

Original Research Article

Functional outcome of posterior-stabilized total knee replacement in women with primary osteoarthritis of the knee joint

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ABSTRACT

Background: Osteoarthritis (OA) of the knee is highly prevalent in postmenopausal women, leading to significant pain and disability. Posterior-stabilized total knee replacement (PS TKR) replaces the posterior cruciate ligament (PCL) with a cam-post mechanism to restore stability and motion. However, data specifically addressing functional outcomes in women are limited.

Methods: This prospective observational study was conducted in the Department of Orthopaedics, Dr. SMCSI Medical College Hospital, Karakonam, Kerala, from January 2023 to January 2025. 36 women patients with osteoarthritis knee who underwent PS TKR were included. Functional outcomes were assessed using KSS preoperatively and at 3 weeks, 6 weeks, 3 months, 6 months, and 1 year postoperatively. The relationship between BMI and KSS was analyzed.

Results: The mean age of female patients was 63.3 years, and mean BMI was 29.4 kg/m². The mean preoperative KSS was 27.6, which improved to 92.3 at 1 year. At final follow-up, 90.5% of women achieved excellent and 9.5% good results. No significant difference in KSS was observed between BMI groups ($p > 0.05$).

Conclusions: Posterior-stabilized TKR offers excellent functional outcomes in women, independent of preoperative BMI. The procedure effectively alleviates pain and restores mobility in postmenopausal women with advanced osteoarthritis.

Keywords: Posterior-stabilized total knee replacement, Women, Osteoarthritis, Functional outcome, Knee society score, BMI

INTRODUCTION

Osteoarthritis (OA) of the knee is the most common degenerative joint disease affecting the elderly, with a notable predominance among women after menopause. Estrogen deficiency contributes to decreased cartilage volume and accelerated joint degeneration.^{1,2} Total knee replacement (TKR) remains the most successful and definitive treatment for end-stage OA, offering significant pain relief and improved function.³ Posterior-stabilized (PS) TKR substitutes the posterior cruciate ligament (PCL) with a cam-post mechanism, facilitating femoral rollback and improved flexion.^{4,5}

Despite proven success, few studies have focused specifically on the outcomes of PS TKR in women—a population with unique anatomical, hormonal, and biomechanical considerations. This study aims to assess the functional outcome of PS TKR in women, using the Knee Society Score (KSS) and to determine whether preoperative BMI influences postoperative recovery.

METHODS

Study design and setting

This was a hospital-based, prospective observational study conducted at Dr. SMCSI Medical College Hospital, Karakonam, Kerala, from January 2023 to January 2025.

Study population

All consecutive female patients with primary osteoarthritis of the knee undergoing PS TKR during the study period were included.

Inclusion criteria

Female patients aged 50 years and above with radiologically confirmed Grade III or IV osteoarthritis (Kellgren–Lawrence classification) undergoing PS TKR after informed consent were included.

Exclusion criteria

Rheumatoid, gouty, or haemophilic arthritis; post-traumatic OA; prior unicompartmental knee replacement or high tibial osteotomy were excluded.

Sample size

The study enrolled 36 consecutive women patients who were operated and followed up during the study period.

Surgical procedure

All patients underwent standard posterior-stabilized TKR by senior orthopaedic surgeons using cemented implants via a medial parapatellar approach. Postoperative rehabilitation followed institutional protocols.

Outcome measure

Functional outcomes were assessed using the KSS preoperatively and at multiple intervals up to 1 year. Grading: 80–100: excellent, 70–79: good, 60–69: fair, <60: poor.

Statistical analysis

Data were analyzed using SPSS v21.0. Quantitative data were expressed as mean±SD. $P < 0.05$ was considered statistically significant.

RESULTS

Demographics

36 (85.7%) women patients were followed for 1 year. The mean age was 63.3 ± 6.4 years, and mean BMI among women was 29.4 ± 4.6 kg/m² (26.2% normal, 33.3% overweight, 40.5% obese).

Variable	Value	Range	Percentage
Age (years)	63.3 ± 6.4	52-75	–
BMI (kg/m ²)	29.4 ± 4.57	19.4-40.1	–
Normal BMI	11	–	30.6
Overweight	14	–	38.9
Obese	11	–	30.6

The majority of female patients belonged to the overweight and obese categories, highlighting the strong association between increased body mass index and the prevalence of knee osteoarthritis in postmenopausal women.

Preoperative KSS

Mean preoperative KSS was 27.6 ± 8.4 , indicating severe functional limitation.

Postoperative functional outcome

At 1 year, mean KSS improved to 92.3 ± 8.3 . 90.5% of women achieved excellent and 9.5% women had good results.

Comparative analysis: BMI vs functional outcome.

BMI category (women)	N (%)	Mean pre-op KSS	Mean 1-year KSS	Improvement (Δ KSS)	Outcome grade	P value
Normal (18.5–24.9 kg/m ²)	11 (26.2%)	29.4 ± 6.3	93.6 ± 7.8	+64.2	Excellent	0.47
Overweight (25–29.9 kg/m ²)	14 (33.3%)	27.1 ± 8.1	91.9 ± 8.6	+64.8	Excellent	0.41
Obese (≥ 30 kg/m ²)	17 (40.5%)	25.9 ± 8.9	90.8 ± 9.2	+64.9	Excellent	0.39

No significant difference was noted among BMI groups ($p > 0.05$).

Functional improvement (Δ KSS) was comparable across all BMI categories, with no statistically significant difference ($p > 0.05$). Obese women achieved outcomes nearly identical to normal and overweight groups, showing that BMI did not adversely affect recovery or final function after PS TKR. Early follow-up (3–6 weeks) KSS scores were slightly lower among obese women, but by 6 months, all groups converged to similar high functional levels. This suggests that while obesity may mildly delay initial mobility and rehabilitation pace, long-term outcomes remain unaffected. The robust cam-post stability of PS designs likely compensates for higher load stresses associated with obesity.

Complications

Two complications were noted—one recurrent hemarthrosis and one cellulitis—managed conservatively. Both patients recovered completely.

DISCUSSION

Estrogen deficiency plays a critical role in accelerating cartilage degeneration by impairing proteoglycan synthesis and reducing cartilage volume leading to higher disease burden of knee osteoarthritis among women, particularly after menopause.⁷ In addition, biomechanical

factors such as increased Q-angle, valgus knee alignment, reduced quadriceps strength, and differences in pelvic morphology further predispose women to progressive medial compartment degeneration and symptomatic osteoarthritis. These biological and mechanical factors explains the higher representation of women requiring surgical intervention.

This study demonstrates that posterior-stabilized total knee replacement (PS TKR) results in excellent functional improvement in female patients suffering from advanced osteoarthritis of the knee. The mean Knee Society Score (KSS) improved from a severely compromised preoperative level of 27.6 to 92.3 at one-year follow-up, indicating substantial pain relief, marked improvement in mobility, and restoration of functional independence. These findings reinforce the role of PS TKR as a highly effective surgical solution for postmenopausal women with end-stage knee osteoarthritis.

A key observation in this study is the absence of a statistically significant association between body mass index (BMI) and final functional outcome in female patients. Although obese women demonstrated a slower pace of early rehabilitation, their one-year functional outcomes were comparable to those of women with normal BMI. The mean KSS improved from 27.6 to 92.3, consistent with reports from Lange et al and Giesinger et al, who found BMI did not significantly affect TKR outcomes.^{8,9} Despite higher BMI, outcomes remained excellent, corroborating Neginhal et al and Liao et al.^{10,11} Therefore, obesity alone should not be considered a contraindication for PS TKR in women when meticulous surgical technique and structured postoperative rehabilitation are ensured. The cam-post mechanism of the posterior-stabilized implant provides enhanced femoral rollback, prevents posterior tibial subluxation, and improves flexion stability. These biomechanical advantages are particularly beneficial in elderly and obese women, where ligamentous integrity and muscular control may be compromised. The excellent functional recovery observed in this cohort further validates the reliability and biomechanical superiority of PS prostheses in female patients.

Postoperative complications were minimal in this study and were managed successfully without implant failure. The low complication rate reflects precise surgical technique, strict adherence to aseptic protocols, structured physiotherapy, and good patient compliance. Early mobilization and supervised rehabilitation played a decisive role in achieving optimal functional recovery.

Despite the highly favorable outcomes, certain limitations must be acknowledged. The study is single-center based with a relatively small sample size, which may limit the generalizability of the results. The absence of a cruciate-retaining comparison group restricts implant-based comparisons. In addition, implant survivorship beyond one year was not assessed. Future multicentric randomized

controlled trials with longer follow-up and inclusion of patient-reported outcome measures are recommended to further validate the long-term effectiveness of PS TKR in women.

CONCLUSION

Posterior-stabilized total knee replacement provides excellent pain relief, joint stability, and functional restoration in female patients suffering from advanced osteoarthritis of the knee. Even in the presence of a high prevalence of overweight and obesity among women in this study, final functional outcomes were uniformly excellent, with no statistically significant influence of body mass index on recovery at one year.

The pronounced functional improvement observed in women highlights the ability of PS TKR to successfully overcome the combined biological and biomechanical disadvantages associated with female knee osteoarthritis, including estrogen deficiency, altered cartilage metabolism, and unfavorable lower-limb alignment. The cam-post mechanism of the PS implant ensures superior stability and flexion mechanics, which are especially advantageous in elderly and obese women.

Based on the findings of this study, posterior-stabilized total knee replacement can be recommended as a reliable, durable, and highly effective surgical option for women with end-stage knee osteoarthritis, irrespective of body mass index.

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Ethical approval: Not required

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