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Brief communication

Effect of morbid obesity on patient-reported outcomes in total joint arthroplasty: a minimum of 1-year follow-up

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ABSTRACT

The objective of this study is to explore the effect of morbid obesity on patient-reported outcomes in primary total joint arthroplasty. We retrospectively reviewed 755 primary total joint arthroplasty cases with a minimum of 1-year follow-up. Two groups were compared: (1) patients with BMI < 40 and (2) those with BMI ≥ 40. The primary outcome was the difference in Short Form-12 physical component summary, Short Form-12 mental component summary, Western Ontario and McMaster Universities Osteoarthritis Index, and patient satisfaction. Multivariate analyses were performed to control for potential confounding factors. 37 patients (5%) were morbidly obese. Morbidly obese patients undergoing total knee arthroplasty had significantly lower net gains in their Short Form-12 physical component summary ($P = .008$), Short Form-12 mental component summary ($P = .049$), and Western Ontario and McMaster Universities Osteoarthritis Index ($P = .009$) in the first 6 months only. For total hip arthroplasty, morbid obesity did not affect any of the outcomes measured ($P > .05$). There was also no difference in patient satisfaction rates between the two groups ($P = .401$ and .143 for total hip arthroplasty and total knee arthroplasty, respectively). The impact of morbid obesity on patient-reported outcomes appears to be limited to total knee arthroplasty only in the initial 6 months after surgery.

Introduction

Obesity is an epidemic in the United States with an estimated prevalence of 34% [1]. Among patients undergoing primary total joint arthroplasty (TJA), the prevalence of morbid obesity, defined as having a body mass index (BMI) ≥40, has been reported to range from 7% to 12.5% [2-4]. Aside from having excessive amount of body fat, obesity is a complex disorder often associated with a number of comorbidities including heart disease, diabetes mellitus, sleep apnea, respiratory problems, and stroke [5]. Obesity is also a significant risk factor for osteoarthritis [6-8]. As the obesity rates are projected to increase in the United States, the demand for TJA among obese patients is therefore likely to increase as well [9].

The impact of obesity in lower extremity TJA, particularly total knee arthroplasty (TKA), has been widely established. This includes higher rates of post-operative complications, such as infection [10-12], all-cause revision surgery [12], and mortality [2]. Obesity is also associated with increased operative time, hospital length of stay, and readmission rates [13,14]. However, when it comes to patient-reported outcome (PRO) measures, the impact of obesity becomes less clear due to conflicting reports [3,4,11,15,16] likely reflecting geographic variations, outcome measures used, research methodology, and severity of obesity (all obese patients vs morbidly obese). In addition, most previous studies have focused on TKA, leaving limited information on the effect of obesity on PROs following total hip arthroplasty (THA).

The purpose of this study is to assess the impact of morbid obesity on PROs in lower extremity TJA. The specific study questions were as follows: (1) Is there an association between morbid obesity

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and a patient's pre-operative general and disease-specific health? (2) Does morbid obesity influence the response to TJA? (3) Is there variability in outcomes based on surgery type (THA vs TKA)?

Material and methods

Institutional Review Board approval was obtained. Our prospectively collected institutional joint database was queried for all primary hip and knee arthroplasties (THA and TKA). Non-elective, bilateral, and tumor-related procedures were excluded. Additionally, in order to avoid any confounding effects, patients undergoing a second arthroplasty within 12 months from the initial procedure were excluded. Seven hundred seventy-nine procedures met the aforementioned criteria, of which 24 had missing data and were excluded, leaving 755 procedures available for analysis.

Patient characteristics collected were age, sex, American Society of Anesthesiologists physical classification system, educational level, smoking status, race, marital status, and insurance type. All patients had baseline Short Form-12 physical and mental component summaries (SF-12 PCS and SF-12 MCS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), which were re-assessed at 6 and 12 months post-operatively. In addition, patient satisfaction was assessed much later in the post-operative period by asking each patient over telephone "On a scale of 0-10, with 0 being completely not satisfied and 10 being absolutely satisfied, how satisfied are you with your hip or knee replacement?" Two groups were compared: patients with BMI ≥40 indicating morbid obesity and those with BMI <40. The primary outcome measures were differences in SF-12 PCS, SF-12 PCS, WOMAC, and satisfaction between the 2 groups.

Results were described using mean and standard deviation for continuous variables, and frequency and proportion for categorical variables. Mixed effects linear regression was used to examine differences in the study outcomes. The alpha level for all statistical tests was set at 0.05. All statistical analyses were performed using Stata Statistical Software (StataCorp LLC, College Station, TX).

Results

Seven hundred fifty-five procedures were included in the analysis (404 THAs and 351 TKAs). Morbidly obese patients had higher baseline comorbidity and mental health score (American Society of Anesthesiologists physical classification system 2.2 vs 2.5, $P = .0279$ and SF-12 MCS 54 vs 59, $P = .0256$). There were no differences with respect to age, sex, surgical indication, smoking status, race, marital status, insurance type, SF-12 PCS, or WOMAC. Table 1 summarizes the baseline characteristics of the study groups.

For TKA, morbidly obese patients experienced a decline in their SF-12 MCS by 6 months post-operatively compared to those without morbid obesity ($P = .049$). Morbidly obese patients also had lower improvements in SF-12 PCS and WOMAC at 6 months ($P = .008$ and .009, respectively). However, by 12 months post-operatively, neither the net changes nor the absolute scores for any of the measured outcomes were significant. In addition, at a mean follow-up of 40.6 ± 19.0 months, the satisfaction rates were similar between the 2 groups (8.5 vs 7.9, $P = .143$). Tables 2 and 3 summarize the changes and absolute outcome scores for TKA adjusted for baseline differences.

For THA, there were no significant differences in either the net changes or absolute scores for any of the measured outcomes at 6 and 12 months post-operatively. In addition, at a mean follow-up of 38.2 ± 19.1 months, the satisfaction rates were similar between the 2 groups (8.4 vs 8.8, $P = 0.401$). Tables 4 and 5 summarize the changes and absolute outcome scores for THA adjusted for baseline differences.

Table 1
Baseline characteristics for the study groups.

Variable	Group 1: BMI < 40 (N = 718)	Group 2: BMI ≥ 40 (N = 37)	*P* value
Demographic factors			
Age	60.2 ± 12.1	60.1 ± 9.0	.9567
Sex			.283
Male	356 (50%)	15 (41%)	
Female	362 (50%)	22 (59%)	
ASA classification	2.2 ± 0.5	2.5 ± 0.5	.0279
Diagnosis			.070
Non-primary osteoarthritis	386 (54%)	5 (14%)	
Primary osteoarthritis	332 (46%)	30 (86%)	
Educational level			.675
Primary/secondary school	338 (49%)	17 (46%)	
College/university	345 (51%)	20 (54%)	
Smoking status			.411
Never/former	593 (86%)	30 (81%)	
Active	97 (14%)	7 (19%)	
Race			.447
White	552 (77%)	30 (83%)	
Black	89 (12%)	3 (8%)	
Hispanic	53 (7%)	1 (3%)	
Other	20 (3%)	2 (6%)	
Marital status			.428
Married/living with significant other	325 (47%)	20 (54%)	
Single/divorced/widowed/ separated	361 (53%)	17 (46%)	
Payer type			.415
Commercial	198 (28%)	14 (38%)	
Medicare	252 (35%)	12 (32%)	
Medicaid	259 (36%)	11 (30%)	
Patient-reported outcome measures			
SF-12 MCS	54 ± 14	59 ± 14	.0256
SF-12 PCS	27 ± 9	27 ± 9	.7420
WOMAC	62 ± 21	58 ± 15	.1024

ASA, American Society of Anesthesiologists physical classification system.
Values are presented as mean and standard deviation or as frequency of occurrence.

Discussion

In this study, we investigated the effect of morbid obesity on PROs following primary THA and TKA. The prevalence of morbid obesity was 5%. Morbid obesity was associated with higher comorbidity and lower mental health at baseline. Post-operatively, there was a differential effect for morbid obesity based on procedure type (THA or TKA). For THA, both the net gains and absolute outcome scores were not affected by morbid obesity. For TKA, however, morbidly obese patients had slower gains in their SF-12 PCS, SF-12 MCS, and WOMAC during the first 6 months after surgery. Beyond 6 months, these differences became insignificant with morbidly obese patients achieving comparable absolute outcome scores to those with BMI <40 at 1-year follow-up. In addition, the satisfaction rates were similar between the 2 BMI groups for both THA and TKA.

Table 2
Changes in outcomes over time for total knee arthroplasty after adjusting for baseline differences.

Patient-reported outcome measure	Follow-up period (mo)	Group 1: BMI < 40 (N = 332)	Group 2: BMI ≥ 40 (N = 19)	*P* value
SF-12 MCS	6	0.6	−6.0	.049
	12	0.4	0.0	.906
SF-12 PCS	6	15.6	6.3	.008
	12	15.6	12.5	.377
WOMAC	6	−39.9	−23.3	.009
	12	−43.0	−32.6	.116

Values are presented as mean difference between baseline and indicated follow-up interval. Negative changes in WOMAC indicate improvement.

Table 3
Absolute outcome scores for total knee arthroplasty adjusted for baseline differences.

Patient-reported outcome measure	Follow-up period (mo)	Group 1: BMI < 40 (N = 332)	Group 2: BMI ≥ 40 (N = 19)	*P* value
SF-12 MCS	6	54.5	54.0	.445
	12	56.3	60.1	.263
SF-12 PCS	6	43.3	33.5	.002
	12	43.4	39.6	.252
WOMAC	6	19.4	33.0	.021
	12	16.3	23.4	.228
Satisfaction (0-10)	40.6 ± 19.0	8.5	7.9	.143

Lower WOMAC scores indicate better disease-specific symptoms.

Table 5
Absolute outcome scores for total hip arthroplasty adjusted for baseline differences.

Patient-reported outcome measure	Follow-up period (mo)	Group 1: BMI < 40 (N = 386)	Group 2: BMI ≥ 40 (N = 18)	*P* value
SF-12 MCS	6	55.5	58.1	.486
	12	54.6	58.6	.268
SF-12 PCS	6	43.5	46.7	.295
	12	45.6	44.2	.650
WOMAC	6	18.8	6.7	.056
	12	14.5	6.3	.185
Satisfaction (0-10)	38.2 ± 19.1	8.4	8.8	.401

Negative changes in WOMAC indicate higher improvement. Lower WOMAC scores indicate better disease-specific symptoms.

There have been numerous reports on the effect of obesity on PROs after TKA although with varying results. Rajgopal et al. [4] prospectively followed 550 patients who underwent primary TKA for primary osteoarthritis between 1987 and 2004 at a single Canadian institution. The prevalence of morbid obesity was 12.5%. Although morbidly obese patients had lower WOMAC, SF-12 PCS, and SF-12 MCS scores at 1-year follow-up, the net pre- to post-operative improvements across these outcomes were similar. Giesinger et al. [3] retrospectively reviewed 402 primary TKAs performed at a single academic center in England. The prevalence of morbid obesity was 7%. At 12 months post-operatively, higher BMI did not affect the Oxford Knee Score or general health well-being, but it was associated with greater awareness of the prosthetic knee and lower patient satisfaction. In another retrospective review of 7733 patients who underwent primary TKA in Singapore, Chen et al. [17] found greater improvement in Oxford Knee Score and Knee Society Knee Score at 2 years of follow-up among morbidly obese patients, and comparable improvements in Knee Society Function Score, SF-36 PCS, and SF-36 MCS.

Unlike TKA, few studies explored the effect of morbid obesity on PROs following THA. Deakin et al. [18] retrospectively reviewed 906 primary THAs and found lower Oxford Hip Score among morbidly obese patients up to 2 years post-operatively. Yeung et al. [19] retrospectively reviewed 2026 primary THAs stratified into 2 groups (BMI <30 vs BMI ≥30). At a mean follow-up of 6.3 years, obese patients had lower Harris Hip Score, but equivalent satisfaction scores compared to non-obese patients. Other studies demonstrated no effect for morbid obesity on PROs following primary THA. Bennett et al. [20] found no differences in pre- to post-operative improvements between morbidly obese patients and those with normal BMI at 1-year follow-up. A systemic review by Barrett et al. [21] also found no differences in the functional outcomes between patients with BMI <35 and those with BMI ≥35 at a minimum of 2 years of follow-up.

Our study should be interpreted in the context of some limitations. First, it is a retrospective review with a low level of evidence. Second, there were very few patients with BMI ≥40—even less when divided into THA and TKA—making any conclusions difficult to substantiate. Third, we did not exclude underweight patients (defined as BMI ≤18.5). There were only 2 such patients in the entire study cohort (1 THA and 1 TKA). Fourth, with a relatively short follow-up, no conclusions can be made regarding the effects of morbid obesity beyond 1 year after surgery.

Table 4
Changes in outcomes over time for total hip arthroplasty after adjusting for baseline differences.

Patient-reported outcome measure	Follow-up period (mo)	Group 1: BMI < 40 (N = 386)	Group 2: BMI ≥ 40 (N = 18)	*P* value
SF-12 MCS	6	2.8	0.8	.605
	12	1.9	1.3	.872
SF-12 PCS	6	17.2	20.4	.385
	12	19.4	17.9	.683
WOMAC	6	−47.7	−52.8	.469
	12	−52.0	−53.1	.870

Values are presented as mean difference between baseline and indicated follow-up interval. Negative changes in WOMAC indicate improvement.

Conclusions

In conclusion, the impact of morbid obesity on PROs following primary lower extremity TJA appears to be limited to TKA only in the initial 6 months after surgery. Specifically, morbidly obese patients are likely to experience slower recovery during this period. Beyond 6 months, morbid obesity does not appear to affect patients' perception of their health or satisfaction. Larger studies are needed to confirm these preliminary findings to inform clinical practice.

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