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Total Joint Arthroplasty in the Morbidly Obese: How Body Mass Index ≥40 Influences Patient Retention, Treatment Decisions, and Treatment Outcomes

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ABSTRACT

Background: The United States is in an obesity epidemic. Obesity has multiple common comorbid conditions, including lower extremity arthritis. We sought to examine the course of treatment for a population with body mass index (BMI) ≥40 kg/m^2 and osteoarthritis (OA) of the hip or knee. We investigated decision criteria that influenced arthroplasty surgeons to recommend nonoperative management vs total joint arthroplasty (TJA). For those patients who ultimately received TJA, we compared outcomes in this population to those with BMI <40 kg/m^2.

Methods: This study retrospectively reviewed 158 new patients with BMI ≥40 kg/m^2 and moderate/severe OA of the hip or knee. Demographics, comorbidity profiles, and weight loss were compared between groups that underwent TJA and those that did not. The arthroplasty database was used to identify patients who underwent TJA during 2016-2018 (N = 1473). Comorbidities, readmissions, surgical site infections, and overall complications were compared between those with BMI ≥40 kg/m^2 and BMI <40 kg/m^2.

Results: About 51.3% of new patients with BMI ≥40 kg/m^2 and moderate/severe OA did not return for a second clinic visit. Of those who did return, 42.9% eventually underwent surgery. BMI was higher in single visit patients vs those with multiple visits (49.5 vs 46.3 kg/m^2, $P < .001$), no difference in those scheduled on an "as-needed" basis vs a specific return date ($P = .18$), and did not change significantly during the 2-year follow-up ($P = .41$). Patients who underwent TJA had a lower mean BMI at presentation than their nonoperative counterparts (44.5 vs 47.6 kg/m^2, $P < .01$) and demonstrated significant weight loss prior to surgery (44.5 vs 42.6 kg/m^2, $P < .05$). When comparing patients with BMI ≥40 kg/m^2 vs BMI <40 kg/m^2, overall complications were not higher in the BMI ≥40 kg/m^2 group, although surgical site infections were higher in those undergoing total hip arthroplasty with BMI ≥40 kg/m^2 (0.3% vs 3.1%, $P < .05$).

Conclusion: A majority of patients with BMI ≥40 kg/m^2 and moderate/advanced OA will be lost to orthopedic follow-up. A relatively lower BMI indicates a greater chance of retention in care, and ultimately surgery, but does not influence surgeons' recommendations to continue orthopedic management. Patients who persist in seeking treatment, lose significant weight, and exhaust nonoperative alternatives may be suitable for TJA despite a BMI ≥40 kg/m^2, with an overall complication rate of 4.3%. However, only 9% of patients at 2-year follow-up achieved BMI <40 kg/m^2 and only 20% of surgeries were performed on patients who had achieved this proposed cutoff.

Obesity remains an epidemic in the United States [1]. Obesity has been repeatedly associated with increased osteoarthritis (OA) development in the hip and knee, and a growing proportion of patients presenting to arthroplasty surgeons are obese [2]. Additionally, obesity has been associated with increased complications following joint replacement [3–10]. Higher rates of perioperative complications such as superficial site infections and deep infections

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Table 1
Characteristics of New Patients Presenting to Adult Reconstruction With BMI >40 and Grade 3 or 4 OA During 2014-2016 (N = 158).

Characteristics	Values
Mean age	59.4, SD 9.63
Gender (female)	62 (39)
Mean BMI at presentation	47.9, SD 6.42
Mean BMI at 2+ years of follow-up	47.3, SD 7.08
BMI at 2+ years of follow-up <40	14 (8.9)
Joint	
Knee	127 (80.3)
Hip	27 (17.1)
Knee and hip	4 (2.5)
Grade	
3	37 (23.4)
4	121 (76.6)
Current smoking	23 (14.6)
Mean Charlson index of comorbidities	2.64, SD 2.09
Surgeries	
Patients who underwent surgery	33 (20.9)
Total surgeries, n	44
Surgeries performed on patients with BMI <40	9 (20.1)

Data are represented as n (%) unless otherwise specified.
BMI, body mass index; OA, osteoarthritis; SD, standard deviation.

requiring surgical debridement have been reported in the obese population [6,7]. Additionally, obesity has been found to be associated with higher rates of total joint arthroplasty (TJA) revision and 10-year mortality [7,8]. Furthermore, resource utilization is higher in obese patients, with longer surgical duration and hospital stay [11].

In spite of increased risks, patient-reported outcomes for TJA in the obese population have been as good as outcomes for the non-obese population [12]. Furthermore, TJA has been found to be cost-effective for all obesity levels [13]. The arthroplasty surgeon must therefore weigh the potential consequences of total joint replacement in the morbidly obese patient with the known individual benefits of high patient satisfaction and cost-effectiveness.

Despite the increasing prevalence of obesity and number of obese patients presenting to arthroplasty clinics with moderate/severe OA, there is very little knowledge regarding the course of their treatment. It is not known what proportion of these patients are counseled on weight loss, given a weight loss goal, and manage to meet that goal. It is also not known how many patients are retained in orthopedic care and managed with nonsurgical treatment or TJA, nor is there guidance for determining which patients may be suitable for surgery despite morbid obesity. The purpose of this study is to examine the course of treatment for a population with body mass index (BMI) $\geq$40 kg/m^2 and moderate/severe OA of the hip or knee at 2-year follow-up, to analyze patient factors leading to surgeons' decisions to approve or deny surgical treatment, and to compare TJA surgical outcomes between those with BMI <40 kg/m^2 and those with BMI $\geq$40 kg/m^2.

Materials and Methods

We obtained Institutional Review Board approval for the study, which was performed entirely at the University of Iowa Hospitals and Clinics, a tertiary referral center and public teaching hospital. For patients presenting with BMI $\geq$40 kg/m^2 and primary OA, our initial consultation revolves around healthy weight loss and physical therapy. Patients are given a BMI chart with a weight loss goal in pounds; they are referred to a weight loss clinic to be evaluated by a dietitian, and they are given a physical therapy script for 3 months. They are also counseled on other means of health optimization including smoking cessation and blood glucose control, and a return visit for 3-month follow-up is offered. Thus, for each morbidly obese patient, a therapeutic plan for weight loss and follow-up is discussed with the patient and documented during the clinic encounter. Patients are further evaluated at subsequent clinic visits to assess progress.

The electronic medical record was queried to identify all new patients who presented to the adult reconstruction clinic with a BMI $\geq$40 kg/m^2 presenting with a chief complaint of hip or knee pain and radiographic evidence of Kellgren-Lawrence (KL) grade 3 or 4 OA during the study period of 2014-2016. These patients were separated into one of the 3 groups based on the treatment they received during the 2-year follow-up study period: (1) TJA at University of Iowa Hospitals and Clinics; (2) conservative treatment, including weight loss management, steroid/hyaluronic acid injection, nonsteroidal anti-inflammatory medications, heel wedges, knee braces, and physical therapy; and (3) lost to orthopedic follow-up. Demographic and comorbidity profiles were compared statistically between all 3 groups. Two-year follow-up data for

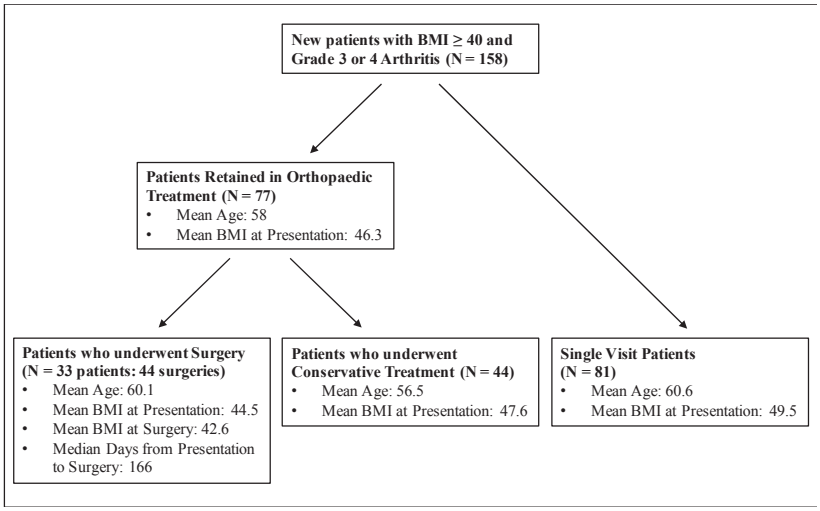

Fig. 1. Patients separated into groups based on whether or not they continued to seek treatment at the adult reconstruction clinic after their initial visit; those retained in treatment were subdivided based on the treatment modality they received (surgery vs conservative treatment).

Table 2
Characteristics of Patients Retained in Treatment vs Single Visit Patients.

Characteristics	Retained in Treatment (N = 77)	Single Visit Patients (N = 81)	*P* Value
Mean age	58, SD 9.15	60.6, SD 9.96	.09495
Gender (female)	47 (61.0)	49 (60.5)	.9441
Mean BMI at presentation	46.3, SD 5.47	49.5, SD 6.3	**.0008**
Mean BMI at 2+ years of follow-up	45.5, SD 7.21	49.1, SD 6.53	**.00127**
BMI at 2+ years of follow-up <40	13 (16.9)	1 (1.2)	**.0005**
Joint			
Knee	64 (83.1)	63 (77.8)	
Hip	12 (15.6)	15 (18.5)	.4414
Knee and hip	1 (1.3)	3 (3.7)	
Grade			
3	19 (24.7)	18 (22.2)	.564
4	58 (75.3)	63 (77.8)	
Current smoking	9 (11.7)	14 (17.3)	.3188
Mean Charlson index of comorbidities	2.6, SD 2.19	2.66, SD 2.02	.7277

Follow-up data for single visit patients were obtained from hospital visits outside the orthopedics department. Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.

patients lost to orthopedic follow-up were obtained through review of hospital visits outside the orthopedics department.

Additionally, to compare TJA surgical outcomes between those with BMI <40 kg/m^2 and BMI ≥40 kg/m^2, data were obtained from the University of Iowa Hospitals and Clinics hospital quality dashboard committee, which includes demographic information, comorbidities, intraoperative variables, and 30-day postoperative complications for all patients who undergo total hip (THA) and total knee (TKA) arthroplasty. To maximize sample size, patient data were collected from the earliest date of our institution's current database. THA data were first recorded in our database in 2016 and TKA data were first recorded in 2017. Data were thus available for the time periods of 2016-2018 for primary THA and 2017-2018 for primary TKA, using the Current Procedural Terminology codes 27130 and 27447, respectively. There were 864 patients who underwent THA and 609 patients who underwent TKA during these time periods. Variables analyzed included patient demographics (age, gender, joint, side, and BMI), comorbidities (diabetes, coronary artery disease, chronic obstructive pulmonary disease, and chronic kidney disease), 30-day readmissions, surgical duration, hospital length of stay, surgical site infections (SSIs), and overall complications. Overall complications included superficial and deep SSIs, wound disruption, pneumonia, unplanned intubation, pulmonary embolism, progressive renal insufficiency, urinary tract infection, cerebral vascular accident, myocardial infarction, blood transfusion, vein thrombosis, *Clostridium difficile* infection, and sepsis.

Statistical Analysis

Statistical analyses were performed using SAS 9.4 statistical software. There were multiple patients with 2 or more surgeries during the study time period. As there was a correlation between these duplicate patients, demographic data from each participant's first clinic encounter was used for analysis. Data were tested for normality and presented as means (standard deviation) with comparison using a 2-tailed *t*-test or the Wilcoxon test as appropriate. Frequencies were compared using either the chi-squared or Fisher's exact test.

Results

We identified 174 new patients with BMI ≥40 kg/m^2 and a chief complaint of hip or knee pain in an arthroplasty clinic from 2014 to 2016. Of these, 158 patients had KL grade 3 or 4 OA. The majority of the patients were female (62%), and the mean BMI was 47.9 kg/m^2 (Table 1). Of these 158 patients, most were counseled on nonoperative management of arthritis and weight loss, but did not follow-up in clinic after this discussion (81 patients, 51%). Of the patients who returned for a follow-up visit (77 patients, 49%), 39 had lost weight (51%) and 33 patients (43%) had total hip or total knee replacement within 2 years. About 20.1% of surgeries were completed on patients who had reached a BMI of <40 kg/m^2. Of all patients with an initial BMI ≥40 kg/m^2, only 8.9% reached a BMI of <40 kg/m^2 by final follow-up.

When comparing the patients retained in treatment with the patients who attended only a single visit in the adult reconstruction clinic, the former had a significantly lower BMI on presentation (46.3 vs 49.5 kg/m^2, $P < .001$), as well as on 2-year follow-up (45.5 vs 49.1 kg/m^2, $P < .01$), and also were more likely to reach a BMI of <40 kg/m^2 (16.9% vs 1.2%, $P < .001$) (Fig. 1 and Table 2). Weight distribution in those retained in treatment showed a leftward skew as did the surgical group (Figs. 2 and 3). Neither the grade of OA nor Charlson Comorbidity Index was statistically different between the 2 groups. There was no difference in BMI between those recommended by surgeons to follow-up on an "as-needed" basis vs those

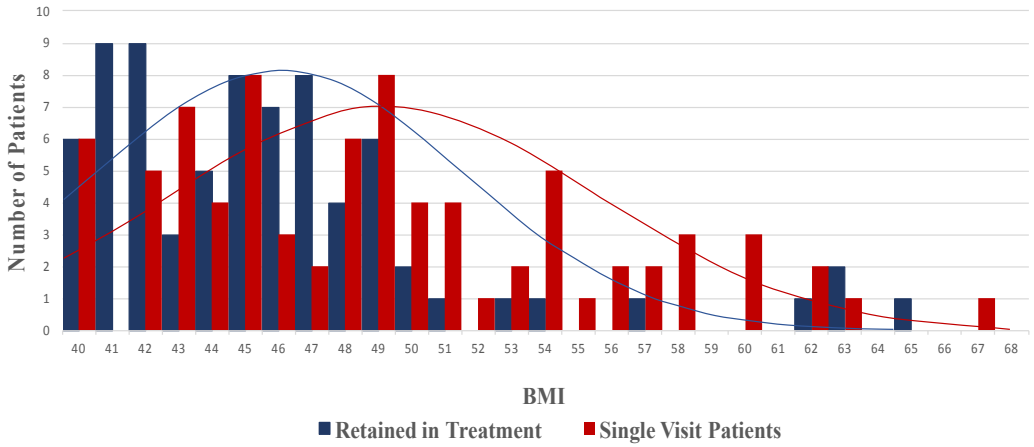

Fig. 2. BMI distribution of patients retained in treatment vs single visit.

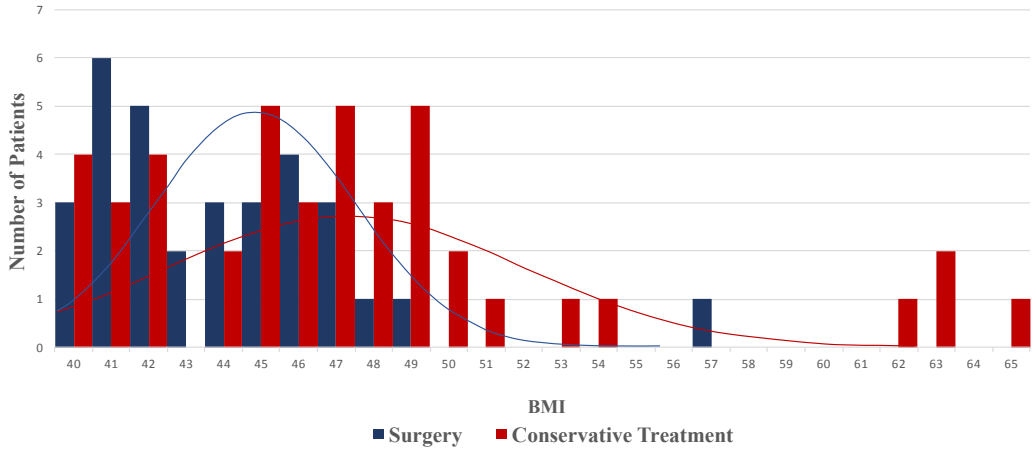

Fig. 3. BMI distribution of patients who underwent surgery vs conservative treatment.

scheduled for a specific return date (Table 3). When comparing the patients who underwent surgery with those who were treated conservatively, the surgical cohort had a significantly lower BMI (44.5 vs 47.6 kg/m^2, $P < .01$). However, they did not have a lower BMI at 2-year follow-up (44.1 vs 46.5 kg/m^2, $P = .13$), nor were they more likely to reach a BMI of <40 kg/m^2 (21.2% vs 13.6%, $P = .38$) (Table 4). There was no difference in KL grade, smoking status, or Charlson Comorbidity Index.

For overall weight loss, no group lost a statistically significant amount of weight during the study period (Table 5). However, the group that underwent surgery had a statistically significant weight reduction between first clinic visit and date of surgery (BMI 44.5 vs 42.6 kg/m^2, $P < .05$).

Data were first recorded in the quality dashboard database in 2017 for TKA and in 2016 for THA, yielding a 2-year sample for TKA (2017-2018) and a 3-year sample (2016-2018) for THA; there were 609 unique patients who underwent TKA and 864 unique patients who underwent THA during these time periods. These patients were divided into groups based on BMI <40 kg/m^2 and BMI ≥40 kg/m^2. For both TKA and THA, patients with BMI ≥40 kg/m^2 were on average younger than those with BMI <40 kg/m^2 ($P < .01$) (Tables 6 and 7). For THA, there was a higher proportion of females ($P < .05$) and a lower rate of smoking ($P < .05$) in patients with a BMI ≥40 kg/m^2 compared to those with BMI <40 kg/m^2 (Table 7).

Among patients who underwent TKA, 30-day overall complications, SSIs, readmissions, surgical duration, and hospital length of stay were not different between the groups (Table 8). For THA, overall complications were not higher in the BMI ≥40 kg/m^2 group (4.1% vs 6.6%, $P < .5$). In contrast, SSIs were statistically higher for BMI ≥40 kg/m^2 ($P < .05$) as was hospital length of stay ($P < .0001$) (Table 9).

Discussion

Numerous studies have shown a precipitous increase in complications after TJA in obese patients, concluding that primary TJA should be restricted or offered cautiously to this high-risk population [5–10]. Indeed, many arthroplasty groups have proposed a cutoff of BMI 40 kg/m^2, above which primary arthroplasty is restricted. Adhering to this cutoff may reduce complications, protecting both patients and surgeons while minimizing healthcare expenditure. Yet, TJA in the morbidly obese population results in a high rate of patient satisfaction and can be cost-effective [12,13]. Thus, the ultimate treatment course—TJA vs continued nonoperative symptom management—can be a complex decision process influenced by patient engagement in care, starting weight and weight change, comorbidity profile, and attempted conservative treatment measures. Despite this complexity, there has been minimal investigation into patient factors that may influence a morbidly obese patient's orthopedic treatment course and engagement in orthopedic follow-up. Prior to this study, it was unclear what proportion of patients would remain in orthopedic care, following presentation to the adult reconstruction clinic, nor what proportion would go on to undergo TJA vs continue with conservative nonoperative management. This study was formulated to address these questions, as well as to examine patient factors that convinced arthroplasty surgeons to offer TJA to some patients with BMI ≥40 kg/m^2.

Table 3
Mean BMI of Patients Scheduled to Follow-Up in the Orthopedic Clinic on an "As-Needed" Basis vs a Specific Scheduled Date.

	As Needed (N = 87)	Scheduled Date (N = 71)	*P* Value
Mean BMI	48.6, SD 6.42	47.3, SD 6.43	.1824

BMI, body mass index; SD, standard deviation.

Table 4
Characteristics of Patients Who Received Surgery vs Conservative Treatment.

Characteristics	Surgery (N = 33)	Conservative Treatment (N = 44)	*P* Value
Mean age	60.1, SD 9.58	56.5, SD 8.59	.08905
Gender (female)	18 (54.5)	29 (65.9)	.3116
Mean BMI at presentation	44.5, SD 3.53	47.6, SD 6.3	**.00644**
Mean BMI at 2+ years of follow-up	44.1, SD 4.41	46.5, SD 8.65	.1269
BMI at 2+ years of follow-up <40	7 (21.2)	6 (13.6)	.3798
Joint			
Knee	26 (78.8)	38 (86.4)	
Hip	7 (21.2)	5 (11.4)	.3563
Knee and hip	0	1 (2.3)	
Grade			
3	5 (15.2)	14 (31.8)	.0932
4	28 (84.8)	30 (68.2)	
Current smoking	2 (6.1)	7 (15.9)	.2861
Mean Charlson index of comorbidities	2.64, SD 1.7	2.58, SD 2.48	.0931

Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.

Table 5
BMI Change From First Visit to Current and BMI Change From First Visit to Time of Surgery.

Group	BMI First Visit	BMI Current	*P* Value
Retained in treatment (N = 77)	46.27	45.45	.4311
Single visit patients (N = 81)	49.48	49.1	.6758
Surgery (N = 33)	44.46	44.12	.7288
Conservative treatment (N = 44)	47.63	46.46	.4705
	BMI First Visit	BMI at Surgery	
Surgery (N = 33)	44.46	42.60	**.03178**

Bolded *P* value for $P < .05$.
BMI, body mass index.

In our analysis of 158 new patients presenting to the adult reconstruction clinic with BMI $\geq$40 kg/m^2 and KL grade 3 or 4 OA, we show that over half of the patients did not return for a second visit. BMI appeared to play an important role, with lower BMI in the group who presented to clinic on multiple occasions vs those with only a single clinic visit. We hypothesized that this relationship between BMI and patient retention may have been heavily influenced by surgeon follow-up recommendations; however, this was not the case. We found no significant difference in BMI between the group of patients who were recommended to follow-up on an as-needed basis vs those given a specific follow-up date. This indicates that arthroplasty surgeons were amenable to continuing care with patients, regardless of patient BMI. However, it also suggests that the prospect of surgery may have been a main driver for patient retention in orthopedic care, and that relatively heavier patients believed that they were less likely to be scheduled for TJA. This was in fact found to be the case; BMI was significantly lower in the cohort that underwent surgery vs those treated with continued nonoperative modalities.

Although BMI was on average lower in the surgical cohort, BMI did not appear to be the only determining factor for undergoing TJA. Indeed, a quarter of the patients who underwent surgery had a BMI >45 kg/m^2 at the time of their surgery. Patients who showed commitment to their care by attending multiple clinic visits, exhausting nonoperative treatment modalities, and successfully losing weight were more likely to undergo surgery. Overall, 20% of all patients with BMI $\geq$40 kg/m^2 underwent TJA within 2 years of presentation, and 43% of patients who attended multiple clinic visits went on to undergo TJA.

Although some patients were able to lose a significant amount of weight during this study period through consistent counseling, diet modifications, exercise, and physical therapy, overall weight loss in this group of morbidly obese patients was low. Only 8.9% of the total cohort was able to reduce their BMI to <40 kg/m^2 and only 20% of the TJAs were performed on patients who had reached this BMI. This indicates that surgeons were often willing to accept the known increased risk of complication when performing TJAs on morbidly obese patients or that they believed the individuals whom they chose for arthroplasty were not representative of the morbidly obese population as a whole, and were better surgical candidates.

Many studies have shown the increased risk of perioperative and long-term arthroplasty complications, including SSIs, periprosthetic infections, readmissions, and mortality for the morbidly obese population [5–8]. Other studies have shown that resource utilization—including surgical duration and hospital length of stay—is also increased in this population. This study adds to the existing body of research by examining the treatment course for morbidly obese patients presenting with moderate/severe OA and analyzing complication rates and resource utilization at an institution that, per protocol, does not immediately offer primary TJA to patients with BMI $\geq$40 kg/m^2. Our analysis of 158 morbidly obese new patients with grade 3 or 4 OA suggests that surgical intervention is a primary motivator for weight loss and orthopedic follow-up, that approximately 20% of patients are eventually selected for surgery in the first 2 years following their initial presentation to the adult reconstruction clinic, and that these patients were deemed to have tried and failed nonoperative treatment modalities.

This study has several limitations. It is a nonrandomized, retrospective, observational study, which may have introduced bias into the results. Additionally, this study was conducted using hospital administrative data, some of which could be missing or inaccurate. Our hospital quality dashboard has a limited number of variables, and all variables were collected in the course of routine patient care, rather than being prospectively planned. The overall number of patients in the study was low, so important differences could have potentially been missed because of low power. Additionally, only 30-day complications were available, and there was not adequate follow-up to examine long-term complications such as revision rates. Also, our hospital serves as a Joint Commission Center of Excellence for TJA, where many resources exist to help

Table 6
Characteristics of Patients Who Received Primary Total Knee Arthroplasty During 2017-2018 by BMI.

Characteristics	BMI <40 (N = 497)	BMI >40 (N = 112)	*P* Value
Mean age	64.6, SD 9.9	61.2, SD 8.78	**.0011**
Gender (female)	270 (54.3)	66 (58.9)	.3763
Current smoking	36 (7.2)	8 (7.1)	.9704
Mean Charlson index	3.1, SD 1.97	2.8, SD 1.61	.4052

Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.

Table 7
Demographic Details of Patients Who Received Primary Total Hip Arthroplasty During 2016-2018 by BMI.

Characteristics	BMI <40 (N = 767)	BMI >40 (N = 97)	*P* Value
Mean age	62.6, SD 13.35	59.3, SD 9.87	**.0031**
Gender (female)	384 (50.1)	62 (63.9)	**.0101**
Current smoking	85 (11.1)	4 (4.1)	**.0336**
Mean Charlson index	2.9, SD 2.07	2.73, SD 2.14	.5241

Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.

Table 8
Total Knee Arthroplasty 30-D Complications, Surgical Site Infections, Readmissions, Surgical Duration, and Hospital Length of Stay by BMI.

Characteristics	BMI <40 (N = 497)	BMI >40 (N = 112)	*P* Value
Mean BMI	31.34, SD 4.81	43.34, SD 3.0	**<.0001**
Overall complications[a]			
Patients with a complication	19 (3.8)	5 (5.2)	.0767
Total complications, n	25	10	
Surgical site infections	1 (0.2)	0	1
Readmissions	16 (3.2)	3 (2.7)	.0804
Mean surgical duration (min)	107.6, SD 26.82	110.8, SD 31.13	.4765
Mean hospital length of stay (d)	2, SD 1.41	2.03, SD 1.53	.6104

Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.
[a] Complications include superficial/deep surgical site infection, wound disruption, pneumonia, unplanned intubation, pulmonary embolism, progressive renal insufficiency, urinary tract infection, cerebral vascular accident, myocardial infarction, blood transfusion, vein thrombosis, *Clostridium difficile* infection, and sepsis.

Table 9
Total Hip Arthroplasty 30-D Complications, Surgical Site Infections, Readmissions, Surgical Duration, and Hospital Length of Stay by BMI.

Characteristics	BMI <40 (N = 767)	BMI >40 (N = 97)	*P* Value
Mean BMI	29.13, SD 5.05	44.8, SD 3.9	**<.0001**
Overall complications[a]			
Patients with a complication	51 (6.6)	4 (4.1)	**.013**
Total complications, n	91	7	
Surgical site infections	2 (0.3)	3 (3.1)	**.0116**
Readmissions	26 (3.4)	7 (7.2)	.0844
Mean surgical duration (min)	103.9, SD 29.36	109.3, SD 31.13	.0697
Mean hospital length of stay (d)	2.13, SD 2.61	2.62, SD 1.93	**<.0001**

Data are represented as n (%) unless otherwise specified.
Bolded *P* value for $P < .05$.
BMI, body mass index; SD, standard deviation.
[a] Complications include superficial/deep surgical site infection, wound disruption, pneumonia, unplanned intubation, pulmonary embolism, progressive renal insufficiency, urinary tract infection, cerebral vascular accident, myocardial infarction, blood transfusion, vein thrombosis, *Clostridium difficile* infection, and sepsis.

care for higher risk populations, so the data may not be translatable to smaller practices. Finally, we do not know the ultimate treatment outcome for patients who attended only a single visit; future studies are needed to follow these patients.

Conclusion

In summary, this study found that the majority of morbidly obese patients presenting with moderate to severe hip and knee OA to the adult reconstruction clinic did not return for a second visit after counseling about weight loss and the risk of TJA in the morbidly obese. A relatively lower BMI indicated a greater likelihood of return to clinic, as well as a greater chance of undergoing surgery during the 2-year follow-up. Twenty percent of all presenting patients and 42.9% of patients with multiple visits went on to have surgery after counseling, health optimization, attempted weight loss, and failed nonoperative management. Complications were relatively low in our cohort with an overall complication rate of 4.3%; however, only 20% of these surgical patients reached the proposed cutoff BMI of <40 kg/m^2.

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