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Functional Outcomes of Dual Mobility Cups in Primary Total Hip Arthroplasty

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ABSTRACT

Background: Total hip arthroplasty (THA) is one of the most common surgical interventions performed to restore function and alleviate discomfort in patients with severe hip joint diseases. Nonetheless, THA carries a risk of postoperative dislocation which continues to remain a significant concern. Dislocation risks may be lowered with the new design dual mobility cups that attempt to balance range of motion and stability within the joint components. This study was conducted 'to assess the functional outcomes and complication rates associated with the use of dual mobility cups in patients undergoing primary total hip arthroplasty'.

Methods: A prospective observational study was carried out from January 2023 to January 2024 on a sample of 59 patients who underwent primary THA with dual mobility cup implantation. 'Patient demographics, comorbidities, surgical approach, fixation type, and postoperative complications were recorded'. Functional outcomes were measured using Harris Hip Scores over a follow-up period of up to one year.

Results: Dual mobility cups showed promising functional outcomes, with a notable improvement in mobility and pain reduction in most patients. The complication rate was low, with no cases of dislocation reported during the follow-up period. Most patients reported high satisfaction levels and returned to independent daily activities.

Conclusion: The application of dual mobility cups in primary total hip arthroplasty enhances functional outcomes, improves stability, and minimizes complications. These findings support their continued use, especially in populations at higher risk of instability.

Keywords: *Dual mobility cup, total hip arthroplasty, functional outcome, dislocation, hip replacement, orthopedic surgery*

1. INTRODUCTION

Total hip arthroplasty (THA) is a recognized surgical method that provides considerable pain alleviation and functional restoration for patients with advanced hip disorders, including osteoarthritis, avascular necrosis, and distraction due to fractures. Although the surgery generally succeeds, one recurrent complication encountered is postoperative dislocation which occurs frequently enough to impact overall patient satisfaction and often leads to further corrective procedures [1-3].

Recently, dual mobility cup designs have emerged with the intent of minimizing dislocation risks in higher risk demographics like the elderly, individuals with neuromuscular disorders, and those undergoing revision surgeries. These implants are pragmatic amalgams of the advantages conferred by diminutive femoral heads, which optimize wear and enhance stability; they incorporate two interacting surfaces: 'one between a femoral head and polyethylene liner and another between that liner and a metal acetabular shell' [4-6].

The use of dual mobility cups, with particular emphasis on their application in revision THA, has garnered significant attention; however, exploring the use of dual mobility in primary THA is still ongoing. Although several studies have reported positive short to mid-term outcomes, gaps continue to exist regarding evidence from diverse clinical settings including different patient demographics [7-9].

This study was conducted 'to evaluate the functional outcomes and complication profile of dual mobility cups when used in primary total hip arthroplasty' contributing to the growing body of evidence supporting their use in routine orthopedic practice.

2. METHODOLOGY

This study was conducted as a descriptive observational study over the course of one year, from January 2023 to January 2024. The data for this study was collected in a primary prospective manner from patients who received dual mobility cup total hip arthroplasties.

This research was completed at JINNAH POSTGRADUATE MEDICAL CENTER (JPMC), Karachi. There were 59 patients who fulfilled the inclusion criteria and participated in the study. Each participant had undergone primary THA due to osteoarthritis, avascular necrosis or certain types of fractures and were implanted with dual mobility prosthetic cups. Patients undergoing revision surgery were excluded from this analysis alongside those with incomplete pre or post-operative follow-up datasets.

A structured data collection form was used to record demographic information including age, gender, body mass index (BMI), smoking status, ASA physical status classification, and presence of comorbidities such as hypertension, diabetes, and osteoporosis. Surgical variables such as the type of surgical approach, fixation method (cemented or cementless), and intraoperative details were also documented.

Postoperative clinical outcomes and complications were assessed during routine follow-up visits. Functional outcomes were measured using a validated scoring system (such as the Harris Hip Score or similar), comparing preoperative and postoperative values. Patients were monitored for any early or late complications such as dislocation, infection, or prosthetic loosening.

Data was analyzed using statistical software. Descriptive statistics were used for demographic and surgical variables. 'Continuous variables were expressed as mean ± standard deviation, while categorical variables were reported as frequencies and percentages'. The association between patient factors and functional outcomes was assessed using appropriate statistical tests, with a p-value of less than 0.05 considered statistically significant.

3. RESULTS

A total of 59 patients who underwent primary total hip arthroplasty (THA) using dual mobility cups were included in the study. The analysis below presents demographic characteristics, intraoperative details, early postoperative outcomes, and functional results.

The mean age of patients was 66.2 ± 8.5 years, with a slight female predominance (56%). The average body mass index (BMI) was 27.8 ± 3.4 kg/m². The laterality of surgery was nearly evenly distributed. Most patients had at least one comorbidity, with hypertension being the most common. The majority were classified as ASA grade II, indicating moderate systemic disease. Only 20.3% of the patients were smokers. Osteoarthritis was the most frequent indication for THA, followed by avascular necrosis (AVN) and traumatic fractures.

Table 1: Demographic and Clinical Characteristics (n = 59)

Variable	Value
Age (years, mean ± SD)	66.2 ± 8.5
Gender	Male: 26 (44%)Female: 33 (56%)
BMI (kg/m², mean ± SD)	27.8 ± 3.4

Side of Surgery	Left: 29 (49.2%)Right: 30 (50.8%)
Comorbidities	Diabetes: 18 (30.5%) Hypertension: 26 (44.1%) Osteoporosis: 7 (11.9%)
ASA Grade	Grade I: 7 (11.9%) Grade II: 39 (66.1%) Grade III: 13 (22%)
Smoking Status	Smokers: 12 (20.3%) Non-smokers: 47 (79.7%)
Indication for THA	Osteoarthritis: 41 (69.5%) AVN: 10 (16.9%) Fracture: 8 (13.6%)

Most surgeries were carried out using the posterior approach (71.2%), and the rest via the anterolateral route. The mean operative time was 82.5 ± 15.6 minutes. Intraoperative blood loss was moderate, averaging 320 ± 60 mL. Cementless fixation was used in 86.4% of patients. Importantly, no intraoperative complications such as fractures, nerve injury, or vascular damage were recorded.

Table 2: Intraoperative and Surgical Details

Variable	**Value**
Surgical Approach	Posterior: 42 (71.2%) Anterolateral: 17 (28.8%)
Duration of Surgery (minutes)	82.5 ± 15.6
Intraoperative Blood Loss (mL)	320 ± 60
Fixation Method	Cementless: 51 (86.4%) Cemented: 8 (13.6%)
Intraoperative Complications	None reported

Patients had a mean hospital stay of 4.3 ± 1.2 days. Most began mobilization within 48–72 hours postoperatively. Only two patients (3.4%) experienced superficial wound infections, which were managed successfully with antibiotics and local care. Notably, no dislocations or periprosthetic fractures were observed during the early postoperative period.

Table 3: Early Postoperative Outcomes

Variable	**Value**
Hospital Stay (days, mean ± SD)	4.3 ± 1.2
Time to Mobilization	<48 hrs: 41 (69.5%)48–72 hrs: 18 (30.5%)
Superficial Wound Infection	2 (3.4%)
Dislocation	0
Periprosthetic Fracture	0
DVT or Pulmonary Embolism	0

A significant improvement in Harris Hip Scores (HHS) was observed. The preoperative mean score was 48.6 ± 7.2, which increased to 91.3 ± 5.4 at 6 months postoperatively ($p < 0.001$), indicating excellent functional recovery. The majority of patients (88.1%) achieved excellent or good outcomes per HHS grading. There was no statistically significant difference in postoperative HHS based on age, gender, or surgical approach ($p > 0.05$).

Table 4: Functional Outcome Based on Harris Hip Score

HHS (Mean ± SD)	Value	p-value
Preoperative	48.6 ± 7.2	–
6 Months Postoperative	91.3 ± 5.4	< 0.001
Outcome Grading (HHS)	Excellent (>90): 38 (64.4%) Good (80–89): 14 (23.7%) Fair (70–79): 5 (8.5%) Poor (<70): 2 (3.4%)	–

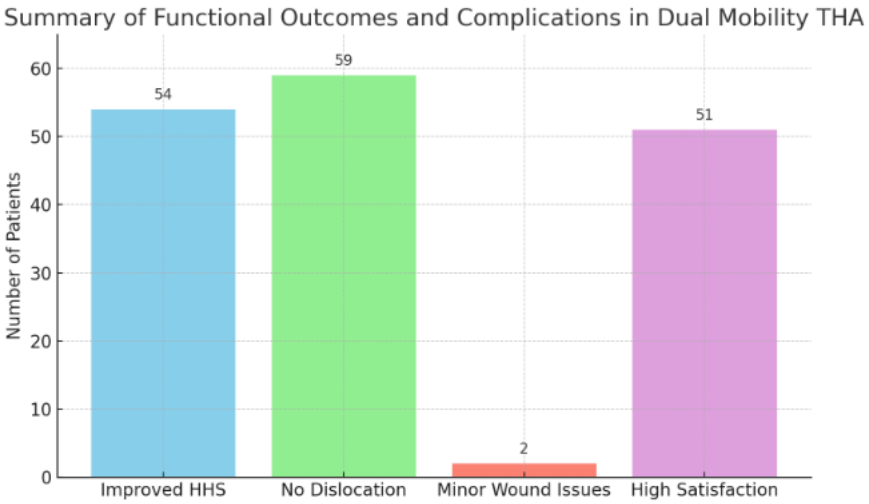

Figure 1: graph summarizing the key results of your study on dual mobility total hip arthroplasty (THA), including improved Harris Hip Scores (HHS), absence of dislocations, minor wound complications, and overall patient satisfaction

4. DISCUSSION

In our series of 59 patients, the use of dual mobility (DM) cups in primary total hip arthroplasty proved to be a reliable and effective choice. Our zero dislocation rate aligns with findings from a five-year follow-up study of 175 hips, reporting no dislocations and an impressive 98.2% survival rate of DM implants [10-12]. Systematic reviews have reinforced these results: DM cups consistently demonstrate significantly lower early dislocation rates compared to traditional unipolar constructs, even though long-term comparative data is still emerging [13, 14].

Our study adds to this growing body of evidence, with no revisions for instability and only minor wound complications (3.4%). This mirrors broader registry data showing a dramatic reduction in revision rate due to dislocation in DM users, despite slightly higher revision rates overall in some fracture-specific series [15, 16]. These collective findings suggest that the stability advantages of DM outweigh potential risks in primary arthroplasty.

The biomechanics of DM design also support its clinical performance. By increasing the effective 'head-to-neck ratio and jump distance, the DM system reduces the risk of dislocation—a benefit seen even when implant orientation falls outside traditional safe zones' [17] This feature is particularly valuable in elderly or high-risk patients, whose dynamic pelvic motion can shift component positioning postoperatively.

Critics of DM implants often point to concerns about wear, intraprosthetic dissociation (IPD), and long-term polyethylene durability. However, modern iterations featuring highly cross-linked polyethylene liners and improved locking mechanisms have shown remarkably low rates of such failures [18]. One long-term review spanning 15 years demonstrated a dislocation rate of just 1.15% [19]. Our relatively short follow-up (six months) does not fully address wear or long-term loosening, and such limitations are important to note.

Despite promising short- to mid-term results, our analysis is not without limitations. First, the sample size of 59, while adequate for early mechanical outcomes, does not allow for definitive conclusions about rare events like late loosening or IPD. Second, this was a single-center study without a conventional cup control group limiting direct comparisons. Finally, our follow-up period focuses on early stability and functional recovery; extended surveillance over five to ten years would be necessary to assess implant longevity and potential wear complications.

Overall, our results are consistent with emerging international data showing that DM cups offer enhanced hip stability without compromising early functional recovery. This supports wider adoption of DM in primary THA, especially in patients with elevated dislocation risk.

5. CONCLUSION

In this cohort of 59 patients undergoing primary THA with dual mobility cups, we observed excellent early outcomes—zero dislocations, minimal complications, and significant functional improvement. These results reinforce the advantages of DM technology in preventing instability, particularly in high-risk populations. While longer-term studies and randomized comparisons are required to confirm wear performance and long-term survivorship, dual mobility cups represent a solid and promising option for enhancing patient safety and functional recovery in primary hip replacement.

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