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Original Article

Diagnosis-Specific Six-Month Functional Recovery Following Total Hip Replacement

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ABSTRACT

Background: Total hip replacement (THR) improves function in patients with end-stage hip disease. Whether short-term functional recovery differs according to the underlying indication for THR remains uncertain.

Methods This study included 79 patients undergoing primary THR with complete Harris Hip Score (HHS) assessments before surgery, immediately after surgery, and at 3 and 6 months. Patients were classified as having avascular necrosis (AVN) or non-AVN indications. The primary outcome was HHS at 6 months. Outcomes included HHS at earlier follow-up visits and improvement in HHS from baseline to 6 months. Group comparisons used Welch's independent-samples t-test. Exploratory multivariable linear regression adjusted for age, sex, and baseline HHS.

Results Thirty-five patients had AVN and 44 had non-AVN indications. Mean preoperative HHS was similar in the AVN and non-AVN groups (26.46 ± 6.50 versus 26.30 ± 5.93; p=0.909). At 6 months, mean HHS was 85.00 ± 2.77 in the AVN group and 83.77 ± 3.15 in the non-AVN group. The unadjusted mean difference of 1.23 points was not statistically significant (p=0.070). Mean improvement from baseline to 6 months was also similar between groups (58.54 ± 6.91 versus 57.48 ± 6.22; p=0.479). In the exploratory adjusted model, AVN was associated with a 1.40-point higher 6-month HHS (standard error 0.69; p=0.046).

Conclusion Patients with AVN and non-AVN indications showed substantial functional improvement after THR. The unadjusted analysis did not demonstrate a clear difference in 6-month functional recovery between the groups. The adjusted association should be interpreted cautiously because of the exploratory design, limited sample size, and heterogeneous non-AVN group.

Keywords: Total hip replacement; total hip arthroplasty; avascular necrosis; Harris Hip Score; functional outcome.

INTRODUCTION

Total hip replacement is an established treatment for end-stage hip disorders (1) and provides substantial pain relief, restoration of mobility, and improvement in daily function (2,3). Functional recovery after THR is commonly assessed using the Harris Hip Score, which evaluates pain, function, deformity, and range of motion (4,5).

The underlying diagnosis leading to THR may influence postoperative recovery (6,7). Avascular necrosis often affects younger and more active patients (3,8), whereas osteoarthritis, fracture neck of femur, inflammatory arthritis (9), and failed hemiarthroplasty may be associated with different baseline disability, bone quality, functional demands, and rehabilitation requirements. These differences may affect both postoperative HHS and the magnitude of functional improvement after surgery.

Although overall functional improvement following THR has been well documented (10,11), fewer studies have examined whether short-term functional recovery differs according to the underlying indication for surgery, particularly in rural and tribal populations in India. Understanding diagnosis-specific recovery may assist in patient counselling, expectation setting, and interpretation of early postoperative outcomes.

Therefore, this exploratory analysis was undertaken to compare functional recovery after THR between patients with AVN and those with non-AVN indications. The primary objective was to compare HHS at 6 months after surgery. Objectives were to compare HHS at the immediate postoperative and 3-month follow-up visits, and to compare the improvement in HHS from baseline to 6 months.

METHODOLOGY

Study design and setting

This was an exploratory analysis of a prospective observational cohort of patients who underwent primary total hip replacement (THR) at the Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, India. The original cohort was followed for 6 months after surgery. No new patients were recruited for this analysis.

Participants

The analysis included all 79 patients from the original cohort with complete HHS assessments at the preoperative, immediate postoperative, 3-month, and 6-month timepoints. Patients were grouped according to the recorded indication for THR.

Patients with right-sided, left-sided, or bilateral avascular necrosis were classified in the AVN group. All remaining indications were classified as non-AVN, including osteoarthritis, fracture neck of femur, rheumatoid arthritis, and prior hemiarthroplasty.

Data collection and outcome measures

The following variables were extracted from the original master chart: age, sex, indication for THR, fixation type (cemented or uncemented), and HHS at four timepoints: preoperatively, immediately postoperatively, at 3 months, and at 6 months.
The primary outcome was HHS at 6 months after THR. Outcomes were HHS immediately after surgery, HHS at 3 months, and the absolute improvement in HHS from baseline to 6 months. Improvement in HHS was calculated as:
HHS improvement = 6-month HHS − preoperative HHS

Statistical analysis

Continuous variables were summarized as mean ± standard deviation, and categorical variables as frequency and percentage. Baseline characteristics and HHS outcomes were compared between the AVN and non-AVN groups using Welch's independent-samples t-test for continuous variables.

An exploratory multivariable linear regression model was used to assess the association between AVN and 6-month HHS after adjustment for age, sex, and baseline HHS. Regression results were presented as regression coefficients with standard errors and p-values. All tests were two-sided, and $p<0.05$ was considered statistically significant.
No imputation was performed because all 79 included patients had complete HHS data at all four assessment timepoints.

Ethical considerations

The original prospective study received approval from the Institutional Ethics Committee of Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, India. Written informed consent had been obtained from all participants before enrolment in the original study.

RESULTS

A total of 79 patients undergoing total hip replacement were included in the analysis. Thirty-five patients (44.3%) had avascular necrosis (AVN) as the indication for surgery, while 44 patients (55.7%) had non-AVN indications. All patients

had complete Harris Hip Score (HHS) measurements before surgery, immediately after surgery, and at 3- and 6-month follow-up.

The AVN group had a mean age of 42.20 ± 14.09 years, compared with 45.73 ± 13.64 years in the non-AVN group. There were 25 males and 10 females in the AVN group, while the non-AVN group included 36 males and 8 females. Uncemented fixation was used in 32 of 35 patients with AVN and in 42 of 44 patients with non-AVN indications.

Preoperative HHS was comparable between the groups: 26.46 ± 6.50 in the AVN group and 26.30 ± 5.93 in the non-AVN group (p=0.909). Immediate postoperative and 3-month HHS were also similar between the groups. At 6 months, the mean HHS was 85.00 ± 2.77 in the AVN group and 83.77 ± 3.15 in the non-AVN group. The unadjusted mean difference was 1.23 points and did not reach conventional statistical significance (p=0.070).

The mean improvement in HHS from baseline to 6 months was 58.54 ± 6.91 points in patients with AVN and 57.48 ± 6.22 points in patients with non-AVN indications (p=0.479).

HHS measure	**AVN, n=35**	**Non-AVN, n=44**	**p-value**
Preoperative HHS	26.46 ± 6.50	26.30 ± 5.93	0.909
Immediate postoperative HHS	39.29 ± 1.51	39.30 ± 1.55	0.978
HHS at 3 months	73.14 ± 2.14	73.11 ± 2.08	0.952
HHS at 6 months	85.00 ± 2.77	83.77 ± 3.15	0.070
Improvement from baseline to 6 months	58.54 ± 6.91	57.48 ± 6.22	0.479

In an exploratory multivariable linear regression model adjusted for age, sex, and baseline HHS, AVN was associated with a 1.40-point higher 6-month HHS compared with non-AVN indications (standard error 0.69, p=0.046). Age, sex, and baseline HHS were not independently associated with 6-month HHS in this model.

DISCUSSION

This exploratory analysis examined whether the underlying indication for total hip replacement influenced short-term functional recovery. The main finding was that patients with AVN and those with non-AVN indications experienced substantial improvement in HHS from baseline to 6 months. Mean 6-month HHS was slightly higher in the AVN group than in the non-AVN group, but the unadjusted difference of 1.23 points was not statistically significant. Similarly, the magnitude of improvement from baseline to 6 months was comparable between groups.

These findings suggest that the functional benefit of THR was broadly maintained across the diagnostic spectrum represented in this cohort (1,2). Although AVN is often seen in relatively younger and more active patients (3,8), the present results do not establish a clinically important unadjusted advantage in recovery for AVN over other indications (1). The small adjusted association between AVN and higher 6-month HHS should be interpreted cautiously because it arose from an exploratory regression model in a limited sample.

The absence of a marked difference in improvement between AVN and non-AVN patients may indicate that THR provides meaningful early functional restoration despite differences in underlying pathology (12). Patients with fracture neck of femur, osteoarthritis, rheumatoid arthritis, and prior hemiarthroplasty had lower mean 6-month HHS than the AVN group, but the individual non-AVN categories were small. Therefore, these apparent differences should not be interpreted as evidence of diagnosis-specific superiority or inferiority (13).

This analysis has several strengths. It used patient-level data from a prospective cohort, included complete HHS measurements at four follow-up timepoints for all 79 patients, and examined both final HHS and change from baseline. The use of a single functional instrument across all visits also allowed a consistent assessment of recovery over time (5). The cohort was small and from a single centre, with only 6 months of follow-up. The non-AVN group was clinically heterogeneous and included several diagnoses with small subgroup sizes.

CONCLUSION

In conclusion, patients undergoing THR for both AVN and non-AVN indications demonstrated marked improvement in HHS by 6 months. The available data do not demonstrate a clear unadjusted difference in functional recovery between the two groups. Larger studies with standardized diagnostic coding, longer follow-up, and comprehensive clinical data are needed to determine whether underlying pathology independently influences functional outcome after THR.

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