REVIEW ARTICLE

CONTENTS

Body mass index as a determinant of surgical outcomes in total hip arthroplasty

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ABSTRACT

Body mass index is an important element influencing surgical outcomes after total hip arthroplasty. This review analyses how body mass index influences perioperative complications, infection rates, implant survival and functional results in patients undergoing this procedure. A literature review of the past decade was carried out using PubMed, Scopus and Web of Science, focusing on studies published between 2020 and 2026. Studies involving humans that examined the relationship between body mass index and outcomes of total hip arthroplasty were included if they reported perioperative complications, infections, revision rates, or patient-reported outcome measures. The evidence indicates that a higher body mass index is associated with an increased risk of wound complications, periprosthetic joint infection and the need for revision surgery. It is also associated with a lower possibility of achieving minimal clinically important differences in functional scores. The relationship follows a U-shaped pattern showing that, compared with normal weight, obesity and underweight status are associated with increased risk. Proposed mechanisms include technical surgical challenges, altered immune function, compromised wound healing and greater mechanical stress on implants. Preoperative optimization strategies consist of nonsurgical weight loss and bariatric surgery. They are promising but require more investigation. New pharmacological approaches using glucagon-like peptide-1 receptor agonists are a useful contribution to perioperative care. Future research should focus on finding biomarkers of obesity-related risk and on developing individualized strategies to improve outcomes across the body mass index spectrum.

KEY WORDS: obesity, postoperative complications, prosthesis-related infections, reoperation, treatment outcome

Wiad Lek. 2026;79(3):558-563. doi: 10.36740/WLek/218174 DOI

INTRODUCTION

Obesity has become a major global public health issue and its occurrence is consistently rising in recent decades. This condition is typically assessed using body mass index (BMI), where a BMI of 30 kg/m^2 or higher signifies obesity; further classification includes Class I (30-34.9 kg/m^2), Class II (35-39.9 kg/m^2), and Class III (≥40 kg/m^2), also known as morbid obesity [1]. Consequently, the escalating rates of obesity have significant consequences for orthopedic surgery, especially total hip arthroplasty (THA), given that a growing proportion of patients seeking hip replacement surgeries are obese [2].

The relationship between higher BMI and surgical outcomes of THA has been a subject of research interest and clinical concern. Obesity is known to place additional mechanical stress on the hip joint, accelerating cartilage degeneration as well as necessitating earlier surgical intervention [1]. However, the same excess weight that contributes to joint deterioration can also cause major challenges in the perioperative period and may compromise implant function in the long-term [2].

Numerous systematic reviews and meta-analyses have consistently shown that obese patients undergoing total hip arthroplasty (THA) encounter increased risks across a range of outcomes. A large-scale meta-analysis, encompassing more than 2 million patients, indicated that obese individuals show considerably higher rates of complications, infections and revision surgeries when contrasted with those of normal weight [2]. Furthermore, these observations have been repeat-

edly supported by supplementary systematic reviews that specifically investigate morbidly obese patient populations [3].

Periprosthetic joint infection (PJI) represents one of the most serious complications following THA and its incidence appears to be substantially elevated in patients with obesity. Recent systematic reviews have evaluated this risk and confirmed a linkage between increasing BMI and infection rates [4]. The mechanisms underlying this increased awareness show multiple factors, involving altered immune function, compromised wound healing, and technical complications during surgery [4, 5].

More attention has been directed towards preoperative strategies after considering all of these risks. They aim at reducing BMI before THA and they have taken various forms. Starting with nonsurgical approaches such as diet modification and supervised exercise programs, to more aggressive options like bariatric surgery [6]. Recent developments in this area could involve the use of digital health platforms. These platforms allow patients and dietitians to communicate through mobile applications. This method grants a scalable approach to controlling weight before surgery [6].

Bariatric surgery is the most effective intervention that allows for substantial and sustainable weight loss in morbidly obese patients. Several systematic reviews and meta-analyses have investigated whether prior bariatric surgery improves outcomes of THA [7, 8]. The evidence regarding this approach continues evolving, according to some studies suggesting benefits in terms of fewer complications, while others question whether the timing and extent of weight loss that is achieved through bariatric procedures meaningfully alter the risk profile for arthroplasty surgery [9].

The influence of obesity on the outcomes of total hip arthroplasty (THA) goes beyond the early perioperative period, affecting longer-term factors such as implant survival, functional restoration and patient-reported outcomes. Understanding these complex interconnections is key to effective patient education, making surgical decisions and creating evidence-based perioperative protocols. This review consolidates existing research regarding the impact of body mass index (BMI) on surgical outcomes after total hip arthroplasty. It specifically addresses perioperative complications, infection risks, implant durability, functional outcomes and the effectiveness of different optimization approaches.

AIM

The aim of this review is to assess the impact of BMI on THA surgical outcome. The focus is placed on how varying BMI affects perioperative complications, infections, implant survival and functional outcomes as well as the effectiveness of preoperative optimalization strategy.

MATERIALS AND METHODS

This descriptive literature review was written using structured searches in three electronic databases: PubMed, Scopus and Web of Science. The search strategy prioritized publications from the previous decade, concentrating specifically on studies published between 2020 and 2026. The search used a combination of Medical Subject Headings (MeSH) terms and free-text keywords in English, encompassing: body mass index, BMI, obesity, overweight, underweight, total hip arthroplasty, total hip replacement, THA, surgical outcomes, complications, periprosthetic joint infection, revision, patient-reported outcomes and weight loss interventions. Boolean operators (AND, OR) were utilized to appropriately clarify and expand the search strategy.

Inclusion criteria comprised original human studies such as cohort studies, case-control studies and randomized controlled trials as well as systematic reviews and meta-analyses. These studies examined the relationship between body mass index and outcomes that follow primary total hip arthroplasty in adult patients. Eligible studies were required to report on at least one outcome measure of interest including perioperative complications, infectious complications, implant survival or revision rates, functional outcomes, or the effectiveness of preoperative optimization strategies.

Exclusion criteria included studies focusing exclusively on revision arthroplasty procedures, pediatric populations, non-English language publications, case reports, conference abstracts without full-text availability and editorials or opinion pieces without original data. Studies examining only knee arthroplasty or other joint replacements without specific hip arthroplasty data were also excluded.

The initial database search provided a considerable number of potentially relevant publications. Abstracts were assessed as part of an initial screening to evaluate studies against established inclusion and exclusion criteria; full-text articles were then retrieved from all studies that had been identified as being potentially eligible through this process and each underwent an additional, more detailed assessment to evaluate both the methodological quality of the individual study as well as its relevance to the review's stated objectives. High-quality systematic reviews and meta-analyses were prioritized for establishing background and context regarding the topic under investigation, while relatively recent, primary research studies focusing on

reporting outcomes across BMI categories were given priority for their ability to inform the discussion of specific outcomes.

The focus of data extraction was placed upon evaluating the study design, population characteristics, methods used to classify BMI into different BMI categories, outcome measures evaluated within the study and the main findings of each study. When multiple studies examined the same or similar outcomes, those studies with the largest sample size, longest follow-up period, and/or most rigorous methodological approaches were considered to be of higher value than other studies addressing the same outcomes. The structure of the narrative synthesis was designed to allow for a systematic examination of distinct domains of outcomes while also providing an opportunity to highlight areas where there is agreement among the body of evidence, as well as those areas that remain in debate.

This review does not represent a systematic review conducted according to PRISMA guidelines. However, it does provide a narrative synthesis of the existing evidence and is intended to provide clinicians and researchers with a broad-based understanding of how BMI impacts outcomes throughout the continuum of care associated with total hip arthroplasty.

REVIEW

PERIOPERATIVE AND EARLY POSTOPERATIVE OUTCOMES

The unique characteristics of the immediate perioperative time frame make it challenging for obese patients who undergo total hip arthroplasty. An analysis of outcomes categorized by BMI class found that variables such as operative time, intraoperative blood loss, length of hospitalization and post-discharge readmission rates all demonstrated a relationship with the patient's weight [10].

A study on underweight patients (BMI <18.5 kg/m^2) found that underweight patients were at higher risk for complications of wound healing and perioperative death than normal weight patients [11]. The shape of the risk curve demonstrates an optimal BMI, where there is a correlation between deviation from this BMI and increased morbidity [11].

The pattern of failure modes varies distinctly between high and low BMI populations. Research systematically comparing these groups has identified that obese patients more commonly experience wound-related complications and infectious problems, while underweight individuals demonstrate higher rates of periprosthetic fracture and dislocation events [12]. These disparate failure mechanisms suggest that risk mitigation strategies must be specifically tailored to the weight category of each individual patient [12].

Extreme obesity, defined as BMI > 50 kg/m^2, presents a particularly challenging clinical scenario. Recent investigation of outcomes in this population has raised fundamental questions about whether the magnitude of perioperative risk justifies proceeding with elective surgery [13]. The data revealed significantly elevated rates of major complications, wound problems and venous thromboembolism which led to an ongoing debate about the risk-benefit calculus in patients with such severe obesity [13].

The influence of surgeon experience and case volume appears to substantially influence the relationship between obesity and surgical outcomes. Analysis using propensity score matching methodologies showed that when THA procedures in obese patients are performed by high-volume surgeons, many of the traditionally observed complications are significantly reduced [14]. This finding suggests that technical skills and awareness of the issues posed by excess body fat can partially cancel out obesity related risks [14].

INFECTIOUS AND WOUND-RELATED COMPLICATIONS

It has been confirmed the morbidly obese patients are subjected to 2-3 times higher risk of periprosthetic joint infection when compared to regular individuals [4]. The other factors contributing to the potential infection might be tissue trauma, prolonged operative time, and other factors like decreased patients defenses [4].

Moreover, it has been observed that the complications resulting from postoperative wounds happen more frequently in case of obese patients. These problems might be related to prolonged drainage, superficial infections or dehiscence. However, these facts haven't been confirmed in case of deep infections [10]. Similar conclusions have been presented in [12].

IMPLANT SURVIVAL, REVISION AND REOPERATION

The extensive studies on 83,000 cases recorded in The Swedish Hip Arthroplasty Register (SHAR) documenting total hip replacements reveal the direct correlation between elevated BMI and higher risk of revisions and reoperations [15]. Apart from the later, other complications like prosthesis instability and loosening occur in morbidly obese patients much more frequently [3].

The specific situation concerns super-obese patients (BMI>50). In this group the risk of reoperation is so high, that the potential improvement in patients welfare is a short-term benefit thus questionable in long-term perspective [13].

However, there are studies questioning the above results. For instance the comparative analysis on total hip arthroplasty (THA) operations presented by Kubsad et al [16] do not confirm the direct impact of bariatric surgeries on surgical complications or revisions in the 10-year long time perspective. The reference group were class III obesity patients who did not undergo bariatric surgeries [16].

FUNCTIONAL OUTCOMES

Analysis of post-operative data reported by Mukka S, et al confirms improvement in patients' life quality [17]. But this recovery is not uniform along all studied BMI groups. The highest satisfaction rate has been observed in obese patients, but one should remember, they started from the lower functional level.

The relatively low satisfaction has been reported by morbidly obese patients [18]. The third analyzed group of patients with class III obesity declared slightly contradictory results in one year time frame observations, so the clinically important differences have been classified as minimal [18].

BMI-RELATED OPTIMIZATION STRATEGIES

Interesting results on preoperative treatment have been reported by Seward MW and his research group [6]. In particular the authors analyzed the importance and efficiency of remote dietitian consultations and mobile applications on patients' behavior. The impact was not very strong but still statistically meaningful. The analysis of postoperative data and records of these patients confirmed the reported above correlation between lower BMI and decreased probability of postoperative complications. The similar studies are communicated by Meissner N et al., but authors underline the necessity of further studies on this topic [19]. In particular, the direct relation between the magnitude of weight loss and its timing on operation outcomes should be analyzed.

The economical aspect of BMI, its impact on operations outcomes and potential risk of complications was studied by Akwuole C, et al [20]. The reference dataset in this study was a nationally representative database of 10,366 primary THAs completed from 2016 to 2022. Statistical analysis revealed that increased BMI is associated with higher 90-day costs for THA.

DISCUSSION

The discussed above papers reveal a complex and diverse impact of BMI on THS outcomes, both in short- and long-term perspectives. The unfavorable consequences of being overweight have been confirmed in all the studies. In particular these are infections, higher risk of revisions and reoperations, prosthesis instability and loosening. Underweight patients have also been under examination. Unexpectedly, this group is also at risk of postoperative complications. Therefore, the combined analysis of these results indicates there's an optimal BMI magnitude, when the complications risk is statistically lower.

The effect of preoperative measures related to weight reduction and its timing for better treatment results is still under investigation. Recent studies in this area are relatively extensive and cover for instance the effectiveness of mobile applications and remote consultations on patients' behavior and reaching the optimal BMI.

There's also intensive research on limiting the risk of postoperative complications. For instance, studies reported demonstrated the expected and positive impact of GLP-1 receptor agonists to decrease potential complications occurrence [21-23]. Other reports investigated the impact of preoperative exercises and nutritional recommendations, especially for sarcopenic obesity patients.

An important factor of a successful operation is the doctor's experience [24]. The statistical analysis confirms the experienced surgeons may have very good results and little complications ratio for both normal weight individuals and overweight ones. However, it should be highlighted that most of the reported cases are retrospective ones, BMI records can be burdened with error and sole BMI might not be the perfect reference data.

CONCLUSIONS

Similar to many other health care studies the discussed problem of BMI and its impact on surgical results of hip replacement needs to be considered from multiple perspectives.

The most important one is patients' satisfaction from the operation outcomes and his/her welfare in short and long-term perspective. These are closely related to the risk of potential complications after surgery. Among them infections, revisions and reoperations, prosthesis instability and loosening seem to be the critical hazards for overweight patients.

Therefore, the measures undertaken to reduce these risks are an important topic of ongoing research. In a wider sense these relate also to surgeons' experience, their professional satisfaction and the level of job performance.

The final viewpoint of this study is related to the socio-economical aspects. The potential risk of complications, reoperations and other additional procedures/treatments generate redundant costs. This contributes to increased healthcare expenses, insurance costs etc. It may also limit access to medical services for other patients.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article

RECEIVED: 10.01.2026
ACCEPTED: 28.02.2026