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Prior Bariatric Surgery Is Not Associated with Increased Risk Following Lower Limb Arthroplasty: A Propensity-Matched Cohort Study

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Research Article

Keywords:

Posted Date: November 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11113707/v1

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Additional Declarations: No competing interests reported.

Abstract

Introduction:

Severe obesity increases adverse outcome risks following lower limb arthroplasty. Bariatric surgery provides sustained weight loss and metabolic improvement, but its role before arthroplasty remains unclear. This study compared arthroplasty outcomes after bariatric surgery with matched controls.

Methods

In this retrospective propensity-matched cohort study, patients undergoing bariatric surgery before total hip or knee arthroplasty were compared with controls matched for body mass index (BMI), age, sex, American Society of Anesthesiologists classification, Charlson Comorbidity Index, and diabetes at arthroplasty. Outcomes included operative time, composite adverse events, complications, readmission, return to the operating room, and mortality.

Results

Ninety patients with prior bariatric surgery (36 hip arthroplasties, 54 knee arthroplasties) were compared with 180 controls. Groups had similar BMI (39.3 ± 7.0 vs 38.8 ± 6.0 kg/m²) and associated medical problems. Bariatric surgery resulted in pre-arthroplasty weight loss (23.6 ± 12.9% of total body weight) and reduced diabetes prevalence (23.3% to 6.7%). Operative time did not differ (104 vs 96.5 minutes, p = 0.179). Composite adverse events occurred in 18.9% of both groups (p = 0.999). Major complications, readmission, return to the operating room, and mortality were comparable (all p > 0.05). Bariatric surgery was not independently associated with adverse outcomes; higher BMI predicted increased complications.

Conclusion

With BMI and associated medical problems matched, prior bariatric surgery was not associated with worse arthroplasty outcomes. Current BMI appears to be the primary determinant of postoperative risk. Bariatric surgery should be considered as a risk-mitigating strategy before lower limb arthroplasty.

Key Points

• Prior bariatric surgery was not associated with worse arthroplasty outcomes.

• Operative time and composite adverse event rates were similar between groups.

• Higher BMI at arthroplasty was associated with adverse outcomes.

Introduction

Obesity is increasingly prevalent and a well-established dose-response risk factor for the development and progression of osteoarthritis, particularly of the hip and knee [1]. Patients with class III and IV obesity are more likely to require lower limb joint arthroplasty at a younger age [2–4]. They also face a higher risk of perioperative complications, readmissions, revisions, and reoperations [5–7].

Bariatric surgery results in sustained weight loss and metabolic improvements. It has been shown to improve outcomes for major cardiac surgery, renal transplant, and major abdominal wall reconstruction [8, 9]. Despite this, evidence supporting bariatric surgery before arthroplasty remains inconsistent. Existing studies have reported mixed results, with some suggesting no benefit and others indicating an increased risk of complications [10–14]. A major limitation of the existing literature is that residual confounding factors (beyond body mass index [BMI]) are often inadequately accounted for. Such comparisons may obscure the independent effect of bariatric surgery by failing to account for metabolic optimization and modification of associated medical problems achieved through surgical weight loss.

To address these limitations, we conducted a propensity-matched retrospective cohort study comparing post-arthroplasty outcomes in patients with and without prior bariatric surgery. By matching the BMI at the time of arthroplasty and key demographic and clinical risk factors, this study aimed to isolate the independent association between bariatric surgery and arthroplasty outcomes. We hypothesized that prior bariatric surgery is not associated with inferior post-arthroplasty outcomes compared with matched controls without bariatric surgery. Secondary objectives included identifying independent predictors of adverse outcomes and exploring the association between bariatric surgery and specific complications.

Materials and Methods

A retrospective cohort study was conducted in a tertiary center. This study was approved by the institutional Human Research Ethics Committee. Patients with severe obesity (Class III and above) who underwent bariatric surgery before primary lower limb arthroplasty between May 2004 and May 2025 were identified from institutional bariatric and orthopedic databases. These patients were compared with patients who underwent primary total hip arthroplasty (THA) or total knee arthroplasty (TKA) without prior bariatric surgery during the same study period. Other selection criteria included being over 18 years of age and having at least 1 year of follow-up. The study sample comprised all eligible patients with prior bariatric surgery who subsequently underwent primary TKA and THA during the study period. No a priori sample size calculation was performed.

Propensity score matching was undertaken to minimize selection bias and confounding factors. Controls were matched at a 2:1 ratio based on BMI, age, sex, Charlson Comorbidity Index (CCI), American Society of Anesthesiologists physical status (ASA) classification, and diabetes mellitus status at the time of arthroplasty. This was performed using nearest neighbor propensity score matching without replacement, with a caliper of 0.1, implemented via the SPSS STATS PSM extension.

Demographic, clinical, and perioperative variables were obtained from electronic medical records. We extracted operative times from the New Zealand Orthopaedic Association Joint Registry. Postoperative outcomes assessed up to one year postoperatively included length of stay, discharge destination, unplanned intensive care unit (ICU) admission, mortality, return to the operating room, hospital readmission, and complications (graded using the Clavien–Dindo classification).

Bariatric outcomes included changes in weight and BMI between bariatric surgery and arthroplasty; percentage total body weight loss (TBWL), excess weight loss (EWL); and changes in diabetes status, ASA, and CCI.

The primary outcomes were operative time (defined as time from the initial skin incision to completion of final skin closure) and a composite adverse post-arthroplasty outcome, defined as the occurrence of one or more:

- Clinically significant complications (Clavien-Dindo grade ≥ 3)
- Clinically significant surgical complication - Surgical site infection (wound infection/ dehiscence or joint infection), bleeding requiring transfusion, iatrogenic fracture or dislocation
- Clinically significant medical complications – Venous thromboembolism, acute coronary syndrome, cerebrovascular accident
- Unplanned return to the operating room within 1 year
- Unplanned ICU admission
- 30-day readmission
- Mortality

Secondary outcomes

- Length of stay – initial admission and total
- Discharge destination
- Readmission within 1 year
- Other medical complications – respiratory, gastrointestinal, acute kidney injury/ acute on chronic kidney injury, other hospital-acquired infection

Statistical analyses were performed using SPSS (IBM Corp., Armonk, NY). A two-sided p-value < 0.05 was considered statistically significant. Continuous variables were summarized as mean ± standard deviation or median with interquartile range/ range, and categorical variables as counts and percentages. Group comparisons were performed using unpaired Student's t-test or Mann–Whitney U test for continuous variables and Chi-squared or Fisher's exact test for categorical variables. There were no missing data for variables included in the primary analyses.

Multivariable logistic regression was used to assess the association between prior bariatric surgery and post-arthroplasty outcomes. Bariatric surgery status was included as the primary exposure, along with BMI, age, gender, ASA 3 and above, CCI 2 and above, diabetes status, chronic kidney disease, and type of orthopedic surgery (THA or TKA). Adjusted odds ratios with 95% confidence intervals were reported.

Results

At the time of arthroplasty, 90 patients with prior bariatric surgery (36 total hip arthroplasty and 54 total knee arthroplasty) were compared with 180 controls (72 THA and 108 TKA). The mean age at arthroplasty was similar between the bariatric surgery cohort and matched controls (56.3 ± 6.4 vs 58.0 ± 7.7 years, p = 0.071), as was the proportion of women (64.4% vs 61.7%, p = 0.356). Likewise, mean body weight (110.0 ± 21.7 vs 109.0 ± 17.2 kg, p = 0.757) and BMI (39.3 ± 7.0 vs 38.8 ± 6.0 kg/m², p = 0.476) did not differ significantly. Perioperative risk profiles were also comparable, with no significant differences in ASA class ≥ III, Charlson Comorbidity Index ≥ 2, diabetes mellitus, or chronic renal impairment (all p > 0.05), confirming effective matching between groups (Table 1).

Table 1
Demographic data of patients with prior bariatric surgery and matched controls at arthroplasty

Arthroplasty procedure, N (%)	**Bariatric surgery**	**Matched controls**	**p value**
	THA 36 (40%)	**THA 72 (40%)**	
	TKA 54 (60%)	**TKA 108 (60%)**	
Age, years	56.3 ± 6.4	58.0 ± 7.7	0.071*
Sex - women, N (%)	58 (64.4%)	111 (61.7%)	0.356□
Ethnicity, N (%)			0.037
Māori	24.4%	17.8%	
New Zealand European	51.1%	56.1%	
Other European	8.9%	8.3%	
Pacific peoples	12.2%	12.8%	
Other ethnicities	3.3%	5%	
Weight, kg	110.0 ± 21.7	109.0 ± 17.2	0.757*
BMI, kg/m²	39.3 ± 7.0	38.8 ± 6.0	0.476*
ASA III and above, N (%)	49 (54.4%)	101 (56.1%)	0.795□
CCI 2 and above, N (%)	18 (20%)	29 (16.1%)	0.427□
Diabetes mellitus, N (%)	6 (6.7%)	25 (13.9%)	0.105
Chronic renal impairment, N (%)	1 (1.1)	2 (1.1)	0.999

* Unpaired two-tailed t-test; □ chi-square test; unmarked p values: Fisher's exact test.

N = number; THA = total hip arthroplasty; TKA = total knee arthroplasty; BMI = body mass index; ASA = American Society of Anesthesiologists physical status; CCI = Charlson Comorbidity Index.

The impact of bariatric surgery is delineated in Table 2. The median interval between bariatric surgery and arthroplasty was 35.4 months (interquartile range [IQR] 83.2; range 2.8–471.8 months). Mean body weight decreased from 144.7 ± 22.2 kg at bariatric surgery to 109.6 ± 21.7 kg at arthroplasty ($p < 0.05$), corresponding to a mean total body weight loss of 23.6 ± 12.9% before arthroplasty. We also observed improvements in metabolic and perioperative risk profiles. The proportion of patients with diabetes mellitus decreased significantly from 23.3% at the time of bariatric surgery to 6.7% at arthroplasty ($p = 0.003$), with diabetes improving or resolving in 32.2% of patients. ASA classification improved in 21.1% of patients ($p = 0.093$). CCI scores improved in 22.2% of patients, remained unchanged in 55.6%, and worsened in 22.2% ($p = 0.703$).

Table 2
Bariatric surgery outcomes

Age, years	**At bariatric surgery**	**At arthroplasty**	**p value**
	50.5 ± 7.3	**56.2 ± 6.4**	**< 0.001***
Weight, kg	144.7 ± 22.2	109.6 ± 21.7	< 0.001*
BMI, kg/m²	51.78 ± 6.31	39.3 ± 7.0	< 0.001*
TBWL, %	23.6 ± 12.9		
ASA III and above, N (%)	60 (66.7%)	49 (54.4%)	0.093
CCI > 1, N (%)	16 (17.8%)	18 (20.0%)	0.703
Diabetes, N (%)	21 (23.3%)	6 (6.7%)	0.003

* Unpaired two-tailed t-test; chi-square test; unmarked p values: Fisher's exact test.

BMI = body mass index; TBWL = total body weight loss; ASA = American Society of Anesthesiologists physical status; N = number; CCI = Charlson Comorbidity Index.

Post-Arthroplasty Outcomes

Post-operative outcomes following lower limb arthroplasty in patients with prior bariatric surgery were comparable to those of propensity-matched controls (Table 3).

Table 3
Outcomes after arthroplasty

Operative time, median (IQR, range), minutes	**Bariatric surgery**	**Matched controls**	**p value**
	104 (50, 48–225)	**96.5 (53.3, 45–234)**	**0.179**
- THA	104 (138, 48–225)	99 (35, 45–190)	0.608
- TKA	102 (56.3, 51–177)	95 (52, 45–234)	0.213
LOS initial admission, median (IQR, range), days	3 (2, 1–112)	3 (2, 1–17)	0.450
Total LOS median (IQR, range), days	4 (2, 1–112)	3.5 (2, 1–26)	0.506
Discharge destination (usual residence), N (%)	84 (93.3%)	175 (97.2%)	0.127
Unplanned ICU admission, N (%)	3 (3.3%)	0	0.065
Mortality within 1 year, N (%)	0	0	
Unplanned RTT within 30 days, N (%)	2 (2.2%)	1 (0.6%)	0.258
Unplanned RTT within 1 year, N (%)	6 (6.7%)	6 (3.3%)	0.223
Readmission within 30 days, N (%)	6 (6.7%)	16 (8.9%)	0.641
Readmission within 1 year, N (%)	11 (12.2%)	26 (14.4%)	0.709
Any complication	15 (16.7%)	30 (16.7%)	0.999
Major complication – Clavien–Dindo grade ≥ 3	6 (6.7%)	5 (2.8%)	0.188
- Unplanned ICU admission for cardiopulmonary issues	2	0	
- Washout for joint infection	2	2	
- Manipulation under anesthetic	1	2	
- Washout for wound infection	0	2	
Direct surgical complication, N (%)	12 (13.3%)	23 (12.8%)	0.898
Medical/ indirect complication, N (%)	3 (3.3%)	11 (6.1%)	0.398
Bleeding requiring transfusion/RTT, N (%)	5 (5.6%)	7 (3.9%)	0.542
All acute infection, N (%)	6 (6.7%)	10 (5.6%)	0.786
Joint infection, N (%)	3 (3.3%)	3 (1.7%)	0.404
Wound infection/ dehiscence, N (%)	1 (1.1%)	9 (5.0%)	0.067

Operative time, median (IQR, range), minutes	Bariatric surgery	Matched controls	p value
	104 (50, 48–225)	**96.5 (53.3, 45–234)**	**0.179**
Iatrogenic fracture, N (%)	2 (2.2%)	1 (0.6%)	0.258
Joint dislocation, N (%)	0	0	
Venous thromboembolism, N (%)	0	4 (2.2%)	0.315
Cerebrovascular accident, N (%)	0	1 (0.6%)	0.999
Acute coronary syndrome, N (%)	0	0	
Respiratory complication, N (%)	0	1 (0.6%)	0.999
Acute kidney injury/ acute on chronic kidney injury, N (%)	0	5 (2.8%)	0.328
Gastrointestinal complications, N (%)	0	1 (0.6%)	0.999
Composite adverse event, N (%)	17 (18.9%)	34 (18.9%)	0.999

 Mann–Whitney test; chi-square test; unmarked p values: Fisher's exact test.

IQR = interquartile range; N = number; THA = total hip arthroplasty; TKA = total knee arthroplasty; LOS = length of stay; ICU = intensive care unit; RTT = return to the operating room.

Primary outcomes

The total operative time was similar between the bariatric surgery cohort and controls (median 104 vs 96.5 minutes, p = 0.179). The composite adverse post-arthroplasty outcome was identical (both 18.9%, p = 0.999).

Secondary outcomes

The median total hospital length of stay did not differ significantly between cohorts (4 vs 3.5 days; p = 0.506). Most patients in both groups were discharged directly to their usual residence (93.3% vs 97.2%, p = 0.127). Readmission rates, unplanned return to the operating room, and overall complication rates were comparable between cohorts (all p > 0.05). There were no deaths within one year in either group. Two unplanned ICU admissions occurred in the bariatric surgery group for postoperative transient hypotension. Major complications (Clavien–Dindo grade ≥ 3) occurred at similarly low rates (6.7% vs 2.8%, p = 0.188). There was no mortality within 1 year of surgery.

The rates of surgical and medical complications, as well as bleeding, thromboembolic events, and acute kidney injury, did not differ significantly between cohorts (all $p > 0.05$). The rates of all acute infections were similar (6.7% vs 5.6%, $p = 0.786$). Deep joint infections occurred in 3 patients in each cohort. Notably, the bariatric surgery cohort had a lower incidence of wound complications (infection and dehiscence) than matched controls; however, this difference did not reach statistical significance (1.1% vs 5.0%, $p = 0.067$).

Factors associated with adverse post-arthroplasty outcomes

On multivariable logistic regression, bariatric surgery was not associated with the composite adverse outcome, reoperation, surgical complications, medical complications, major complications (Clavien-Dindo grade ≥ 3) or prolonged length of stay (≥ 4 days). In contrast, higher BMI at the time of arthroplasty was consistently associated with increased risk, including the composite adverse outcome (odds ratio [OR] 1.068, 95% confidence interval [CI] 1.015–1.124; $p = 0.011$), reoperation (OR 1.131, 95% CI 1.021–1.253; $p = 0.018$), surgical complications (OR 1.107, 95% CI 1.104–1.178; $p = 0.001$), and prolonged hospitalization (OR 1.081, 95% CI 1.038–1.126; $p < 0.001$), indicating that obesity rather than prior bariatric surgery is the primary independent driver of adverse outcomes.

Discussion

In this propensity-matched retrospective cohort study, prior bariatric surgery was associated with postoperative arthroplasty outcomes comparable to those of matched controls without bariatric surgery. Operative time, overall complication rates, major complications, readmission, return to the operating room, and mortality were similar between groups, supporting the safety of arthroplasty in patients who have previously undergone bariatric surgery. By matching the body mass index and key perioperative risk factors at the time of arthroplasty, we were able to isolate the independent association between bariatric surgery and arthroplasty outcomes with greater methodological rigor than prior reports.

Large administrative database studies examining this question have reported heterogeneous findings. United States Medicare data published in 2016 showed higher 30-day and 2-year surgical complications in patients with prior bariatric surgery than in normal-BMI controls (BMI 20–35 kg/m²) who underwent TKA [15]. Similarly, Medicare data on THA published in 2018 reported higher rates of dislocation and revision [16]. On the contrary, more recent PearlDiver analyses suggest that complication rates in patients with prior bariatric surgery are comparable to those in patients with BMI 20–35 kg/m², including periprosthetic joint infection and revision [17]. However, these large-database studies lack accurate BMI data and detailed perioperative risk adjustment, thereby limiting direct comparison.

The methodology most closely aligned with our study is the Mayo Clinic cohort study by Martin et al. The study matched 91 patients who underwent bariatric surgery prior to TKA with controls, matching for BMI at arthroplasty, sex, and year of TKA [13]. They reported higher re-operation (HR 2.4) and revision (HR

2.2) rates in the bariatric surgery cohort but similar overall complication and infection rates. However, baseline physical status and burden of associated medical problems, particularly diabetes, were not incorporated into matching, raising the possibility of residual confounding. A later Mayo study by Ryan et al. similarly reported higher revision and reoperation rates following TKA compared with controls with BMI < 40 kg/m², although BMI itself was not included in the propensity score matching [18].

In contrast, we found that patients with prior severe obesity who underwent bariatric surgery achieved similar operative times and postoperative outcomes on par with non-bariatric surgery controls with similar BMI at arthroplasty, across all major endpoints. This supports the safety of lower limb arthroplasty in patients who have previously undergone bariatric surgery. Consistent with these findings, multivariable regression demonstrated that prior bariatric surgery was not independently associated with adverse outcomes. However, higher BMI at the time of arthroplasty was a significant predictor of complications. This suggests that obesity itself, rather than bariatric surgery, is the primary driver of postoperative risk. The more granular and multifaceted nature of risk adjustment may also explain why our findings differ from those of the large administrative database and previous matched institutional studies.

In our study, patients experienced substantial weight loss at approximately 3 years post-bariatric surgery, along with a marked reduction in diabetes prevalence. The ASA and CCI also improved in one in five bariatric surgery patients. The metabolic improvement may mitigate perioperative risks associated with severe obesity, particularly inflammation, impaired wound healing, and cardiovascular stress. Given that elevated BMI is consistently associated with poorer outcomes following joint arthroplasty, bariatric surgery may be considered a risk-modifying intervention to optimize patients prior to arthroplasty, particularly for those with severe obesity who may otherwise face increased perioperative risk.

Several limitations warrant acknowledgment. Its retrospective design carries the potential for unmeasured confounding despite robust matching. The sample size limits the power to detect differences in uncommon outcomes, such as joint infection and revision. Outcomes were assessed up to 1 year; therefore, we could not evaluate longer-term implant survivorship. Lastly, the retrospective design restricted the assessment of metabolic and nutritional status, micronutrient deficiencies, and body composition. Future prospective studies incorporating detailed nutritional and metabolic markers are needed to further clarify how physiological recovery and biological changes after bariatric surgery influence arthroplasty outcomes.

Conclusion

Taken together, these findings indicate that prior bariatric surgery does not independently increase the risk of adverse arthroplasty outcomes when BMI and perioperative associated medical problems are carefully matched. Notably, patients with prior severe obesity who underwent bariatric surgery achieved outcomes comparable to non-bariatric controls. BMI at the time of arthroplasty was associated with increased perioperative risk. This highlights the importance of evaluating patients based on their current

metabolic and risk profiles rather than bariatric history alone. Bariatric surgery should be considered as one of the strategies to optimize patients with severe obesity before joint arthroplasty.

Declarations

Conflict of Interest: All authors declare that they have no conflicts of interest.

Ethical Approval: This study was approved by the institutional Human Research Ethics Committee (approval number blinded for review). All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its later amendments.

Informed Consent: The requirement for informed consent was waived by the ethics committee due to the retrospective nature of the study.

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