

Systematic Review

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Impact of bariatric surgery on total knee arthroplasty

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ABSTRACT

Obesity is a key risk factor for the development of knee osteoarthritis, and the incidence of obesity has more than quadrupled in the last 30 years. Total knee arthroplasty is used to treat severe knee osteoarthritis, and the need for initial total knee arthroplasties is predicted to expand rapidly. Total knee arthroplasty, on the other hand, is related with increased problems, longer hospital stays, and higher expenditures in obese individuals. The purpose of this study was to see if bariatric surgery affected knee symptoms in obese (BMI >30 kg/m²) adult patients. The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, TRIP, BIOSIS-Previews, and reference lists of retrieved articles were thoroughly searched in English from the earliest available up to 30 December 2022. They included studies with a minimum follow-up of 4 months on the effect of surgically induced weight loss on knee symptoms in obese adult patients. Excluded were research investigating the impact of lipectomy or liposuction, as well as trials in which patients had already undergone total knee arthroplasty. This systematic review comprised 127 studies with a total of 22,229 patients. Despite the fact that several evaluation measures were utilized, an overall substantial reduction in knee pain was observed in 76% of the assessments. After bariatric surgery, all trials assessing the level of knee pain, physical function, and stiffness revealed a considerable improvement. For the majority of the included research, the quality of the evidence was extremely poor or very low, while it was moderate for one study. In obese adult patients, bariatric surgery followed by significant weight reduction is likely to improve knee pain, physical function, and stiffness. However, considering the existing data, high-quality research is required.

Keywords: Bariatric surgery, Obesity, Total knee arthroplasty, Post-operative complications, BMI

INTRODUCTION

More than 240 million people worldwide have symptomatic and activity-limiting hip or knee osteoarthritis (OA).¹ Over the course of their lives, more than half of persons with knee osteoarthritis will have a total knee arthroplasty (TKA). Obesity is also one of the most common disorders, is a key contributor in the development of OA, is related with persistent joint complaints, and is overrepresented in TKA patients.²

Obesity, defined as an abnormal or excessive buildup of fat that can harm health, has become a worldwide pandemic.³ Elevated BMI is related with an increased incidence of degenerative knee osteoarthritis and increases

the frequency of TKA procedures.⁴ Several studies have shown that obese and morbidly obese (BMI 40 kg/m²) patients have an increased risk of major and minor complications following total knee arthroplasty (TKA). In 2013, the American Association for Hip and Knee Surgeons (AAHKS) issued a consensus opinion recommending delaying elective total knee arthroplasty (TKA) when BMI exceeds 40 kg/m².⁵ Due to this, a lot of surgeons now consider severe obesity to be an absolute contraindication to surgery, and plenty of health insurance have adopted this advice.⁶ Preoperative weight loss in some obese patients undergoing bariatric surgery before total knee arthroplasty is one of the preoperative health optimization programs that have been developed to lessen overall postoperative problems.⁷ The frequency of bariatric surgery in the United States has stabilized at

roughly 113,000 per year, despite the rise in the number of obese patients.⁸ Studies have demonstrated that these techniques can benefit conditions including diabetes and hypertension that are chronic.⁹ The ideal timing and indication for bariatric surgery in orthopedic surgery are still unknown, despite the potential theoretical benefit, and several recent studies have shown that having bariatric surgery before lower extremity arthroplasty may increase the risk of perioperative complications.¹⁰

The academic community is now divided about whether bariatric surgery prior to total knee arthroplasty TKA impacts the prognosis of later total knee arthroplasty TKA.¹¹ Despite the fact that various research has attempted to address this issue, the literature still lacks consensus due to low study quality, substantial inter-study heterogeneity, and even data processing flaws.^{12,13} The major goal of this systematic review and meta-analysis was to look at the impact of prior bariatric surgery on prosthesis revisions and postoperative complications following TKA. This meta-analysis and comprehensive review will add to our understanding of the association between past bariatric surgery and later total knee arthroplasty.

Objectives

In this analysis, we conducted a thorough literature search to find out how bariatric surgery affected knee complaints in total knee arthroplasty patients who were obese (BMI $>30 \text{ kg m}^2$).

METHODS

Search strategy

The preferred reporting items for systematic reviews and meta-analyses (PRISMA) and assessing the methodological quality of systematic reviews (AMSTAR) recommendations were used to build the study. Two independent reviewers conducted a thorough search of the following databases in February 2023: PubMed (1982-2022), EMBASE (1980-2022), Web of Science (1995-2022), and Cochrane Central Register of Controlled Trials (1954-2022). Medical Subject was used to examine each database.¹⁴ The utilized the keywords "arthroplasty," "knee," "weight," "BMI," and "obesity" in our search. Additionally, the reference sections of the returned articles were manually examined for other research that could have matched the inclusion standards but had eluded the computerized search. The dangers of bariatric surgery before TKA are highlighted in this meta-analysis, and it is suggested that prior bariatric surgery may raise the risk of perioperative blood transfusion as well as the risk of revision and infection in long-term follow-up. This knowledge can be used by surgeons to advise patients having bariatric surgery prior to primary total knee arthroplasty (TKA).¹⁵ A study was considered if it was a comparative trial and the primary TKA result was reported in accordance with BMI. Studies including all varieties of

cemented complete knee prosthetic designs and none that were deranged were included. The exclusion criteria included review papers, expert comments, surgical methods, and abstracts from scientific meetings. Only English-language articles were included. There was no source, association, or author blinding in the studies.

Inclusion and exclusion criteria

The study has to satisfy each of the following inclusion criteria in the PICOS order in order to be counted in our meta-analysis: The target population was made up of patients with morbid obesity (BMI $>40 \text{ kg/m}^2$); the intervention was BS before TJA; the comparison intervention was no BS before TJA; the outcome measures were at least one of complications, revision, length of stay (LOS), and operating time; and the study design was either prospective, retrospective, or registry. No publications that did not assess the aforementioned outcomes or that did not contrast bariatric surgery (BS) with non-bariatric surgery (NBS) were included in the meta-analysis. Conference abstracts and duplicate reports were excluded. Additionally, excluded were case studies, biochemical experiments, correspondence, and reviews.

Study selection

Duplicate articles were eliminated and exports to EndNote were made. To identify whether articles met the criteria, two separate writers looked at the titles and abstracts of prospective relevant publications. Discussions with a third reviewer helped to settle disagreements.

Data extraction

From the selected studies, two independent authors retrieved the following descriptive raw data: study characteristics such as author, publication year, research design, and follow-up time; and patient demographic details such as patient number, average age, BMI, and gender ratio. Complications and revision were the major end measures, whereas LOS and operational time were secondary outcomes. Short-term follow-up was defined as anything from hospital discharge to 90 days, while long-term follow-up was anything more than a year. If data was missing or could not be collected directly, we contacted the authors to verify that the information was included. Otherwise, we used the Cochrane Handbook for Systematic Reviews of Interventions 5.1.0 guidelines to compute them. We would stop the extraction if necessary.

RESULTS

The search approach produced a total of 127 publications. Five non-randomized controlled trials were chosen as eligible (Figure 1). The study covered a total of 22,229 patients. There were 9425 men and 12804 women in the group, with an average age of 59.3 years (45 to 60). 15904 individuals received bariatric surgery, whereas 13675 did not. The type of bariatric surgery employed was not

reported by the authors. TKA was performed on 1509 individuals, whereas others did not. The mean BMI at the time of arthroplasty in the bariatric group was 35.8 kg/m² (range: 31.64–36.87) and 41.6 kg/m² (range: 33.225–42.42) in the non-bariatric cohort. Three studies omitted the BMI information. Four more trials separated the patients into groups according to whether they had bariatric surgery three years earlier or later. The results of the other two investigations did not include this time frame. The research's caliber ranged from fair to excellent. The seven studies all shared the common trait of explicitly describing their aims and objectives, patients' characteristics, surgical techniques, and any confounders that could affect the results. The findings from each of the eight investigations were reported in detail, including point and variance data for clinical ratings and adverse events. But the evidence was not without flaws. Two studies did not account for varying follow-up durations and did not provide the results using probability values. Due to their retrospective nature, no research performed a subgroup analysis, and it was impossible to blind patients to whether or not they had undergone bariatric surgery. Two trials in total simultaneously recruited patients and controls. Last but not least, no author calculated the power needed to analyze enough cases to find a statistically significant difference. In Table 1, a summary of the findings from the meta-analyses is shown. At 28 days after surgery, data on complications were reported in all six investigations. According to a meta-analysis, there was no discernible difference in the rates of superficial wound infection (RR 1.76), deep wound infection (RR 1.02), DVT (RR 0.36), and PE (RR 0.44) between people who had bariatric surgery and those who did not. There was no statistically significant difference in the rate of revision surgery (RR 1.26,) or death (RR 1.33) between 12 months and 16 years after arthroplasty. There was a substantial difference, however, in favor of individuals who had bariatric surgery prior to the number of men and women in their cohort. 15904 individuals received bariatric surgery, whereas 13675 did not. There was no documentation of the type of bariatric surgery employed. The seven studies' recurring strengths included explicitly expressing the aims and objectives, patient characteristics, surgical methods, and potential confounders to impact the result. The findings of all seven investigations were clearly provided, including both point and variance data for clinical ratings and side events.

However, the evidence foundation has shortcomings. Two studies did not use probability values to report the results and did not account for various periods of follow-up. There was no subgroup analysis in any of the studies, and because they were all retrospective, it was impossible to blind patients to whether or not they had bariatric surgery. Two trials included both patients and controls at the same time. Finally, no author calculated the power of their study to see if they had enough patients to detect a statistically significant difference.

At 28 days after surgery, data on complications were reported in all six investigations. In a meta-analysis, there was no statistically significant difference between those who had bariatric surgery and those who did not for mortality (RR 1.33), revision surgery between 12 months and 16 years after arthroplasty (RR 1.26), or superficial wound infection (RR 1.76), deep wound infection (RR 1.02), DVT (RR 0.36), or PE (RR 0.44). However, the proportion of men and women in the group who had undergone bariatric surgery earlier showed a substantial difference in their favor.

Using the GRADE method, the assessments of post-operative complications were rated as having "very low" quality of evidence. Due to variability, imprecision, and the possibility of bias, there is thus very little trust in these findings. The amount of information needed to analyze the length of stay, which was noted in two investigations, was insufficient. Those who had bariatric surgery before having an arthroplasty did not vary statistically from those who did not ($p>0.05$) based on the narrative review. Information on the frequency of blood transfusions following TKA was reported in two trials in total.

In a meta-analysis, there was no statistically significant difference between the two bariatric groups' transfusion needs. However, there is little reason for trust in these results because they were rated as "low" quality by GRADE because of the possibility of bias and imprecision. The Harris hip score, the OHS, or the OKS were not used in any research to evaluate pain, clinical outcomes, or PROMs. To do subgroup analysis by age and BMI category, insufficient data were available. However, there was enough information to do further analyses by the interval between the arthroplasty and the bariatric surgery. For individuals who underwent TKA within two years after having bariatric surgery or more than two years later, there was no discernible difference in the risk of deep wound infection. Due to the risk of bias and imprecision, these findings were once more rated as "low" quality by GRADE.

Table 1: Summary of the results of the meta-analyses.

Outcome	Risk ratio	P value
Superficial wound infection	1.76	0.06
Deep wound infection	1.02	0.86
Deep vein thrombosis	0.36	0.42
Pulmonary embolism	0.44	0.63
Joint revision	1.26	0.44
Mortality	1.33	0.75
In-patient re-admission	0.51	0.72
Medical complication (collective)	0.59	<0.01
Post-operative infection (with/without I&D)	0.32	0.02
Post-operative blood transfusion	2.40	0.42
Complications within first 90 post-operative days	0.63	0.18

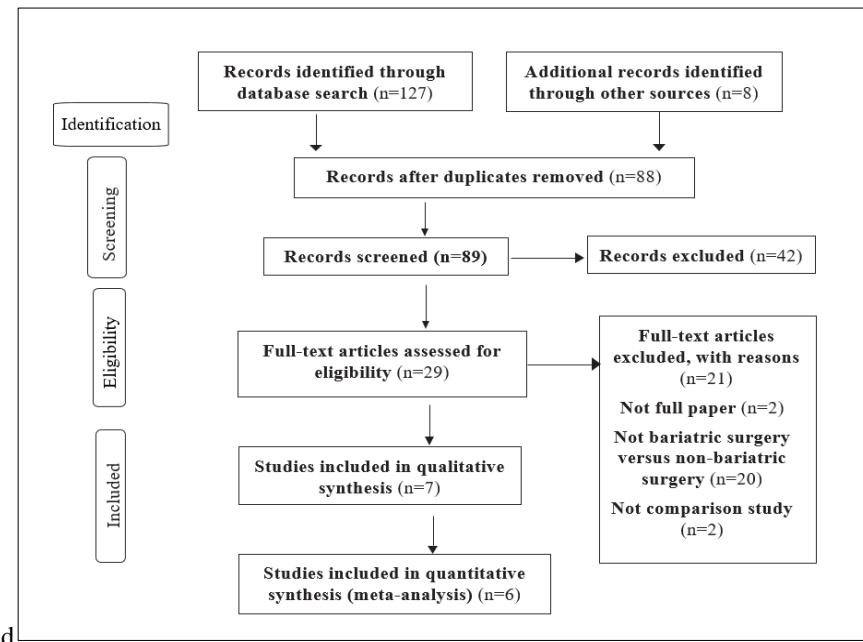


Figure 1: Systematic reviews and meta-analyses flowchart presenting the search strategy results.

DISCUSSION

According to these data, there is no significant difference in the frequency of perioperative problems and post-operative clinical outcomes between individuals who have bariatric surgery prior to arthroplasty and those who do not.¹⁶ Only overall medical problems (as measured collectively) and wound infection (needing or not requiring irrigation and drainage) demonstrated a significant risk, favoring the bariatric surgery group. While the evidence-base was of intermediate quality, the GRADE analysis concluded that the studies were of 'low' or 'very low' quality, hence the conclusions should be interpreted with care.¹⁷ Nonetheless, the findings contradict earlier notions that bariatric surgery performed prior to arthroplasty in obese individuals may assist to lower the odds of a bad outcome. It is also worth noting that all of the studies examined were underpowered, which might account for the disparity in outcomes revealed in this meta-analysis.¹⁸ While the non-bariatric surgery groups had higher BMIs before arthroplasty than the bariatric surgery groups, the difference varied from 0 kg/m² to 25 to 7.6 kg/m².¹⁹ Thus, in studies as Martin, Watts, and Taunton's, there was minimal variation in mean BMI between the two groups. Because of inadequate reporting of past non-bariatric treatment of obesity in these patients, it is uncertain if bariatric surgery gives extra benefit over and above non-surgical treatments to weight loss prior to arthroplasty.²⁰ To ascertain this, future writers should make sure that earlier (pre-randomization) non-surgical ways of obesity therapy are reported in their studies.

CONCLUSION

Bariatric surgery that was performed before total knee arthroplasty was linked to somewhat superior short-term

outcomes. Long-term outcomes, however, were not significantly impacted by bariatric surgery. High-quality, controlled trials should be conducted in the future to demonstrate the short-term benefits of bariatric surgery in light of the relative higher comorbidity burden.

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