

## Is there a threshold limit for body mass index for patients undergoing primary total knee or total hip arthroplasty?

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**Response/Recommendation:** Although most studies show a higher complication rate in patients with higher body mass index (BMI), we are unable to determine an exact threshold for BMI in patients undergoing primary TJA.

**Level of Evidence:** moderate

**Rationale:** There is a plethora of studies that have attempted to address the topic of body mass index (BMI), and its threshold, in patients undergoing primary total joint arthroplasty (TJA). Although there appears to be an increased rate of complications in patients with higher BMI undergoing TJA, the exact threshold for BMI beyond which complications are unacceptable in these patients remains unknown. Two recent meta-analyses reported obese patients undergoing primary total knee and hip arthroplasty, respectively had higher risks of revisions (OR 1.15, 95% CI: 1.08–1.24,  $P < 0.0001$ /OR 1.44, 95% CI: 1.32–1.57,  $P < 0.001$ ), deep infections (OR 1.47, 95% CI: 1.27–1.69,  $P < 0.0001$ /OR 2.71, 95% CI: 2.08–3.53,  $P < 0.001$ ), superficial infections (OR 1.59, 95% CI: 1.32–1.91,  $P < 0.0001$ /OR 1.99, 95% CI: 1.55–2.55,  $P < 0.001$ ), readmissions (OR 1.21, 95% CI: 1.05–1.40,  $P = 0.009$ /OR 1.37, 95% CI: 1.15–1.63,  $P < 0.001$ ), and all complications (OR 1.21, 95% CI: 1.06–1.38,  $P = 0.004$ /OR 1.53, 95% CI: 1.30–1.80,  $P < 0.001$ ). Obese patients undergoing THA also had higher risks of dislocations (OR 1.72, 95% CI: 1.66–1.79,  $P < 0.001$ ) and reoperations (OR 1.61, 95% CI: 1.40–1.85,  $P < 0.001$ ), and those undergoing TKA had higher risk of wound dehiscence (OR 1.46, 95% CI: 1.24–1.72,  $P < 0.0001$ ). Meanwhile, obese patients did not exhibit an increased risk of VTE, nerve injuries, aseptic loosening, periprosthetic fracture in either hip or knee arthroplasty. There was also no increased risk of reoperations for obese patients undergoing TKA<sup>1,2</sup>.

A review of additional literature shows appreciable heterogeneity in both the methods and results<sup>3–26</sup>. The variability in BMI grouping and comparisons between groups contributes to the obscurity of determining appropriate BMI thresholds. The comparison of obese (BMI > 30) to non-obese (BMI < 30) patients often overestimates the importance of a cut-off at lower BMI thresholds, as evidenced by reports from studies that further stratify groups at higher BMI<sup>11,12,15</sup>. A study separating morbidly obese (BMI > 40) and super-obese (BMI > 50) groups from the obese group reported increased risk of complications following primary THA in the morbidly and super-obese groups compared to normal BMI, but not in the obese group<sup>12</sup>. Even when compared to the morbidly obese group directly, super-obese patients had an increased risk of PJI at 1- and 2-years postoperatively<sup>12</sup>. However, the majority of prior studies including additional BMI groups often only compare each group to the normal BMI group. More importantly, studies rarely adjust for potential confounders, making it difficult to separate BMI as an independent variable. For example, most of the studies that did account for confounding variables only adjusted for age, sex, and CCI/ECI either via matched cohorts or through multivariable regression analysis<sup>3–5,9,10</sup>. While several others adjusted for diabetes, none differentiated between

those who were controlled versus uncontrolled<sup>4,13,16,17,24</sup>. Several studies adjusted for additional variables, though most did not include pertinent confounders with known associations to the reported postoperative outcomes<sup>6,11,13,16,17</sup>. Relevant perioperative variables associated with high risk for postoperative complications were absent from most studies including— among others— preoperative albumin, HbA1c, operative duration, and DVT prophylaxis.

Studies that analyzed the functional and patient reported outcomes following TJA also have highly discordant BMI groupings and are therefore difficult to interpret collectively. Many studies in our review reported no difference in postoperative improvement including knee flexion, VAS pain scores, and patient-reported outcome measures between BMI groups<sup>17,22–26</sup>. Meanwhile, some reported a greater improvement in higher BMI groups compared to the normal BMI group<sup>7,14</sup>.

Given the incongruity in the literature across all BMI groups, BMI as a standalone screening tool and an absolute contraindication to surgery without considering all relevant patient factors is not recommended. Further studies that adequately control for pertinent confounding variables with increased risk of complications are necessary to assess the independent association of BMI with TJA outcomes and create a working algorithm for patient screening. We, therefore, cannot recommend a specific BMI threshold to utilize as a screening for postoperative complications but rather emphasize incorporating BMI as a component of the comprehensive preoperative clinical assessment that encompasses more impactful patient related variables. However, we do caution surgeons when contemplating surgery for morbidly obese and super obese patients to conduct a thorough assessment of associated comorbidities including anemia, malnutrition, metabolic syndrome, and other significant risk factors as these variables are likely to associate with these higher BMI categories and significantly increase the risk of postoperative complications.

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