

Obesity

The Modifiable Risk Factor in Total Joint Arthroplasty



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KEYWORDS

• Arthroplasty • Total hip arthroplasty • Total knee arthroplasty • Obesity • Risk factors

KEY POINTS

- Obesity is associated with increased complication rates in arthroplasty patients.
- Obese patients are at higher risk for infection and dislocation, and have poorer implant survivorship and functional scores postoperatively.
- To some degree, obesity is a modifiable risk factor and nutritional or bariatric surgery evaluation should be considered.
- Obese patients must be counseled to set realistic expectations after arthroplasty.

INTRODUCTION

Obesity is a significant and growing challenge facing the entire health care system. It has reached epidemic status in the United States. Obesity poses several challenges and raises unique issues for the arthroplasty surgeon.¹ Of the US population, 37% is classified as obese and rates are climbing.^{2,3} Overall, medical costs in the United States due to obesity exceed \$275 billion and account for more than 20% of all US health care expenditure.⁴

For adults, the World Health Organization defines a normal body mass index (BMI) as 19.5 to 24.9 kg/m² and overweight as 25 to 29.9 kg/m². A BMI greater than 30 kg/m² is defined as obese, greater than 40 kg/m² as morbidly obese, and greater than 50 kg/m² as superobese.⁵ The terminology of class 1 obesity (BMI 30.0–34.9 kg/m²), class II obesity (35.0–39.9 kg/m²), and class III obesity (40.0 kg/m² and up) can also be used.⁵

The purpose of this discussion is to characterize how the modifiable risk factor of obesity

interacts with total joint arthroplasty (TJA). This article examines the role obesity plays in early progression of osteoarthritis (OA) and need for TJA; discusses perioperative optimization, the role of bariatric surgery, and the rate of complications in obese patients; and assesses the outcomes of arthroplasty in obese patients.

INCIDENCE AND TIMING OF ARTHROPLASTY

It stands to reason that obese patients are at higher risk of developing OA.^{6,7} OA is multifactorial in origin and obesity is among the principal modifiable risk factors.⁴ The intuitive biomechanical explanation is clear: increased joint reactive forces from higher body weight cause subsequent wear and articular cartilage breakdown.⁶ Obesity may also act via local and systemic biomechanical changes to activate inflammatory pathways that affect progression of cartilage damage and perception of pain.^{3,6} Although OA has been labeled as noninflammatory, there

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is evidence that it has an inflammatory component. Obesity is characterized by secretion of proinflammatory cytokines causing a low-grade, chronic inflammatory state that may contribute to progression of OA.⁶

Several studies have assessed the role of obesity on the timing of arthroplasty. A biomechanical model by Reclik and colleagues⁷ assessed a cohort of 431 consecutive hip arthroplasty subjects. They used radiographic parameters to model peak contact hip stresses and joint reactive forces. They found that increased body weight tracked directly with increased hip contact stresses in their model. Additionally, higher body weight was significantly correlated with earlier age at total hip arthroplasty (THA).⁷

A large cohort study by Bourne and colleagues⁸ of 54,406 subjects from the Canadian Joint Registry analyzed the association between obesity and the subsequent need for hip or knee arthroplasty. Compared with a control group of subjects with BMIs 25 kg/m² or less,² they found that increasing BMI was progressively correlated to higher risk of arthroplasty. At BMI 25 to 29.9 kg/m², risk was 3.2-fold higher for TKA and 1.92-fold higher for THA. At BMI 30 to 34.9 kg/m², relative risk progressed to 8.53 for total knee arthroplasty (TKA), and 3.42 for THA. At BMI 35 to 39.9, risk was 18.73 for TKA, and 5.24 for THA. Finally, for those subjects with BMI greater than 40 kg/m², risk was 32.73-fold higher for TKA, and 8.56-fold higher for THA. The data support the conclusion that obesity is a significant risk factor for severe OA progressing to need for arthroplasty, likely disproportionately affecting progression of knee OA more than hip OA.

In a 2011 study in *Annals of Internal Medicine*, Losina and colleagues⁹ estimated the impact of obesity on various associated medical conditions. Their analysis attempted to quantify an overall loss of per-person quality-adjusted life years due to knee arthritis in obese subjects. Subjects lost 3.5 quality-adjusted life years due to knee OA from obesity, with a total of 86 million quality-adjusted life years lost in the United States due to obesity and/or knee OA. Their model demonstrated that reducing obesity to the levels of 10 years earlier could avert 111,206 knee replacements.⁹

PREOPERATIVE CONSIDERATIONS

Obesity is associated with multiple medical comorbidities that can negatively affect both the results of arthroplasty and the associated medical and anesthetic risks.¹⁰ Diabetes, obstructive sleep

apnea, and cardiopulmonary disease are all clearly associated with obesity and significantly increase risk of overall complications.¹⁰

Diabetes is a major complicating factor for arthroplasty. A recent study, analyzing a large cohort of morbidly obese (BMI >40 kg/m²) subjects who underwent TKA, looked at diabetes and insulin dependence as an independent risk factor, with a cohort stratified into nondiabetics, type II diabetics who required no insulin, and type II diabetics who used insulin.¹¹ All subjects had complication rates far greater than the norm in nonobese subjects (74%–85% 10-year reoperation rate and 5%–9% infection rates). The nondiabetic and diabetic morbidly obese subjects had similarly high complication rates; however, the insulin-dependent diabetics had even higher complication rates, with significantly increased rates of reoperation (75% 10-year reoperation rate) and prosthetic joint infection (PJI; 9% 10-year infection rate). Overall, implant survivorship rates at 10 years (84% for insulin-dependent diabetics) were also significantly decreased.

Obstructive sleep apnea and restrictive lung disease pose multiple challenges in the perioperative period. Obesity causes a restrictive lung disease picture, which makes ventilating these patients much more difficult, with significantly decreased airway compliance.¹ Obstructive sleep apnea, of which obesity is a major risk factor, increases the risk of dangerous apneic episodes, leading to hypoxia, especially due to the use of general anesthetic agents and opiates in the perioperative period.¹ The risk screening questionnaire for obstructive sleep apnea, the STOP-BANG score, allows for a quick screening for this condition. STOP-BANG is an acronym for the screening questions: Snoring, often feeling Tired, Observed apnea, high blood Pressure, BMI greater than 35 kg/m², Age greater than 50, Neck circumference greater than 16 inches, and male Gender.¹ For this reason, many anesthesiologists advocate for increased use of neuraxial anesthesia and regional blocks in these high-risk patients to help make anesthesia safer.¹⁰

PREOPERATIVE WEIGHT LOSS AND THE ROLE OF BARIATRIC SURGERY

It is common practice to encourage weight loss in obese patients before arthroplasty.

Guidelines vary but many centers have practices to refer all morbidly obese patients to a weight loss clinic before considering THA or TKA. Strong recommendations should be made

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