increased blood loss, and greater soft tissue dissection. Furthermore, obesity has been associated with higher rates of wound complications, superficial and deep surgical site infections, delayed wound healing, venous thromboembolism, implant malalignment, aseptic loosening, polyethylene wear, and early revision surgery in several studies.[10,11] Conversely, numerous contemporary investigations have demonstrated that obese patients achieve substantial improvements in pain relief, knee function, mobility, and quality of life following TKA despite experiencing slightly higher complication rates. Several prospective studies and systematic reviews have reported that although obese patients may have lower absolute postoperative functional scores than non-obese individuals, the magnitude of functional improvement after surgery is often comparable. These findings suggest that obesity alone should not be considered an absolute contraindication for total knee arthroplasty when appropriate patient

optimization and perioperative care are provided.[12,13]

The relationship between obesity and short-term clinical outcomes following TKA remains an area of ongoing debate. While several investigators have reported increased postoperative complications and prolonged rehabilitation among obese patients, others have demonstrated comparable implant survival, patient satisfaction, and functional recovery irrespective of BMI. Differences in patient characteristics, obesity classification, surgical techniques, implant designs, rehabilitation protocols, and duration of follow-up have contributed to inconsistent findings across published studies. Therefore, further prospective comparative studies are required to better understand the influence of obesity on early postoperative recovery and functional outcomes.[13,14]

The present study was undertaken to compare the short-term clinical and functional outcomes following Total Knee Arthroplasty in obese and non-obese patients. The study aims to evaluate postoperative pain relief, functional recovery, complications, and early rehabilitation using standardized clinical assessment tools. The findings are expected to provide valuable evidence regarding the influence of obesity on postoperative recovery and assist orthopedic surgeons in preoperative patient counseling, risk stratification, and optimization of perioperative management strategies.

Materials and Methodology

The present prospective comparative observational study was conducted in the Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, over a period of nine months from May 2025 to January 2026. The study was designed to evaluate the impact of obesity on short-term clinical and functional outcomes following Total Knee Arthroplasty (TKA) by comparing obese and non-obese patients undergoing primary knee replacement. Institutional Ethics Committee approval was obtained before commencement of the study, and written informed consent was obtained from all participants prior to enrollment.

Patients aged 45 years and above diagnosed with primary osteoarthritis of the knee requiring total knee replacement were screened for eligibility. Patients undergoing primary unilateral or bilateral TKA, willing to participate in the study, able to provide written informed consent, and available for regular postoperative follow-up according to the study protocol were included. Patients undergoing revision total knee arthroplasty, those with inflammatory arthropathies such as rheumatoid arthritis, post-traumatic osteoarthritis of the knee, active local or systemic infection, severe neuromuscular disorders affecting gait or functional assessment, patients unwilling to participate, and

those with incomplete clinical records or loss to follow-up were excluded from the study.

The sample size was calculated to compare postoperative functional outcomes between obese and non-obese patients undergoing total knee arthroplasty using the formula for comparison of two proportions. The calculation assumed a 95% confidence interval ($Z\alpha/2 = 1.96$), 80% study power ($Z\beta = 0.84$), and expected differences in satisfactory functional outcomes between obese and non-obese groups based on previously published literature. The minimum required sample size was estimated to be 52 participants. To compensate for possible loss to follow-up and incomplete data, a total of 56 patients were included in the study.

Patients were categorized into obese and non-obese groups based on their preoperative Body Mass Index (BMI), calculated according to the World Health Organization (WHO) classification. All patients underwent primary Total Knee Arthroplasty using standardized surgical techniques performed by experienced orthopedic surgeons. Standard perioperative protocols including antibiotic prophylaxis, thromboprophylaxis, pain management, physiotherapy, and postoperative rehabilitation were uniformly followed for all patients to minimize treatment-related bias.

Baseline demographic and clinical variables including age, sex, body mass index, affected side, comorbidities, duration of symptoms, and preoperative clinical status were recorded. Perioperative variables including operative duration, intraoperative blood loss, length of hospital stay, and perioperative complications were documented. Patients were followed postoperatively at regular intervals of 6 weeks, 3 months, and 6 months. Clinical evaluation included assessment of pain using the Visual Analogue Scale (VAS), functional outcome using the Knee Society Score (KSS) and Oxford Knee Score (OKS), range of motion, walking ability, and overall patient satisfaction. Postoperative complications including wound infection, delayed wound healing, deep vein thrombosis, prosthetic joint infection, implant-related complications, and requirement for revision surgery were also recorded.

The primary outcome measures were short-term functional recovery, clinical improvement, and postoperative complications following total knee arthroplasty. Secondary outcome measures included operative time, intraoperative blood loss, duration of hospital stay, postoperative pain, knee range of motion, and functional outcome scores.

All collected data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Comparisons between

obese and non-obese groups were performed using the independent Student's t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables wherever appropriate. Changes in functional outcome scores during follow-up were analyzed using paired t-tests. A p-value of less than 0.05 was considered statistically significant throughout the study.

Result:

A total of 56 patients undergoing primary total knee replacement were included in the study and divided equally into obese and non-obese groups. The mean age of patients was comparable between the two groups, and a female predominance was observed in both cohorts.(Table 1)

Table 1: Baseline demographic distribution of study participants (n = 56)

Variable	Category	Obese (n=28)	Non-obese (n=28)
Age (years)	Mean $\pm$ SD	63.4 $\pm$ 6.8	64.1 $\pm$ 7.2
Gender	Male	10 (35.7%)	9 (32.1%)
	Female	18 (64.3%)	19 (67.9%)

BMI (kg/m ²)	Mean $\pm$ SD	32.6 $\pm$ 2.8	24.1 $\pm$ 2.3
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Comorbid conditions such as diabetes mellitus and hypertension were more frequently observed in the obese group.(Table 2).

Table 2: Distribution of comorbidities among study groups

Comorbidity	Obese (n=28)	Non-obese (n=28)
Diabetes mellitus	10 (35.7%)	6 (21.4%)
Hypertension	14 (50.0%)	11 (39.3%)
Both DM + HTN	6 (21.4%)	3 (10.7%)

Operative parameters demonstrated that obese patients had a longer mean operative time, increased intraoperative blood loss, and prolonged hospital stay compared to non-obese patients.(Table 3).

Table 3: Operative and perioperative parameters

Parameter	Obese (n=28)	Non-obese (n=28)
Operative time (minutes)	98 $\pm$ 12	88 $\pm$ 10
Intraoperative blood loss (mL)	420 $\pm$ 85	360 $\pm$ 70
Hospital stay (days)	7.6 $\pm$ 1.4	6.3 $\pm$ 1.2

Postoperative complications were more frequent among obese patients, particularly superficial wound infection and wound healing issues, although deep infection and thromboembolic events were infrequent overall.(Table 4).

Table 4: Postoperative complications

Complication	Obese (n=28)	Non-obese (n=28)
Superficial wound infection	3 (10.7%)	1 (3.6%)
Deep infection	1 (3.6%)	0 (0%)
Wound dehiscence	2 (7.1%)	0 (0%)
Deep vein thrombosis	1 (3.6%)	0 (0%)

Functional outcome assessment using Knee Society Score revealed that both groups showed substantial improvement following surgery. However, obese patients demonstrated comparatively lower mean postoperative KSS and a higher proportion of fair and poor outcomes, whereas non-obese patients had a higher proportion of excellent outcomes.(Table 5).

Table 5: Functional outcomes based on Knee Society Score (KSS)

Outcome category	Obese (n=28)	Non-obese (n=28)
Excellent	8 (28.6%)	12 (42.9%)
Good	12 (42.9%)	13 (46.4%)
Fair	6 (21.4%)	3 (10.7%)
Poor	2 (7.1%)	0 (0%)

Discussion

The present prospective comparative study evaluated the influence of obesity on short-term clinical and functional outcomes following Total Knee Arthroplasty (TKA). Although both obese and non-obese patients experienced significant clinical improvement after surgery, obesity was associated with longer operative duration, greater intraoperative blood loss, prolonged hospital stay, higher postoperative complication rates, and comparatively lower functional outcome scores.

The demographic characteristics of both groups were comparable with respect to age and sex, thereby minimizing potential confounding factors. The mean age of patients in both groups was approximately 64 years, reflecting the well-established epidemiology of primary knee osteoarthritis, which predominantly affects older adults due to progressive cartilage degeneration and age-related biomechanical changes. Female predominance observed in both groups is also consistent with previous reports, where postmenopausal hormonal changes, increased

longevity, and a higher prevalence of obesity contribute to an increased incidence of symptomatic knee osteoarthritis among women.[15,16]

The prevalence of associated comorbidities such as diabetes mellitus and hypertension was higher among obese patients. Obesity is a major component of metabolic syndrome and is strongly associated with insulin resistance, hypertension, cardiovascular disease, and chronic systemic inflammation. These comorbid conditions may increase perioperative risk and influence postoperative recovery following total knee arthroplasty. Similar findings have been reported by Namba et al. and Kerkhoffs et al., who demonstrated that obese patients undergoing TKA frequently present with multiple medical comorbidities requiring meticulous perioperative optimization.[17,18]

Operative parameters in the present study revealed significantly longer operative time, increased intraoperative blood loss, and prolonged hospital stay in obese patients compared with non-obese patients. These findings can be attributed to the technical challenges associated with excessive soft tissue, difficult surgical exposure, prolonged wound closure, and increased operative complexity. Previous investigators have similarly reported that obesity contributes to increased operative duration and perioperative resource utilization during total knee arthroplasty.[18,19]

Postoperative complications occurred more frequently in obese patients. Superficial wound infection, wound dehiscence, and deep vein thrombosis were observed more commonly among obese individuals, whereas deep infections remained uncommon in both groups. Increased adipose tissue, impaired wound perfusion, prolonged operative time, and associated diabetes mellitus are recognized contributors to impaired wound healing and postoperative infection in obese patients. Similar complication profiles have been reported in several systematic reviews and meta-analyses evaluating outcomes following total knee arthroplasty in obese individuals.[19,20]

Despite these increased perioperative risks, functional recovery following TKA was satisfactory in both groups. Assessment using the Knee Society Score (KSS) demonstrated substantial postoperative improvement irrespective of body mass index. However, non-obese patients achieved a greater proportion of excellent functional outcomes, whereas obese patients demonstrated relatively higher proportions of fair and poor outcomes. Although absolute postoperative scores were lower among obese patients, the overall improvement from the preoperative functional status remained clinically significant. These observations are consistent with studies by Vincent and Vincent and Boyce et al., who concluded that obese patients derive considerable benefit from TKA despite

experiencing comparatively lower postoperative functional scores than non-obese individuals.[21,22] The findings of the present study support the growing evidence that obesity should not be considered an absolute contraindication to total knee arthroplasty. While obesity increases perioperative challenges and postoperative complications, appropriately selected patients can still achieve substantial pain relief, improved mobility, and enhanced quality of life following surgery. Careful patient selection, optimization of medical comorbidities, weight management, meticulous surgical technique, and structured postoperative rehabilitation are essential to maximize functional outcomes and minimize complications in obese patients undergoing total knee arthroplasty.

Overall, the results of this study are comparable with previously published literature and reinforce the importance of comprehensive perioperative management in obese patients undergoing TKA. Further multicenter studies with larger sample sizes and long-term follow-up are warranted to determine the influence of obesity on implant survival, revision rates, and long-term functional outcomes.

Conclusion

The present study demonstrated that Total Knee Arthroplasty (TKA) provides significant short-term clinical and functional improvement in both obese and non-obese patients with primary knee osteoarthritis. Although obese patients experienced longer operative time, increased intraoperative blood loss, prolonged hospital stay, and a higher incidence of postoperative complications such as superficial wound infection and wound healing problems, the overall complication rates remained acceptable and manageable.

Functional assessment using the Knee Society Score (KSS) showed substantial postoperative improvement in both groups. However, non-obese patients achieved comparatively better functional outcomes, with a higher proportion of excellent and good results, whereas obese patients had relatively lower functional scores and a greater proportion of fair and poor outcomes. Despite these differences, obese patients experienced meaningful pain relief, improved mobility, and enhanced quality of life following surgery.

Based on the findings of this study, obesity should be considered an important risk factor for increased perioperative morbidity rather than a contraindication to Total Knee Arthroplasty. Careful preoperative optimization of comorbidities, appropriate patient selection, meticulous surgical technique, and structured postoperative rehabilitation are essential to minimize complications and optimize functional recovery in obese patients. Further prospective multicenter studies with larger sample sizes and longer follow-up are recommended to evaluate the long-term effects of obesity on implant survival, revision rates,

and patient-reported outcomes after Total Knee Arthroplasty.

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