

Short Stature Associated with Sex-Based Differences in Mechanical Complications Following Total Knee Arthroplasty: A Propensity Score-Matched Analysis

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INTRODUCTION: The impact of patient-specific factors such as sex, age, and body mass index (BMI) on outcomes following total knee arthroplasty (TKA) are well-established in the literature. With the increasing annual rates of TKA, an increased number of patients fall into subgroup phenotypic variations not previously studied in detail. Height has received less attention despite its potential influence on knee biomechanics and patellofemoral function as an independent anthropometric measure. Shorter individuals may experience distinct mechanical loading and implant stress. This study aims to evaluate whether decreased patient height is associated with elevated risk of complications following TKA.

METHODS: This retrospective cohort study using the TriNetX US-collaborative health records database identified 218,528 patients who underwent TKA from 2010–2025. The International Classification of Diseases, Ninth and Tenth Revisions (ICD-9 and ICD-10) procedure codes were utilized to identify patients undergoing primary, elective TKA. Patients with osteoarthritis at least 18 years old with two or more years of follow-up were included. After excluding trauma, infection, malignancy, inflammatory disease, ligamentous instability, or syndromes associated with short stature, patients were stratified into two balanced sex-specific cohorts based on height, in inches. Propensity score matching (PSM) was used to match cohorts 1:1 based on age, sex, and Charlson Comorbidity Index, pairing patients with heights at or below the 5th percentile (15,609 total) with patients with “normal” heights, defined as heights within one standard deviation of the mean (202,919 total). Multivariable logistic regression was used to compare risks of postoperative complications at 90 days and 2 years.

RESULTS: PSM successfully paired 10,642 short-stature females and 4,967 short-stature males with control counterparts. Short-stature females had a 18% increase in TKA mechanical complications, including dislocation, instability, broken prosthetic components, mechanical loosening, and polyethylene wear, within two years of their initial operation (Relative Risk [RRFemale]:1.18; 95% Confidence Interval [CI]:1.00, 1.40; $p \leq 0.05$). In contrast, short-stature males had a 27% decreased mechanical complications (RRMale:0.73; 95% CI:0.57, 0.93; $p \leq 0.01$).

DISCUSSION AND CONCLUSION:

Short stature, defined as the bottom 5th percentile of height, is associated with opposing risks of postoperative mechanical complications after TKA- increased in women and decreased in men—compared to “normal” heights. These findings may reflect sex-based biomechanical differences in lower limb alignment and knee implant stress. Height may be an underrecognized risk factor, and reliance on BMI alone may overlook important aspects of joint mechanics. This study highlights a unique and understudied patient population and underscores the need for further investigation into the mechanisms driving these disparities and strategies to mitigate adverse outcomes.

These findings should not be interpreted as justification to limit surgical indications or restrict access to care for patients based on anatomical characteristics. Rather, they underscore the importance of using data-driven insights to inform innovation in implant design, surgical technique, and perioperative protocols. By better understanding how individual biomechanical factors influence outcomes, we can work toward more personalized, durable, and equitable arthroplasty care for all patients. This is especially those who fall outside the traditional norms used in implant development and who may benefit from personalized implants similar to what is used in shoulder arthroplasty.

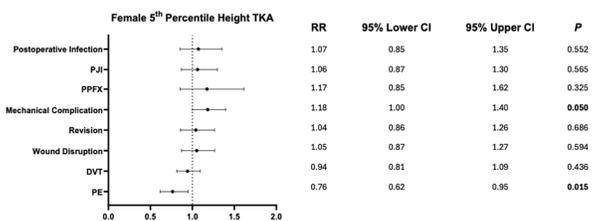


Figure 1: Relative risk of postoperative complications following TKA in female patients < 5th percentile of height compared to patients within one standard deviation of the mean. Abbreviations: PJI, periprosthetic joint infection; PPF, periprosthetic fracture; DVT, deep vein thrombosis; PE, pulmonary embolism.

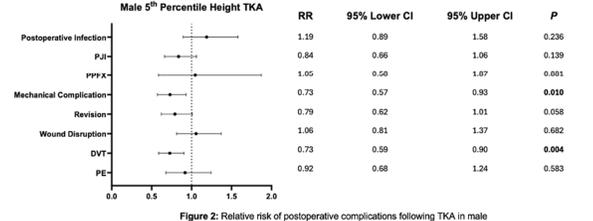


Figure 2: Relative risk of postoperative complications following TKA in male patients < 5th percentile of height compared to patients within one standard deviation of the mean. Abbreviations: PJI, periprosthetic joint infection; PPF, periprosthetic fracture; DVT, deep vein thrombosis; PE, pulmonary embolism.