

Impact of Body Mass Index on Functional Outcome Following Total Knee Arthroplasty: A Prospective Study

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Abstract

Background: Obesity is a known risk factor for knee osteoarthritis, and it could affect postoperative results after Total Knee Arthroplasty (TKA). However Body Mass Index (BMI) has an impact on functional recovery following TKA remains controversial.

Materials and Methods: This was a prospective observational study carried out in the Department of Orthopaedics, Patna Medical College and Hospital (PMCH), Patna, Bihar, from May 2025 to January 2026. A total of 56 patients underwent primary TKA. Using the BMI classification from the World Health Organisation (WHO), patients were divided into three groups normal weight (n=16), overweight (n=24), and obese (n=16). Functional outcome measures included the Knee Society Score (KSS), WOMAC score, Visual Analog Scale (VAS) and Range of Motion (ROM). Pre-operative and 6-month post-operative assessments were done.

Results: Of the 56 patients, 34 (60.7%) were female and 22 (39.3%) were male, with a mean age of 64.8 ± 7.6 years. There was a significant improvement in functional outcome in all BMI groups. The mean KSS improved from 45.6 ± 6.8 to 89.4 ± 4.3 in normal-weight patients, from 43.8 ± 7.1 to 86.1 ± 4.9 in overweight patients, and from 41.5 ± 7.4 to 82.7 ± 5.4 in obese patients at 6 months postoperatively. In normal-weight, overweight and obese subjects, the mean improvement in KSS was 43.8 ± 7.1 , 42.3 ± 6.8 and 41.2 ± 7.4 points, respectively. There was a significant negative correlation between BMI and postoperative KSS using Pearson's correlation analysis ($r = -0.342$, $p = 0.011$).

Conclusion: This study concludes that there was a comparatively lower functional scores in higher BMI; however, there were significant improvements in all BMI groups after TKA. The surgical group had slightly worse functional results but still had a significant benefit for obese patients.

Keywords: Total Knee Arthroplasty, Body Mass Index, Obesity, Knee Osteoarthritis, Functional Outcome, Knee Society Score.

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Introduction

Osteoarthritis (OA) is a common chronic musculoskeletal condition globally, and one of the most common reasons for pain and disability and for poor quality of life in older people [1]. OA is usually associated with progressive degeneration of the articulating cartilage, subchondral bone remodeling and joint inflammation and is commonly seen in weight-bearing joints, like the knee [2]. Population ageing, the rise in life spans, and obesity rates have contributed to a significant rise in the global burden of knee osteoarthritis [3].

In India, knee OA is a major public health problem, affecting the elderly and showing high prevalence in rural and urban areas [4]. The disease frequently

causes chronic pain, reduced mobility, loss of independence, and higher health care utilization with significant socioeconomic impacts [5]. TKA has become the standard surgical procedure for advanced knee osteoarthritis patients who have not responded to conservative treatment modalities [6]. TKA is designed to reduce pain, restore the alignment of the knee joint, and improve function and quality of life. The long-term results and patient satisfaction have been excellent since the introduction of new surgical techniques, implant design and peri-operative management [7,8].

However, there are several patient-related factors that can affect the recovery and functional results

after surgery, and BMI has been the subject of much attention. One of the most common anthropometric measurements is BMI, which is weight (in kg) divided by height (in m) raised to the power of 2 [9]. The WHO defines the BMI as underweight (BMI < 18.5 kg/m²), normal (BMI: 18.5-24.9 kg/m²), overweight (BMI: 25.0-29.9 kg/m²), and obese (BMI ≥ 30 kg/m²) [10]. Obesity is a global health problem and is a significant risk factor for developing and developing knee OA because of the increased mechanical loading and metabolic inflammation.

The association of BMI with outcomes after TKA is still being discussed. Various [11] studies have shown that a higher BMI has been correlated with more complex surgery, longer operating room times, higher peri-operative risk, and higher stress on the implant. In addition, obese patients may suffer from limited mobility and comorbidities that can affect their post-surgical rehabilitation. Several [12] studies, however, have reported significant functional improvements and pain relief after TKA, regardless of BMI, contradicting the true effect of obesity on surgical outcome.

Although obesity and knee osteoarthritis are becoming common problem in India, there is a scarcity of prospective data regarding the effect of BMI on the functional outcome of TKA, especially in Eastern India. Hence, the present study was a prospective study performed at Patna Medical College and Hospital, Patna, Bihar. In the present study, aim to evaluate the effect of BMI on the postoperative functional outcome of patients undergoing TKA.

Objectives

- To evaluate the effects of BMI on functional outcomes after TKA.
- To assess the postoperative functional outcome of TKAs.
- To compare the results across BMI groups.
- To evaluate the correlation between BMI and recovery after surgery.

Materials and Methods

Study Design: This was a prospective observational study aimed at assessing the effect of BMI on functional outcomes after TKA. Patients who were undergone for primary TKA were prospectively enrolled and followed according to a study protocol. The primary objective of the study was to evaluate the functional recovery of patients in various BMI groups after surgery and to see if BMI affects surgery outcomes.

Study Setting: The study was conducted at the Department of Orthopaedics of PMCH Patna, Bihar, a tertiary care teaching hospital with a large population of patients with the problem of

degenerative knee disorder who require surgical intervention.

Study Duration: This study was carried out for nine months from May 2025 to January 2026. During this period, patient recruitment, surgical intervention, follow-up assessment, and data collection were completed.

Sample Size: 56 patients with primary knee osteoarthritis who were undergoing primary TKA were enrolled in the study. Patients were selected consecutively from the orthopaedic outpatient and inpatient departments during the study period.

Inclusion Criteria

- Age greater than 50 years old.
- Diagnosed with primary osteoarthritis of the knee.
- Scheduled for unilateral or bilateral primary TKA.
- Willing to participate and provide written informed consent.
- Can be used for postoperative follow-up assessments.

Exclusion Criteria

- Undergoing a revision TKA.
- Had a diagnosis of rheumatoid arthritis or inflammatory arthropathies.
- History of past knee joint infection.
- Severe neurological or neuromuscular diseases that impact mobility.
- Failure to obtain informed consent.

BMI Assessment: Preoperatively, BMI was determined by dividing kg by m². Patients were classified according to the WHO classification as normal weight (18.5-24.9 kg/m²), overweight (25.0-29.9 kg/m²) or obese (≥30 kg/m²) for comparative analysis.

Outcome Measures: The KSS was the main outcome measure used to assess the postoperative knee function and clinical improvement. Secondary outcomes were the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), VAS for pain assessment and knee ROM. These parameters were evaluated before and at the follow-up visits.

Data Collection: Demographic and clinical parameters were documented before surgery, such as age, sex, BMI, comorbidities and functional scores. Functional recovery and clinical outcome after TKA were assessed at 6 weeks, 3 months and 6 months postoperatively.

Statistical Analysis: The data were analyzed by SPSS. Continuous variables were presented as mean ± SD and categorical variables as frequency and percentages. Independent t-test, Chi-square test and One-Way analysis of variance (ANOVA) were

used for comparing between BMI groups as appropriate. Pearson correlation analysis was used to determine the correlation between BMI and postoperative functional outcome. The p-value of < 0.05 was deemed to be statistically significant.

Ethical Considerations: Before the study was started, the study protocol was approved by the Institutional Ethics Committee of PMCH. All participants provided informed, written consent before entering the study and confidentiality was preserved for all patient information.

Results

Fifty-six patients who underwent primary TKA for end-stage osteoarthritis (ESOA) were included in

the study. The patients completed the prescribed follow-up evaluations and were evaluated for demographic factors, BMI distribution, functional outcomes, and the relationship of BMI and postoperative recovery.

Demographic Characteristics: The mean age of the study population was 64.8 ± 7.6 years and comprised 56 patients. Most of the patients were in the age group of 61-70 years. It was found that females constituted a larger proportion than males and this was because higher prevalence of osteoarthritis among women. The socio-demographic data of participants in the study are presented in the Table 1.

Table 1: Age and Gender Distribution of Study Participants (N = 56)

Variable	Number (%)
Age Group (Years)	
51–60	14 (25.0)
61–70	28 (50.0)
>70	14 (25.0)
Gender	
Male	22 (39.3)
Female	34 (60.7)

BMI Distribution: Patients were grouped according to the WHO BMI classification into normal, overweight and obese groups. The majority of participants were in the overweight group, followed by the obese group. Table 2 shows the summary of BMI distribution.

Table 2: Distribution of Patients According to BMI Category

BMI Group	Number (%)
Normal Weight (18.5–24.9 kg/m ²)	16 (28.6)
Overweight (25–29.9 kg/m ²)	24 (42.9)
Obese (≥ 30 kg/m ²)	16 (28.6)
Total	56 (100)

Preoperative Functional Scores: Both groups had similar functional status for the baseline assessment before surgery. Obese patients also had slightly lower KSS and higher WOMAC scores, meaning they had more disability and pain before surgery.

Table 3: Preoperative Functional Scores According to BMI Category

BMI Group	Mean KSS ($\pm$ SD)	Mean WOMAC ($\pm$ SD)
Normal Weight	45.6 ± 6.8	68.4 ± 8.2
Overweight	43.8 ± 7.1	71.2 ± 7.9
Obese	41.5 ± 7.4	74.6 ± 8.5

Postoperative Functional Outcomes: There was consistent improvement across all BMI categories in functional outcome after TKA. The highest degree of improvement was seen at 6-month follow-up compared to 6 weeks. However, postoperative KSS values were slightly higher in normal-weight patients as compared to overweight and obese patients.

Table 4: Mean Knee Society Scores during Follow-Up

BMI Group	6 Weeks	3 Months	6 Months
Normal Weight	68.2 ± 5.4	80.6 ± 4.8	89.4 ± 4.3
Overweight	65.7 ± 5.9	77.8 ± 5.2	86.1 ± 4.9
Obese	62.4 ± 6.3	74.1 ± 5.8	82.7 ± 5.4

Comparison of Functional Improvement: The function outcome is good after surgery in all BMI categories. Patients with normal weight showed the greatest increase in KSS scores from baseline through 6 months, whereas the scores of obese patients increased the least.

Table 5: Improvement in Knee Society Score from Baseline to Six Months

BMI Category	Mean Improvement in KSS
Normal Weight	43.8 ± 7.1
Overweight	42.3 ± 6.8
Obese	41.2 ± 7.4

Correlation Analysis: There was a moderate negative correlation between BMI and postoperative Knee Society Score at six months (Pearson correlation analysis). Slightly poorer functional outcomes were seen with higher BMI after TKA.

Table 6: Correlation between BMI and Postoperative Functional Outcome

Variable	Correlation Coefficient (r)	p-value
BMI vs 6-Month KSS	-0.342	0.011
BMI vs 6-Month WOMAC	0.298	0.024

Results showed that patients with all BMI groups experienced significant improvements after TKA, but patients with higher BMI tended to have lower functional scores after surgery. Even with this correlation, obese patients also showed significant improvements in pain relief and functional capacity, indicating that obesity does not appear to be a contraindication to successful TKA results.

Discussion

The current prospective study examined the relationship between functional outcome after TKA and BMI in 56 patients who underwent surgery for primary knee osteoarthritis. The results showed that all patients had observed improvements postoperatively, regardless of their BMI levels. KSS showed a steady improvement from baseline to six months postoperatively, and WOMAC scores showed a significant decrease in pain, stiffness, and physical function scores postoperatively. But patients with higher BMI had relatively lower functional scores after surgery compared with normal-weight patients.

A moderate negative correlation was also found between BMI and postoperative KSS, indicating that a higher BMI may negatively impact functional recovery following TKA.

Comparison with Previous Studies: The results of the present study support the results of [13], who found that obese patients had improved functional outcome following TKA, but with slightly worse results than non-obese patients. Likewise, [14] found technical difficulty during surgery and a moderately reduced postoperative functional score to be correlated with obesity, but still, a good clinical outcome was obtained. In a large arthroplasty registry study [15] found that increased BMI was correlated with increased perioperative complications and revision risks, but in the majority of obese patients, patient-reported functional outcomes were satisfactory.

The findings of the present study corroborate the existing literature suggesting that obesity negatively impacts some of the aspects of the postoperative period, yet it may not be considered a

contraindication for good TKA outcomes. There was a significant improvement in functional scores for all BMI groups, showing that surgery can provide useful benefits for obese patients. In the present study, although wound complications, infection, and extended hospital stay were not outcome measures, other studies have indicated increased rates of wound complications, infection, and prolonged hospital stays in obese patients. This may be related to the relatively low functional scores of patients with higher BMI.

Clinical Implications: The results of this study have important implications for clinical practice. Discussions about the possible impact of obesity on postoperative recovery and function should be included in the preoperative counselling. BMI optimization programs should be encouraged in patients with a high BMI before surgery to minimise the surgical risk and enhance rehabilitation potential. Also, in obese patients, personalised post-operative rehabilitation programmes could be useful to improve mobility, strengthen muscles and maintain weight after surgery. These can help to optimize functional recovery and patient satisfaction after TKA.

Strengths of the Study: There are a number of strengths in the current study. Initially, there was clinical and functional outcome data that could be systematically collected in the design of this research. Secondly, surgical procedures, perioperative care, and follow-up protocols were uniform across all patients, and all patients were treated at a single tertiary care hospital, eliminating variation in practice. Finally, the study has incorporated real-life clinical practice and is informative about BMI's effects in TKA in an Indian population.

Limitations: Although the study has its benefits, there are a few limitation to be addressed. The sample size was small, and this might limit generalizability of the findings. The findings are from a single center and may not apply to other centers. Furthermore, a short follow-up period (six months) was used, making it impossible to evaluate long-term implant survival and functional results.

Further multicentre studies with greater numbers of patients and longer follow-up times are needed to confirm these results.

Conclusion

The present study was a prospective study, showing that the BMI has an impact on functional results after TKA.

Patients in all BMI groups demonstrated marked improvements in pain relief and functional status, but patients with higher BMI had lower postoperative functional scores when compared to other BMI groups.

However, obesity does not appear to be a contraindication for TKA, with significant clinical benefits seen in each group. Larger multicenter studies with longer follow-up are recommended to further elucidate the long-term effects of BMI on TKA outcomes.

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