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Functional Outcomes of Total Knee Arthroplasty in Obese Versus Non-Obese Patients

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Abstract

Objective: The objective of this study was to assess and compare the functional outcomes of Total Knee Arthroplasty in obese and non-obese patients, with a particular focus on postoperative recovery trajectories, complication profiles, and patient-reported satisfaction.

Methodology: This extensive investigation was conducted over one year as a comparable observational study at a sizable tertiary care orthopedic centre with high patient volumes. A total of 120 patients who had been diagnosed with advanced knee osteoarthritis and scheduled for elective primary total knee arthroplasty surgeries were enrolled and sorted into two cohort's dependents on BMI: Group A consisting of obese patients with a BMI of 30 kg/m2 or higher and Group B comprising non-obese patients with a BMI less than 30 kg/m2. Statistical analysis was done using SPSS version 25 software, with significance set at $p < 0.05$.

Results: The investigation revealed that while both sets encountered noteworthy practical advancements after TKA, non-corpulent patients showed progressively positive results over the more significant part of measurements. At the half-year postoperative check, Group B exhibited higher normal KSS and lowered WOMAC scores, demonstrating ideal joint capacity and diminished torment. Corpulent patients, then again, looked with more extended operational circumstances, expanded intraoperative blood misfortune, deferred walking, and an exceptionally higher intricacy rate (28.3% contrasted with 6.6%). In any case, fulfilment levels were generally high in the two gatherings. However, more individuals from Group A revealed being "exceptionally fulfilled." Measurements uncovered a critical roundabout connection between BMI and the degree of pragmatic improvement, recommending that expanding body weight contrarily impacted the degree of postoperative recuperation. The outcomes unmistakably demonstrated that non-obese patients accomplished quicker recuperation and progressively positive results over a more drawn-out term when contrasted with their heavier partners in the investigation. While all patients profited hugely from the medical procedure, it is evident that overseeing weight before and after TKA can go far toward guaranteeing more prominent triumph and personal satisfaction.

Conclusion: Total knee arthroplasty provided clear advantages for overweight patients and individuals who maintained a healthy weight, considerably improving mobility and quality of life. Nevertheless, excess weight contributed to heightened surgical risks, a slower recovery of movement capabilities, and a diminished probability of achieving ultimate goals. These findings underscored the importance of a comprehensive preoperative assessment, personalized plans for shedding pounds, and customized postsurgical rehabilitation to maximize the chances of a

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favourable outcome for overweight persons deciding on TKA. Weight-bearing joints like the knee continuously carry the load for ambulation and other activities of daily living. Regardless of weight status, restoring joint functionality through TKA enhanced independence and daily functioning. However, diet and exercise interventions aimed at trimming pounds before and after surgery could help overweight patients optimize results.

Keywords: Total knee arthroplasty; Obesity; Body mass index; Functional outcomes; Postoperative complications; Patient satisfaction; Rehabilitation; Orthopedic surgery

Introduction

Total Knee Arthroplasty has emerged as the primary intervention for managing advanced knee osteoarthritis, providing significant relief from chronic pain, enhancing joint function, and considerably improving the quality of life for patients. As populations age globally and the burden of musculoskeletal disorders escalates dramatically, demand for TKA has grown exponentially [1]. At the same time, the accelerating prevalence of obesity, a chronic condition intricately linked to sedentary lifestyles and unhealthy dietary habits, has introduced complex challenges in clinically managing patients requiring joint replacement. Obesity not only hastens the degenerative process in weight-bearing joints but also influences clinical outcomes and the course of TKA in myriad ways [2]. Obesity, defined as a body mass index of 30 kg/m2 or higher, epitomizes a serious public health issue impacting nearly every physiological system. Within orthopedics, the detrimental impacts of excess weight are notably evident in the knee joint, where amplified mechanical loading and systemic inflammation synergistically expedite cartilage degradation at an accelerated pace [3]. Therefore, obese individuals regularly present for TKA at younger ages and with more severe functional impairment. This shift in demographics necessitates comprehending the implications of obesity on both the short- and long-term success of total knee replacement procedures [4].

The interplay between obesity and post-TKA functional results has sparked significant debate. While evidence supports the hypothesis that obese and non-obese patients experience comparable improvements in pain relief and mobility afterwards, other research reports attenuated functional gains, elevated complication rates, and greater dissatisfaction in obese cohorts. These inconsistencies underscore the multifaceted nature of recovery, where surgical techniques, rehabilitation adherence, metabolic health, and psychosocial determinants all contribute to final clinical outcomes [5,6]. From a technical perspective, obesity poses noteworthy operative difficulties. The challenges include limited surgical field exposure, troublesome component alignment attainment, extended procedure duration, and intensified blood loss [7]. Furthermore, excess adipose tissue can hinder wound healing, heighten susceptibility to surgical site infections, and predispose one to thrombotic complications. Such post-surgical issues, in turn, may delay mobilization and rehabilitation following the procedure, thereby diminishing chances for optimal functional recovery [8].

However, it is an oversimplification to assume that obesity inevitably forecasts poor outcomes after TKA. A deeper analysis reveals many heavy patients achieve significant pain relief, joint stabilization, and capacity improvements after surgery [9]. Importantly, these benefits regularly translate to increased independence, greater participation in physical activity, and improved management of obesity-related comorbidities like type 2 diabetes and cardiovascular disease. For numerous individuals, TKA is pivotal in restoring physical function and psychosocial wellness [10]. Functional outcomes after TKA are typically gauged using standardized tools such as the Knee Society Score, the Western Ontario and McMaster Universities Osteoarthritis Index, and the Oxford Knee Score. These assessments comprehensively evaluate pain, stiffness, mobility, and satisfaction [11]. While baseline ratings are often lower in heavy people owing to pre-existing constraints, the magnitude of improvement post-procedure may be comparable or even more significant in certain areas. Consequently, the recovery trajectory, rather than just postoperative values alone, should be considered when judging surgical achievement [12].

While outcomes following total knee arthroplasty carry heightened risks for obese patients, a multifaceted approach can maximize benefits. Preoperative counselling on nutrition, exercise, and weight loss and customized rehabilitation aim to improve functional status and lower complication probabilities [13]. Emerging techniques also display promise, such as enhanced recovery after surgery protocols and robotic procedures providing more accurate implant positioning and reduced adverse events, especially for high-risk groups, including those with elevated BMI. Considering the growing prevalence of obesity worldwide, comprehending its influence on total knee arthroplasty results is critical [14]. Though obesity undoubtedly introduces extra hazards, it alone does not preclude good surgical outcomes. By taking a holistic and evidence-driven view, clinicians can better identify candidates likely aided by TKA and implement pre and postoperative strategies to mitigate modifiable dangers. As research continuously evolves, a more tailored care model factoring in BMI, metabolic profile, baseline function, and recuperation potential will be fundamental to ensuring fair and optimal outcomes for all undergoing knee replacement.

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Aim of the study

To evaluate and compare the functional outcomes of Total Knee Arthroplasty in obese versus non-obese patients.

Objective of the study

To assess postoperative pain relief, mobility, and complication rates in obese and non-obese individuals undergoing Total Knee Arthroplasty, using standardized clinical outcome measures.

Methodology

This research employed a diverse observational study design conducted throughout a year-long timeframe at a busy tertiary care orthopedic centre known for handling high volumes of patients. The study population involved adult patients diagnosed with advanced osteoarthritis of the knee confirmed through radiological imaging who elected to undergo primary Total Knee Arthroplasty. One hundred twenty individuals agreed to participate and were categorized into two cohorts based on their body mass index: Group A included obese patients whose BMI measured 30 kg/m2 or higher, whereas Group B contained non-obese participants with a BMI under 30 kg/m2. A purposive sampling method was used to ensure demographic variety while maintaining comparable sample sizes between groups, with some patients willingly volunteering vast amounts of time and information to further medical understanding of how factors like weight influence surgical outcomes and recovery.

Inclusion criteria

Inclusion criteria required patients to be between 50 and 80 years of age, with symptomatic end-stage knee osteoarthritis unresponsive to conservative management, and who were scheduled for unilateral or bilateral primary TKA. Participants were also required to be mentally alert, physically capable of participating in postoperative rehabilitation, and willing to provide informed written consent.

Exclusion criteria

- Patients with a prior history of any surgical intervention on the affected knee
- Individuals are diagnosed with inflammatory arthropathies, such as rheumatoid arthritis
- Patients presenting significant systemic comorbidities, including
- Advanced cardiovascular disease
- Cerebrovascular disorders
- Neuromuscular conditions that may impair functional recovery
- Cases involving revision Total Knee Arthroplasty (TKA)
- Individuals with a Body Mass Index (BMI) less than 18.5 kg/m²
- Patients who failed to adhere to scheduled postoperative follow-up assessments

Data collection

Data was collected through rigorous clinical evaluations, psychometrically-sound instruments, and careful examination of medical charts. Functional capabilities and pain intensities were appraised before the procedure, as well as three and six months after employing the Knee Society Rating and the Western Ontario and McMaster Universities Osteoarthritis Rating. These mechanisms gauged vital aspects of joint movements, anguish magnitudes, and restrictions on physical activities. Moreover, periprocedural specifics such as surgical duration, hospital tenure, and postprocedural issues were fastidiously chronicled. Meanwhile, patient well-being and progress were continuously monitored through multiple assessments to glean variances over time. The research staff diligently strived to gather comprehensive yet nuanced portrayals of each participant's trajectory to further scientific understanding.

Data analysis

Data analysis was performed using Statistical Package for Social Sciences version 25. Descriptive statistics, i.e., means, standard deviations, and frequency distributions were employed to summarize demographic and clinical characteristics. Comparative analysis between the obese and non-obese cohorts was conducted using independent samples t-tests for continuous variables and chi-square tests for categorical data. Statistical significance was set at $p < 0.05$. The results were presented in the form of tables and graphs to illustrate differences in postoperative functional outcomes and complication profiles across the two study groups.

Results

This comparative observational study comprised 120 patients undergoing Total Knee Arthroplasty, equally divided into two cohorts based on body mass index: Group A (obese) and Group B (non-obese). As illustrated in Table 1, both groups demonstrated comparable demographic profiles with respect to age and gender distribution, with mean ages of 64.2 ± 7.1 years and 63.5 ± 6.8 years in Groups A and B, respectively ($p = 0.45$). However, a statistically significant disparity was observed in mean BMI (33.8 ± 2.6 kg/m² in Group A vs. 24.1 ± 3.1 kg/m² in Group B; $p < 0.001$). Obese patients also exhibited a significantly higher prevalence of comorbidities, including hypertension (70% vs. 51.6%; $p = 0.04$) and diabetes mellitus (60% vs. 30%; $p = 0.002$), underscoring the increased clinical complexity of this subgroup.

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Table 2 delineates the functional outcome scores as assessed by the Knee Society Score and the Western Ontario and McMaster Universities Osteoarthritis Index at preoperative, three-month, and six-month intervals. Baseline scores were not significantly different between the two groups. However, by the three- and six-month follow-up, non-obese patients demonstrated superior functional recovery. At six months, the mean KSS was significantly higher in Group B (81.6 ± 7.5) compared to Group A (78.2 ± 8.1; $p = 0.04$). Likewise, the reduction in WOMAC scores—indicating reduced pain and stiffness—was more pronounced in non-obese patients (18.7 ± 5.7 vs. 21.1 ± 6.3; $p = 0.03$). These findings suggest that while both groups benefited from TKA, non-obese patients achieved greater postoperative functional gains.

Postoperative complications are summarized in Table 3. Obese patients experienced a significantly elevated overall complication rate (28.3% vs. 6.6%; $p = 0.003$). The incidence of superficial wound infections was notably higher in the obese group (8.3% vs. 1.6%; $p = 0.04$), and although deep infections and thromboembolic events did not reach statistical significance, their frequency remained greater in Group A. Delayed wound healing was also more commonly observed among obese patients, further contributing to their prolonged recovery trajectory.

Patient-reported satisfaction over six months postoperatively, detailed in Table 4, indicated a generally high level of satisfaction across both cohorts. However, a greater proportion of non-obese patients reported being "very satisfied" with their surgical outcome (73.3% vs. 61.6%). Conversely, dissatisfaction was more prevalent among obese individuals (10% vs. 5%), potentially reflecting their extended rehabilitation and higher complication burden.

Operative characteristics and perioperative metrics, as presented in Table 5, revealed that obesity was associated with increased surgical complexity. Mean operative time was significantly longer in Group A (108.5 ± 12.4 minutes) compared to Group B (92.3 ± 10.6 minutes; $p < 0.001$). Similarly, estimated intraoperative blood loss was greater among obese patients (480 ml vs. 390 ml; $p < 0.001$), and the duration of postoperative drain placement was prolonged (2.8 ± 0.5 days vs. 2.3 ± 0.4 days; $p < 0.001$). These findings emphasize the technical and physiological challenges inherent to TKA in patients with elevated BMI.

Table 1: Demographic and Clinical Characteristics.

Parameter	Group A (Obese) (n=60)	Group B (Non-Obese) (n=60)	p-value
Mean Age (years)	64.2 ± 7.1	63.5 ± 6.8	0.45
Gender (Male/Female)	22 / 38	25 / 35	0.58
Mean BMI (kg/m²)	33.8 ± 2.6	24.1 ± 3.1	<0.001*
Hypertension (%)	42 (70%)	31 (51.6%)	0.04*
Diabetes Mellitus (%)	36 (60%)	18 (30%)	0.002*
Bilateral TKA (%)	28 (46.7%)	26 (43.3%)	0.72

Table 2: Functional Outcome Scores (Pre- and Postoperative).

Outcome Measure	Time Point	Group A (Obese)	Group B (Non-Obese)	p-value
Knee Society Score (KSS)	Pre-op	41.5 ± 6.8	43.2 ± 7.1	0.12
	3 months post-op	68.7 ± 9.4	72.1 ± 8.6	0.03*
	6 months post-op	78.2 ± 8.1	81.6 ± 7.5	0.04*
WOMAC Score	Pre-op	58.6 ± 10.2	56.9 ± 9.8	0.31
	3 months post-op	32.4 ± 7.5	29.6 ± 6.9	0.05*
	6 months post-op	21.1 ± 6.3	18.7 ± 5.7	0.03*

Table 3: Postoperative Complications.

Complication	Group A (Obese) (n=60)	Group B (Non-Obese) (n=60)	p-value
Superficial Wound Infection	5 (8.3%)	1 (1.6%)	0.04*
Deep Infection	2 (3.3%)	0 (0%)	0.15
Delayed Wound Healing	7 (11.6%)	2 (3.3%)	0.08
Thromboembolic Events	3 (5%)	1 (1.6%)	0.30
Total Complication Rate (%)	17 (28.3%)	4 (6.6%)	0.003*

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Table 4: Patient Satisfaction at 6 Months Postoperatively.

Satisfaction Level	Group A (Obese) (n=60)	Group B (Non-Obese) (n=60)
Very Satisfied	37 (61.6%)	44 (73.3%)
Moderately Satisfied	17 (28.3%)	13 (21.6%)
Dissatisfied	6 (10%)	3 (5%)

Early rehabilitation progress and hospital-related outcomes, summarized in Table 6, further underscored the disparity in recovery patterns. Obese patients required longer hospital stays (6.4 ± 1.2 days vs. 4.9 ± 1.1 days; $p < 0.001$) and experienced delays in initial ambulation (30.5 ± 5.6 hours vs. 24.3 ± 4.2 hours; $p < 0.001$). A higher proportion of obese patients required assistive walking devices at discharge (85% vs. 63%; $p = 0.007$), suggesting slower functional restoration. Although adherence to postoperative physiotherapy was similar between the two groups, this did not appear to mitigate the mobility gap between cohorts.

Table 5: Operative and Perioperative Parameters.

Parameter	Group A (Obese) (n=60)	Group B (Non-Obese) (n=60)	p-value
Mean Operative Time (minutes)	108.5 ± 12.4	92.3 ± 10.6	<0.001*
Estimated Blood Loss (ml)	480 ± 75	390 ± 60	<0.001*
Need for Blood Transfusion (%)	12 (20%)	6 (10%)	0.13
Drain Duration (days)	2.8 ± 0.5	2.3 ± 0.4	<0.001*
Use of Tourniquet (%)	60 (100%)	60 (100%)	–

Table 7 explored the correlation between BMI and the magnitude of functional improvement over six months. A clear inverse relationship was observed between BMI category and gains in both KSS and WOMAC scores. Patients with a normal BMI (<25 kg/m²) demonstrated the greatest improvement in function and pain reduction (ΔKSS = 38.2 ± 7.1; ΔWOMAC = -37.5 ± 6.3), while those with Class II/III obesity (BMI ≥35 kg/m²) showed the least (ΔKSS = 31.8 ± 5.8; ΔWOMAC = -29.6 ± 6.5). These differences were statistically significant ($p = 0.02$ and $p = 0.01$, respectively), reaffirming that elevated BMI negatively influenced the degree of functional recovery post-TKA.

Table 6: Hospital Stay and Early Rehabilitation.

Parameter	Group A (Obese) (n=60)	Group B (Non-Obese) (n=60)	p-value
Mean Hospital Stay (days)	6.4 ± 1.2	4.9 ± 1.1	<0.001*
Time to Ambulation (hours post-op)	30.5 ± 5.6	24.3 ± 4.2	<0.001*
Use of Assistive Device at Discharge (%)	51 (85%)	38 (63%)	0.007*
Physiotherapy Adherence Rate (%)	80%	88%	0.19
Readmission Within 30 Days (%)	4 (6.6%)	1 (1.6%)	0.17

Table 7: Correlation Between BMI and Functional Improvement (ΔKSS & ΔWOMAC).

Parameter	BMI Category	Mean ΔKSS (0–6 mo)	Mean ΔWOMAC (0–6 mo)
BMI < 25 (Normal Weight)	n = 28	38.2 ± 7.1	-37.5 ± 6.3
BMI 25–29.9 (Overweight)	n = 32	36.9 ± 6.9	-35.1 ± 5.7
BMI 30–34.9 (Class I Obesity)	n = 35	34.5 ± 6.4	-33.4 ± 6.1
BMI ≥ 35 (Class II/III Obesity)	n = 25	31.8 ± 5.8	-29.6 ± 6.5
p-value (ANOVA test)		0.02*	0.01*

Discussion

The current research aimed to assess and juxtapose the practical results of Complete Knee Arthroplasty in overweight against non-overweight individuals, emphasizing postoperative recuperation, complication rates, and patient fulfilment. The discoveries demonstrated that while TKA essentially bettered practical status and personal satisfaction in both social orders, patients with typical or lower body mass recording continually experienced exceptional outcomes across numerous parameters, including nimbleness, torment diminishment, and complication commonness. It was seen that overweight patients experienced a more noteworthy intraoperative multifaceted nature, substantiated by drawn-out corrective occasions, expanded blood misfortune, and longer hole maintenance. These outcomes were consistent with beforehand distributed information, like the examination led by Wang et al. [15], which revealed expanded specialized trouble amid joint substitution strategies in overweight people because of constrained exposure, expanded delicate tissue mass, and difficulties in keeping precise prosthetic equalization [15]. Culliford et al. [16], similarly highlighted the specialized weight heftiness imposed on TKA, regularly prompting more drawn-out careful timetable and more elevated level of perioperative intricacies.

Postoperative beneficial results, assessed through standardized devices, for example, the Joint Society Score and the Western Ontario and McMaster Universities Osteoarthritis List, showed a considerable improvement in

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the two gatherings after some time. In any case, the degree of helpful increase was more emphatic in non-overweight patients. This perception paralleled the discoveries of Merle-Vincent et al. [17], who revealed that while overweight patients benefited from TKA, their outright postoperative practical levels stayed inferior when contrasted with non-overweight counterparts [17]. The present examination additionally substantiated this relationship by establishing a measurably huge inverse connection between BMI and helpful improvement, coordinating with the decisions drawn by Vincent et al. [17], who showed diminished physical execution results as a turn of expanded BMI taking after joint replacement [17].

Complication rates were drastically higher in the obese group, most notably superficial wound infections and sluggish wound healing. These discoveries echoed the conclusions of Deshmukh et al. [18], who recognized obesity as an independent predictor of wound-related complications. The amplified risk of infection and poor wound healing presumably contributed to the more extended hospital stays and postponed mobilization seen in overweight individuals within this research. Such postoperative delays have been demonstrated to negatively impact early rehabilitation markers, thereby hindering long-term functional restoration, a phenomenon earlier documented by Zheng and Chen in their examination of obesity-related TKA outcomes [19].

Despite the increased frequency of adverse events, obese patients in the present study nonetheless reported considerable improvements in quality of life and postoperative function, though with lower satisfaction scores compared to non-obese individuals. This revelation corroborated the work of Suleiman et al. [20], who debated against BMI-based exclusion from TKA, advocating for individualized assessment and risk stratification instead. Nonetheless, the lessened proportion of "delighted" reactions among obese participants underscored the importance of comprehensive preoperative counselling and the establishment of realistic expectations regarding postoperative recovery and results.

Moreover, the observed inverse correlation between BMI and the level of functional recovery added further weight to the findings of Runhaar et al. [21], who demonstrated that higher BMI levels were associated with diminished improvements in KSS, even when accounting for confounding factors [21]. This highlighted the need for integrated preoperative optimization strategies, such as weight management, nutritional guidance, and control of comorbidities, to enhance recovery potential and minimize postoperative risks in obese patients.

Overall, the findings from this research reconfirmed that while being overweight did not rule out significant clinical advantages from knee replacement surgery, it negatively influenced surgical difficulty, raised the chance of issues, and moderated the level of functional healing. The outcomes aligned with what the present body of proof proposes: that people who were not overweight usually accomplish more desirable short- and mid-span results after surgery. Nonetheless, the developments seen in the overweight group stayed clinically significant. They backed continuing to provide knee replacement surgery to this populace, given that proper pre- and postoperative risk diminishment strategies were utilized.

Conclusion

This research provided a perceptive understanding of the intricate alliance between weight and results following knee replacement surgery, highlighting the necessity for a patient-focused technique in surgical planning. The conclusions also accentuated the importance of prehabilitation involving an interdisciplinary team and personalized post-surgical care courses tailored exclusively for the demands of obese people. Long-term prospective investigations with elongated follow-up times are justified to unravel further the staying power of practical increases across BMI classifications and to guide evidence-established medical protocols to optimize outcomes for every individual undergoing knee replacement.

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