e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(11); 304-308

Original Research Article

Obesity Status-Related Functional Gain and Pain Relief Following Total Joint Replacement

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Received: 16-08-2023 / Revised: 28-09-2023 / Accepted: 27-10-2023
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Conflict of interest: Nil

Abstract

Background: There exists a correlation between obesity and decreased functionality as well as heightened pain both prior to and during complete hip or knee replacement surgeries (THR or TKR). This study conducted an analysis on a substantial and representative cohort of individuals in medical college. The goal was to look at any possible relationships between being obese and changes in pain thresholds and functional ability both before and after surgery.

Methods: Between January 2019 and December 2022, information was gathered from 129 TKR (total knee replacement) patients and 120 THR (total hip replacement) patients. The information included body mass index (BMI) classification, which divides patients into different weight groups, and Knee injury and Osteoarthritis Outcome Score, Hip disability and Osteoarthritis Outcome Score, and Short Form-36 Physical Component Summary (PCS) scores for function for joint pain assessment.

Results: The average age of total hip replacement (THR) recipients was 65 years, with 59% being female, 94% of white ethnicity, and 13 percent severely or morbidly obese. Higher obesity levels were associated with poorer Physical Component Summary (PCS) scores both preoperatively and six months post-surgery, particularly in severely and morbidly obese patients. More obesity correlated with increased initial pain, but greater pain relief after surgery, resulting in similar postoperative pain scores regardless of BMI. The average age of total knee replacement (TKR) patients was 69 years, with 60% of them being female, 92% being Caucasian, and 24% being extremely or morbidly obese. Obesity was linked to lower PCS scores before and after surgery, but postoperative PCS score improvement did not significantly differ by BMI. Initial pain increased with higher obesity levels, but pain relief at the 6-month mark equaled out, leading to similar pain scores among different BMI categories.

Conclusions: Severe or morbidly obese individuals reported significant functional gain and great pain relief six months following total joint replacement (TJR), which was consistent with other patient findings. Even while obesity raises the likelihood of early problems, obesity shouldn't be a barrier to receiving TJR to reduce symptoms.

Keywords: Total knee replacement (TKR), Total joint replacement (TJR), Total hip replacement (THR).

Introduction

Musculoskeletal problems including severe osteoarthritis in the knees and hips are predicted to worsen in the Orissa States as long as obesity rates remain high [1]. Increased incidence of knee and hip osteoarthritis as well as increased utilization of total joint replacements (TJR), specifically total hip replacement (THR) and total knee replacement (TKR), have been associated with higher body mass index (BMI) [4]. Similar to the growth in adult obesity, the yearly number of TJRs has increased during the last thirty years. It is critical to comprehend how obesity affects functional progress and pain alleviation as experienced by patients following TJR in order to guide surgical timing, control patient expectations, and promote patient-surgeon shared decision-making.

Prior research on the relationship between osteoarthritis, TJR outcomes, and obesity has primarily attentive on revision techniques, post-operative complications, and activity levels [3]. While these studies have verified that patients with obesity face higher problems, variations in functional recovery after total joint replacement have also been seen. Moreover, they often used data from surgeries completed more than a decade ago, making them less appropriate to the TJR population of today. Important factors that were frequently disregarded included pre-operative emotional health and pain in other joints, both of which can have an impact on post-TJR function [4].

Surgeons need to have a deeper understanding of how BMI affects symptom alleviation because in a time when value-based payment systems stress early complications, pain relief, and functional improvement as indicators for evaluating surgical outcomes [5]. This knowledge is crucial for having productive conversations with patients, establishing reasonable expectations, and promoting collaborative decision-making regarding the best time for surgery. An investigation to close this knowledge gap in TJR patients was carried out using pre-operative and post-operative data from the nationally representative FORCE-TJR (Function and Outcomes Research for Comparative Effectiveness in Total Joint Replacement) cohort. The purpose of this research was to assess the extent of pain relief and functional improvement that total joint replacement patients with varying degrees of obesity experienced.

Materials and Methods

Data Source and Data Collection

FORCE-TJR is a large prospective cohort of TJR patients from over 100 community orthopedic practices throughout 22 Orissa state and a variety of high-volume medical institutes. Pre-operative data were collected from the surgeons and the patients themselves, and participating surgeons asked all of their TJR patients to take part in FORCE-TJR. Following surgery, patients are routinely followed up with FORCE research staff at 6, 12, 24, and 36 months to gather patient-reported outcome data. Prior to joining the cohort, patients gave their consent, and the appropriate institutional review boards granted ethical approvals for participation in FORCE-TJR.

Study Population

Over 83% of all patients enrolled in the study were treated by 60 orthopaedic surgeons among the first 129 patients who went through primary unilateral TKR and the first 120 patients who went through initial unilateral THR between the January 2019 and December 2022 in the Sriram Chandra Bhanj Medical College and Bhima Bhoi Medical College who finished the 6-month post-operative questionnaire.

Exculsion Patients were excluded if they had the TJR for an acute fracture or malignancy, or if their initial diagnosis was something else, like osteonecrosis or inflammatory arthritis. The inclusion criterion was an initial diagnosis of osteoarthritis. The analysis explicitly took into account individuals for whom valid height and weight data at the time of surgery were available, as well as pre-operative and a six-month post-TJR functional outcome data.

Measures

Questionnaires that were validated, standardized, and structured were used to gather patient-reported data before to and six months after surgery. This thorough approach to data gathering used a variety of techniques, including telephone interviews, in-person clinic visits, mailed paper forms, and online questionnaires customized to the preferences of each patient. The variables of interest for this study encompassed physical function, joint pain, body mass index (BMI), as well as several other factors. These factors included mental health, medical complications, sociodemographic characteristics, and the influence of illness on the musculoskeletal system. These data were deemed pertinent for the purposes of this research endeavor.

1. Pain Severity: The Hip Disability and Osteoarthritis Outcome Score (HOOS) [6] for hips and the Knee injury and Osteoarthritis Outcome Score (KOOS) for knees were used to measure the amount of pain in both the operated-on joint and the contralateral joint. The range of these scores is also 0 for the worst pain and 100 for no pain.
2. Calculating BMI: The patient's height and weight were obtained during the preoperative assessment, or the measurements were taken at the clinical facility. Subsequently, the weight of the individual, measured in kilograms, was then divided by a square of their height, measured in meters, in order to ascertain the BMI expressed in kilograms per square meter (kg/m^2). As per the classification provided by the World Health Organization (WHO) [7], the patient cohort was categorized into five distinct groups based on their preoperative body mass index (BMI) values. These groups include individuals who were classified as underweight (BMI $\leq$ 24.99 kg/m^2), obese (BMI ranging from 30.00 to 34.99 kg/m^2), overweight (BMI ranging from 25.00 to 29.99 kg/m^2), morbidly obese (BMI $\geq$ 40.00 kg/m^2), or severely obese (BMI ranging from 35.00 to 39.99 kg/m^2).
3. Sociodemographic Variables: The sociodemographic characteristics of the patients comprised their age, gender, race, level of education, employment position, and kind of health insurance.
4. Musculoskeletal Burden: The number of hips and knees with moderate to severe pain (based on HOOS or KOOS scores) and moderate to severe low back pain (based on the Oswestry Disability Index) was used to calculate the musculoskeletal burden of illness.
5. Medical Comorbidities: In order to avoid duplication with the previously described musculoskeletal burden index, medical comorbidities were evaluated using the modified Charlson Comorbidity Index, which excluded musculoskeletal diseases.

Statistical Analysis

Covariates included low back pain, the number of additional uncomfortable joints, age, sex, race, education, medical comorbidities, and the hospital's surgery volume in addition to the baseline function and pain score. Patients who had surgery in the same clinic and experienced changes in their PCS and pain scores were regarded as independently and identically normally distributed. After a thorough examination, no obvious violations of the model's assumptions were discovered.

Results

THR

The average age of the 120 THR patients was 64, with 58% of them being female, 24% having just completed high school, and 49% being eligible for Medicare. A total of 41% of the participants reported having one or more comorbidities, 34% had moderate to severe low back pain, and 34% experienced discomfort in their knees or hips in addition to the operated joint. According to BMI, 21 percent of people were obese, 9 percent were extremely fat, and 3 percent were severely obese. Of those, 36 percent were overweight. Twenty-five percent of underweight people were underweight or normal weight. Patients classified as severely and morbidly obese tended to be younger and female in comparison to patients classified as normal weight or obese. They were also more inclined to have medical conditions and to have medium to serious low back pain as well as discomfort in other joints. Those with morbid obesity scored worse on mental health measures than those with other BMI ranges.

Lower PCS scores at baseline and six months after THR were associated with higher levels of obesity. When grouped by BMI status, the mean change in PCS scores from preoperative to postoperative was not significantly different; however, for individuals who were seriously and morbidly obese, the mean change was somewhat lower. Differences in the improvement of postoperative PCS scores became more apparent after covariate adjustment, with patients who were extremely and morbidly obese showing considerably less improvement than their peers.

Higher obese patients had more improvement in the pain score at baseline and six months after the trauma, but they also had lower baseline HOOS pain scores. Patients in all BMI categories reported great pain scores at the 6-month post-THR mark, with mean scores decreasing within a fairly close range. For example, individuals with morbid obesity had a baseline score that was 11.8 points lower than underweight or normal-weight patients (37.2 vs 50.0 points). However, at 6 months, this disparity dropped to 3.2 points (87.4 versus 90.8 points). After accounting for factors, the amount of pain relieved prior to and following surgery did not alter much according on BMI level.

Table 1: Patient Features Overall and by BMI Group

Characteristics	Total
THR group (n =120)	
Male (%)	42.4
Age (yr)	64.2
Current smoker (%)	6.5
≥1 medical comorbidities (%)	41.2
Moderate or severe low-back pain (%)	34.0
≥1 other painful joints (%)	33.7
TKR group (n = 129)	
Male (%)	37.9
Age (yr)	66.0
Current smoker (%)	3.5
≥1 medical comorbidities (%)	47.7
Moderate or severe low-back pain (%)	25.9
≥1 other painful joints (%)	30.4

TKR

The average age of the 129 patients undergoing TKR was 68 years; 60% of the patients were female; 31% of the patients had only completed high school; and 55% of the patients had Medicare insurance. Within the TKR cohort, 26% experienced moderate to severe low back pain, 30% felt discomfort in the low back or in one or more joints besides the one that was replaced, and 48% had one or more concomitant medical problems. Of the individuals who underwent TKR, twelve percent were underweight or had a normal weight, 32 percent were overweight, 28 percent were obese, fourteen percent were severely obese, and eight percent were dangerously obese. Patients with severe and morbid obesity had higher odds of being female, younger; they also had lower odds of living alone and having lower household income and private insurance. The individuals exhibited a higher propensity for medical comorbidities, along with the presence of moderate to serious low back pain, and other

uncomfortable joints. Patients who were morbidly obese scored lower on mental health measures than those in the other BMI groups.

The overall mean was 9.6. Despite covariate adjustment, the results held up well. Individuals with a higher BMI exhibited more pronounced enhancements in pain scores from baseline to 6 months after TKR surgery. However, it is noteworthy that these individuals initially presented with lower (more severe) pain scores according to the Knee injury and Osteoarthritis Outcome Score (KOOS). Irrespective of BMI classification, the pain scores following TKRs were remarkable. Notably, the average pain scores at the 6-month mark exhibited a relatively narrow distribution, except for individuals classified as morbidly obese, who displayed a slightly lower (indicating worse) mean score in comparison to the scores observed in the remaining groups. These results were similar to those obtained after the THRs. At six months, the mean overall pain score was 83.5. Preoperative to postoperative pain alleviation that was covariate-adjusted resembled that of the unadjusted analysis.

Discussion

A deeper comprehension of obesity's impact on post-treatment joint replacement function and pain outcomes is imperative given the rising incidence of obesity and TJR use in the Orissa population. In order to close this information gap, the first norms for TJR patients in the Orissa was created by analyzing data from a sizable, nationally representative cohort of TJR patients from the current day. Based on the available data, it has been observed that individuals who are classified as severely or morbidly obese may exhibit notable enhancements in functional capacity and experience substantial alleviation of pain within a span of six months subsequent to undergoing total joint replacement surgery, akin to their non-obese counterparts. The findings of this study hold significant importance in facilitating healthcare professionals' efforts to educate individuals with severe and morbid obesity regarding anticipated enhancements in physical functionality and alleviation of pain. This intervention aims to assist patients in establishing realistic expectations and making informed choices pertaining to the optimal timing for surgical procedures.

The current study's results clearly demonstrate that, notwithstanding individuals with elevated levels of obesity experiencing more severe preoperative pain and functional limitations, patients across all body mass index (BMI) categories exhibited substantial enhancements in both pain levels and functional abilities at the six-month mark subsequent to total joint replacement surgery. At six months following THR, all BMI groups reported significant functional increases; however, patients who were extremely and morbidly obese showed a little lower mean functional gain than the other categories. Patients with higher degrees of obesity did, however, report improvements in function and pain scores after TKR that were on par with or higher than those of patients in other BMI groups.

Patients who exhibited extreme and morbid obesity demonstrated lower levels of functional ability following THR compared to individuals with lower body mass indexes, aligning with previous findings. In patients undergoing TKR or THR, there is an observed correlation between elevated BMI and reduced engagement in physical activity [8]. Patients with a high degree of obesity may present with a greater number of concurrent medical and musculoskeletal conditions, which can hinder their overall functionality, despite experiencing a lack of pain in their surgically treated hip joints. Furthermore, the results provide support for the hypothesis that individuals suffering from obesity may present elevated levels of arthritic pain linked to total knee replacement (TKR) in their untreated knee, hips, and lumbar region, potentially hindering their overall functional capacity subsequent to the surgical intervention [9]. Based on the available data, it has been observed that individuals classified as extremely and morbidly obese exhibited lower post-total hip replacement (THR) function scores in comparison to patients categorized as overweight, underweight, or within the normal weight range. However, it is noteworthy that the extent of functional improvement following the surgical procedure was found to be comparable among these different weight categories. In accordance with the observed results, recent studies involving limited cohorts have failed to identify any notable disparities in SF-12 Physical Component Summary (PCS) or Mental Component Summary (MCS) scores between individuals with morbid obesity and those without obesity [10]. Similarly, no significant variations have been observed in post-total knee replacement (TKR) assessments, including knee ratings, within a span of up to 12 months following the surgical procedure.

Future studies will compare the risks of problems based on the severity of obesity with the advantages of pain alleviation and functional gain in order to fully assess the benefit-risk ratio for patients contemplating TJR. Numerous features of the study include its extensive comorbidity data, excellent response and patient retention rates, and prospective cohort design.

Conclusion

Finally, this study supports the notion that weight shouldn't be a barrier to hip and knee osteoarthritis surgery, based on a sizable representative cohort of TJR patients. Based on the findings of the study, it can be inferred that individuals presenting with

extreme or morbid obesity can anticipate experiencing notable alleviation of pain and enhanced functional capacity subsequent to undergoing total joint replacement surgery. It is crucial, nonetheless, for healthcare professionals and patients in Orissa to engage in discussions regarding the potential association of obesity and an elevated susceptibility to surgical complications. Future studies will examine how to balance the potential risks of problems with the anticipated benefits of pain reduction and functional improvement.

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