Dual Mobility Versus Large Femoral Head in Primary and Revision Total Hip Arthroplasty; A Meta-analysis of Outcomes

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INTRODUCTION:
Instability is a common complication after total hip arthroplasty (THA), and recurrent instability is a leading cause of revision surgery. The risk of further instability is higher after revision surgery. This leads to significant patient morbidity and increases the economic burden on healthcare systems. Large femoral heads (LFH) and dual mobility (DM) constructs have been used to mitigate the risk of dislocation especially in high-risk patients.
The aim of this analysis is to compare LFH and DM constructs in THA. Outcomes include postoperative complications, particularly dislocation risk, and revision rates in patients undergoing primary or revision THA.
METHODS:
A systematic review and meta-analysis were conducted in accordance with the Cochrane Handbook for Systematic Reviews and the PRISMA statement guidelines. LFH were defined as femoral heads ≥36 mm. Studies directly comparing LFH and DM implants were analysed for outcomes including dislocation, periprosthetic fracture, periprosthetic joint infection (PJI), acetabular radiolucencies, postoperative Harris Hip Score (HHS), and revision rates (for dislocation, aseptic loosening, periprosthetic fracture, and all-cause revision). Analyses were performed separately for primary cases, revisions, and the total cohort. Random-effects models were used, and the certainty of evidence was assessed using the GRADE system. Risk of bias was assessed using the Cochrane Risk of Bias (RoB) tool for randomised controlled trials (RCTs) and the Methodological Index for Non-Randomised Studies (MINORS) criteria for comparative studies.
RESULTS:
Twenty studies were eligible for inclusion, comprising 2 RCTs and 18 non-randomised studies. The total number of patients was 140,481, with 16,059 (11.4%) in the DM group and 125,026 (88.6%) in the LFH group. The weighted mean age for primary THA was 69.5 ± 10.8 years in the LFH group vs. 72.9 ± 11.3 years in the DM group, and for revision THA, 66.6 ± 12.5 years in LFH vs. 67.6 ± 11.4 years in DM. The weighted female percentage for primary cases was 42.5% in LFH vs. 62.7% in DM, and for revision cases, 53.1% in LFH vs. 64.4% in DM. The weighted mean BMI for primary THA was 32.6 ± 10.3 in LFH vs. 30.6 ± 8.7 in DM, and for revision THA, 28.6 ± 8.6 in LFH vs. 29.5 ± 6.9 in DM. The most common indication for primary THA was osteoarthritis (LFH: 90.2%; DM: 73.1%). For revision THA, the most common indication was dislocation/instability in both groups (LFH: 33.3%; DM: 66.5%). The weighted mean follow-up duration for primary cases was comparable between groups (LFH: 4.4 years vs. DM: 4.3 years). For revision cases, the LFH group had a longer mean follow-up (4.3 years) than the DM group (2.6 years).
LFH implants were significantly associated with a higher risk of dislocation in both primary THA (OR: 4.93; 95% CI [3.49, 6.98]; $p < 0.00001$; $I^2 = 0\%$) and revision THA (OR: 2.02; 95% CI [1.45, 2.80]; $p < 0.0001$; $I^2 = 0\%$), as well as in the overall analysis (OR: 2.64; 95% CI [1.68, 4.16]). Total heterogeneity: $Chi^2 = 10.35$, $p = 0.32$; $I^2 = 41\%$.
For revision due to dislocation, the risk was not statistically significant in primary (OR: 1.39, 95% CI [0.97, 2.00], p=0.07; I^2=0%) or revision cases (OR: 1.38, 95% CI [0.89, 2.14], p=0.16; I^2=13%) when analysed separately. However, the overall analysis showed LFH was associated with a significantly higher risk of revision for dislocation (Total OR: 1.38, 95% CI [1.05, 1.83], p=0.02; I^2=0%).
LFH were linked to a significantly higher risk of revision for aseptic loosening in primary cases (OR: 2.39, 95% CI [1.09, 5.22], p=0.03; I^2=31%) but not in revision cases (OR: 1.52, 95% CI [0.73, 3.17], p=0.27; I^2=21%). The overall total revealed a significantly higher risk for LFH (Total OR: 1.92, 95% CI [1.20, 3.06], p=0.006; I^2=22%).
No significant difference in the risk of PJI was found in primary (OR: 1.71, 95% CI [0.66, 4.40], p=0.27; I^2=61%), revision (OR: 1.00, 95% CI [0.66, 1.53], p=1.00; I^2=0%), or total cases (Total OR: 1.16, 95% CI [0.85, 1.58], p=0.36; I^2=0%).
LFH was associated with a significantly higher risk of periprosthetic fracture in both primary (OR: 1.60, 95% CI [1.03, 2.47], p=0.04; I^2=28%) and revision cases (OR: 3.05, 95% CI [1.15, 8.09], p=0.03; I^2=0%). Similarly, the risk of revision for periprosthetic fracture was significantly higher with LFH in both primary (OR: 1.60, 95% CI [1.03, 2.47], p=0.04; I^2=28%) and revision cases (OR: 3.44, 95% CI [1.08, 10.92], p=0.04; I^2=0%).
For all-cause revisions, no significant difference was found between LFH vs DM (OR: 1.83, 95% CI [0.96, 3.51], p=0.07) with very high heterogeneity (I^2=92%), but a significantly higher risk in revision cases (OR: 1.67, 95% CI [1.28, 2.17], $p < 0.0001$; I^2=15%). The overall total risk for all-cause revision was significantly higher with LFH (Total OR: 1.60, 95% CI [1.25, 2.05], p=0.0002; I^2=60%).
Furthermore, LFH was linked to a significantly higher risk of acetabular radiolucency (OR: 4.47, 95% CI [1.25, 16.02], p=0.02; I^2=0%).
No significant difference was noted in postoperative Harris Hip Scores (Mean Difference: -0.32, 95% CI [-2.77, 2.14], p=0.80; I^2=62%).

DISCUSSION AND CONCLUSION:

Our analysis revealed that, in primary THA, LFH were associated with a fivefold higher risk of dislocation, with the difference being statistically significant. DM also demonstrated a marginal clinical, yet statistically significant, advantage over LFH in reducing periprosthetic fractures, revisions for periprosthetic fractures, and revisions for aseptic loosening. There was no significant difference between the two groups in PJI, revision for instability, all-cause revision, or postoperative outcomes measured by the HHS.

For revision THA, our analysis indicates that LFH was associated with a significantly higher risk of both dislocation and all-cause re-revision. Additionally, DM demonstrated a marginal clinical, but statistically significant, benefit over LFH in reducing periprosthetic fractures and the need for subsequent revision due to this complication. In contrast, there were no statistically significant differences between the groups in rates of PJI, outcome scores measured by HHS, revision for instability, or revision for aseptic loosening.