Triple Taper Stems in Obese THA Patients: Complication and Revision Rates from a U.S. Registry

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INTRODUCTION:

Obesity is a known risk factor for complication and revision following total hip arthroplasty (THA), potentially due to increased torque at the implant-bone interface. Femoral stem geometry, particularly triple taper designs, may improve metaphyseal engagement and rotational stability. This study investigated revision risk and short-term outcomes in obese patients undergoing cementless primary THA by stem design.

METHODS:

A retrospective cohort study was conducted using data from a US integrated health care system's total joint arthroplasty registry. We identified 25,112 obese patients (BMI ≥ 30 kg/m2) ≥18 years old who underwent primary, unilateral, cementless THA for osteoarthritis between 2018-2024. Patients were categorized by stem type per the Khanuja-Mont 2011 classification: Type 1 (single taper), Type 2 (dual taper), and type 3C (triple taper), and stratified by obesity class (Class I: BMI 30.0-34.9; Class II-IV: BMI ≥35.0). Multivariable Cox proportional hazard models assessed cause-specific revision risk (aseptic, infection, peri-prosthetic fracture (PPF), instability, loosening, other), adjusting for confounders and surgeon clustering. Type 1 and Type 2 stems were modeled as the reference compared to type 3C. 90-day readmission and emergency department (ED) visits were captured and evaluated using multivariable logistic regression. Hazard ratios (HR), Odds Ratios (OR), and 95% confidence intervals (CI) are presented. A P<0.05 was considered statistically significant.

RESULTS:

The final study sample included 25,112 patients. There were 15,645 patients with Class I obesity: (Type 1=4,775, Type 2=3,940, and Type 3C=6,930) and 9,467 patients with Class II-IV obesity: (Type 1=2,858, Type 2=2,955, and Type 3C=3,654). The utilization of triple taper (3C) components increased over the study period (25.4% in 2018 vs 58.3% in 2024). Mean patient age and BMI kg/m2.were 65.06 years (Standard deviation STD=9.20) and 34.5 (STD=3.3), respectively. Mean patient follow-up time was 3.33 years (STD=2.07).

For patients that underwent revision surgery, the average time to first revision for any reason was 1.98 (STD=2.18). years. The cumulative aseptic revision probability at 5-years follow-up was lowest in Type 3C compared to Type 1 and 2 in Class I (Figure 1a) and Class II-IV (Figure 1b) patients, respectively. Class I obese patients with Type 3C stems had a lower risk of aseptic revision (Type 3C vs. 1: HR=0.47, 95% CI=0.31-0.71, P=0.0004) and PPF (Type 3C vs. 1: HR=0.24, 95% CI=0.11-0.50, P=0.0002 and Type 3C vs 2: HR=0.39, 95% CI=0.17-0.91, P=0.029). Similarly, Class II-IV obese patients with type 3C stems had a lower risk of aseptic revision (Type 3C vs. 1: HR=0.58, 95% CI=0.34-0.99, P=0.047 and Type 3C vs. 2: HR=0.43, 95% CI=0.25-0.74, P=0.002) and PPF (Type 3C vs. 1: HR=0.23, 95% CI=0.07-0.75, P=0.015 and Type 3C vs. 2: HR=0.12, 95% CI=0.04-0.36, P=0.002).

Obese Class I patients with a Type 3C stem had an increased risk of infection (Type 3C vs. 1: HR=1.73, 95% CI=1.04-2.86, P=0.035) and 90-day return to ED (Type 3C vs. 1: OR=1.35, 95% CI=1.17-1.55, P<.0001 and Type 3C vs 2: OR=1.17, 95% CI=1.01-1.36, P=0.037). We failed to detect a difference in risk of revision due to instability or aseptic loosening for patients with type 3C stems (Table 1a, 1b).

DISCUSSION AND CONCLUSION: Triple-taper (3C) stems are increasingly utilized in obese THA patients and associated with reduced aseptic revision and PPF risks compared to Type 1 and 2 stems, suggesting a biomechanical advantage. However, increased infection risk and 90-day ED visits in Class 1 obesity patients highlight a need for careful perioperative management in this subgroup.

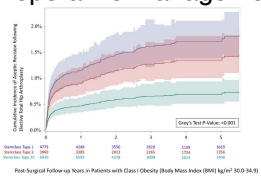

Figure 1a.

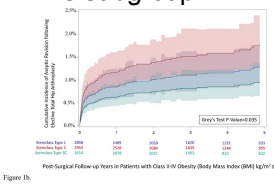

Figure 1b.