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# Functional Outcomes of Conservative Management in Children with Legg-Calvé-Perthes Disease: A Cross-Sectional Study at a Tertiary Pediatric Orthopedic Center in Nepal

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## Abstract

**Introduction:** Legg-Calvé-Perthes disease (LCPD) is a self-limiting pediatric hip disorder that can leave femoral head deformity and impaired hip function. Conservative treatment remains an important option, particularly in younger children and less severe disease. This study evaluated functional outcomes after conservative management at a tertiary pediatric orthopedic center in Nepal and explored demographic and clinical factors associated with outcome.

**Methods:** This cross-sectional analytical study included 30 children with LCPD who completed conservative management at the Hospital and Rehabilitation Centre for Disabled Children (HRDC), Banepa, Nepal, between January 2010 and December 2024. Functional outcome at the latest follow-up was assessed using the Harris Hip Score (HHS), categorized as <80 or ≥80. Associations with age group, sex, laterality, and follow-up duration were assessed using Pearson chi-square or Fisher exact tests, with $p < 0.05$ considered significant.

**Results:** Twenty-one participants (70.0%) achieved HHS ≥80. The cohort was predominantly male (23/30, 76.7%); 16 (53.3%) were younger than 10 years, and left-sided disease was most frequent (17/30, 56.7%). No demographic or follow-up variable was statistically significantly associated with functional outcome after exact testing. Sex showed a borderline association: all seven female participants achieved HHS ≥80 compared with 60.9% of males (Fisher exact $p = 0.058$). Age group, laterality, and follow-up duration were not significantly associated with outcome.

**Conclusion:** In this Nepalese tertiary-center cohort, conservative management was associated with good-to-excellent functional outcome in 70% of children. No factor was definitively associated with outcome; the borderline sex finding should be interpreted cautiously because of the small female subgroup. Prospective studies incorporating radiographic severity and pediatric-specific outcome measures are needed.

**Keywords:** Avascular necrosis, Conservative management, Harris Hip Score, Legg-Calvé-Perthes disease, Pediatric orthopedics.

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# Introduction

Legg-Calvé-Perthes disease (LCPD) is a pediatric hip disorder caused by temporary interruption of the femoral head blood supply, resulting in avascular necrosis of the capital femoral epiphysis. It commonly affects children aged 4–10 years and shows a marked male predominance. Although self-limiting, disease-related femoral head deformity may compromise hip congruency and predispose to early osteoarthritis.[1-5]

The disease evolves through necrosis, fragmentation, reossification, and remodeling. Treatment aims to preserve hip motion and maintain containment of the femoral head during healing. Conservative treatment includes activity modification, protected weight-bearing, physiotherapy, and, when indicated, orthotic containment.[4-7] Age at onset and radiographic severity are important prognostic considerations, with younger children generally having more favorable outcomes.[7-9,17]

Evidence from low-resource settings remains limited. Nepal presents challenges related to delayed diagnosis and restricted access to advanced imaging and rehabilitation resources.[10] This study therefore evaluated functional outcomes after conservative management of LCPD at HRDC, Banepa, and examined demographic and clinical factors associated with functional outcome.

# Methods

## Study Design

This was a cross-sectional analytical study of children with LCPD who had completed conservative treatment. The study is reported in accordance with the STROBE guidelines.[11]

## Place and duration of study

The study was conducted at the Hospital and Rehabilitation Centre for Disabled Children (HRDC), Banepa, Kavrepalanchok District, Nepal. Patients treated between January 2010 and December 2024 were considered.

## Ethical approval and Patient consent

Ethical approval was obtained from the B&B Hospital Institutional Review Committee before data collection. Because this was a retrospective review of anonymized medical records, individual informed consent was waived. Patient identifiers were removed during data extraction and analysis. The study was conducted in accordance with the Declaration of Helsinki.

## Inclusion and exclusion criteria

Inclusion criteria were: confirmed LCPD based on clinical evaluation and plain radiography; completion of conservative management at HRDC; and complete medical records including follow-up and functional outcome assessment. Patients with incomplete records or those who underwent surgical treatment such as femoral or pelvic osteotomy were excluded.

## Sample Size and sampling

Thirty eligible participants met the predefined criteria and were included. The available records meeting the eligibility criteria were analyzed.

## Data collection and outcome measure

Data were extracted from medical records and structured follow-up assessments using a standardized, pre-tested proforma. Variables included age at diagnosis, sex, laterality, duration of follow-up, and HHS at latest follow-up. The primary outcome was functional status measured by the HHS, a 100-point score assessing pain, function, deformity, and range of motion. HHS was dichotomized as <80 (poor-to-fair) and ≥80 (good-to-excellent).

## Statistical analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized using frequencies and valid percentages. Associations between age group (<10 vs ≥10 years), sex, laterality, follow-up duration (<12 vs ≥12 months), and dichotomized HHS were assessed using Pearson chi-square tests when all expected cell counts were ≥5; Fisher exact or Fisher-Freeman-Halton exact tests were used when any expected cell frequency was <5. Statistical significance was set at $p < 0.05$. No imputation was performed for missing data; only complete cases were analyzed.

# Results

## Participant characteristics

Thirty children with LCPD who had completed conservative management were included. Twenty-one participants (70.0%) achieved good-to-excellent functional outcome (HHS ≥80). The cohort was predominantly male, and most participants were younger than 10 years at diagnosis. Left-sided involvement was the most frequent laterality, and 63.3% had follow-up of at least 12 months (Table 1).

## Predictors of functional outcome

No demographic or follow-up variable was statistically significantly associated with dichotomized HHS after exact testing. Sex showed a borderline association: all seven female participants achieved HHS ≥80, compared with 60.9% of male participants (Fisher exact $p = 0.058$) (Figure 3).

Age group, laterality, and follow-up duration were not significantly associated with functional outcome (Table 2).

Table 1. Demographic and Clinical Characteristics

| Variable | Frequency | % (Valid) |
|---|---|---|
| **Age group** | | |
| Below 10 years | 16 | 53.3 |
| Above 10 years | 14 | 46.7 |
| **Sex** | | |
| Male | 23 | 76.7 |
| Female | 7 | 23.3 |
| **Laterality** | | |
| Left | 17 | 56.7 |
| Right | 8 | 26.7 |
| Bilateral | 5 | 16.7 |
| **HHS category** | | |
| Below 80 (poor-to-fair) | 9 | 30.0 |
| 80 or above (good-to-excellent) | 21 | 70.0 |
| **Follow-up duration** | | |
| Below 12 months | 11 | 36.7 |
| ≥12 months | 19 | 63.3 |

*HHS: Harris Hip Score.*

# Discussion

The present study found that 70.0% of children with LCPD managed conservatively at a tertiary pediatric orthopedic center in Nepal achieved good-to-excellent functional outcome by HHS. The cohort showed the expected male predominance and a concentration of cases below 10 years of age. These findings are broadly consistent with established epidemiological patterns of LCPD.[2,14,15]

The favorable overall outcome supports the continued role of conservative management, particularly when treatment is individualized according to age, disease stage, hip motion, and containment. Contemporary recommendations emphasize physiotherapy, activity modification, family education, and close monitoring, while radiographic severity remains important when deciding whether conservative treatment is appropriate.[7-9,17]

The borderline association between sex and outcome should be interpreted cautiously. All seven female participants achieved HHS ≥80, whereas 60.9% of males did so; however, this did not reach statistical significance using Fisher exact test ($p = 0.058$). This observation differs from reports in which female sex has been associated with later presentation or more advanced disease.[15] The small number of female participants and the absence of radiographic severity data prevent conclusions about a biological sex effect. Earlier presentation, less severe disease, or better containment could explain the observed difference, but these possibilities were not directly measured.

Table 2. Association between demographic variables and functional outcome (HHS) in children with LCPD (n=30)

| Variable | HHS <80 n (%) | HHS ≥80 n (%) | $\chi^2$ | df | p |
|---|---|---|---|---|---|
| **Age group** | | | | | |
| Below 10 (n=16) | 6 (37.5%) | 10 (62.5%) | 0.918 | 1 | 0.440* |
| Above 10 (n=14) | 3 (21.4%) | 11 (78.6%) | | | |
| **Sex** | | | | | |
| Male (n=23) | 9 (39.1%) | 14 (60.9%) | 3.913 | 1 | 0.058* |
| Female (n=7) | 0 (0.0%) | 7 (100.0%) | | | |
| **Laterality** | | | | | |
| Left (n=17) | 7 (41.2%) | 10 (58.8%) | 3.249 | 2 | 0.267† |
| Right (n=8) | 2 (25.0%) | 6 (75.0%) | | | |
| Bilateral (n=5) | 0 (0.0%) | 5 (100.0%) | | | |
| **Follow-up** | | | | | |
| <12 months (n=11) | 3 (27.3%) | 8 (72.7%) | 0.062 | 1 | 1.000* |
| ≥12 months (n=19) | 6 (31.6%) | 13 (68.4%) | | | |

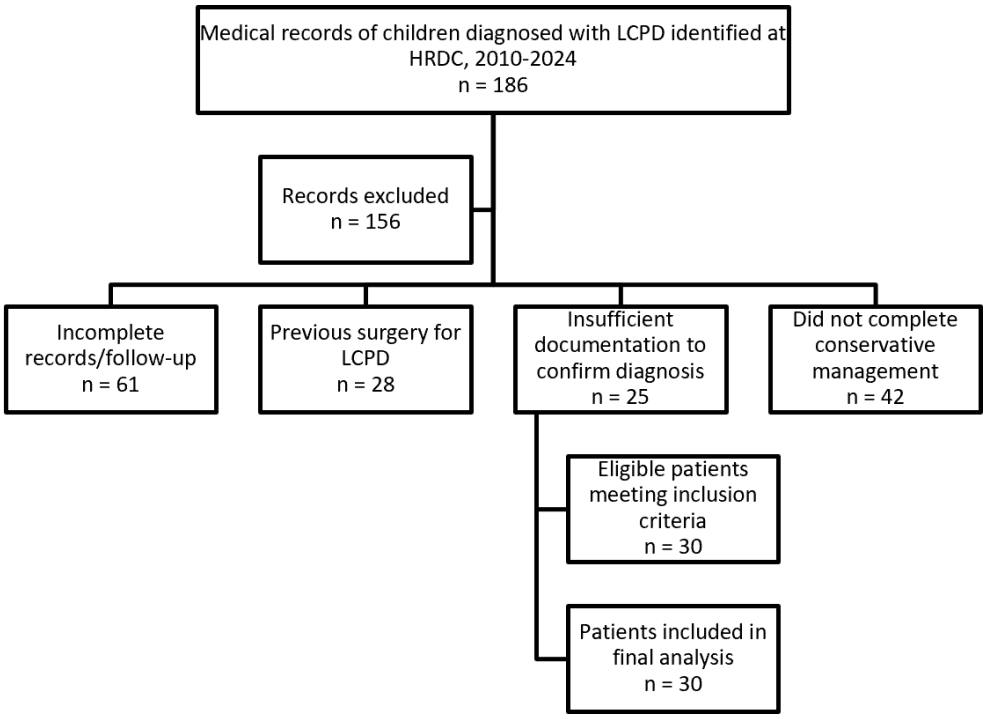



**Figure 1** Patient flow diagram showing records screened, and 30 participants included in the final analysis.

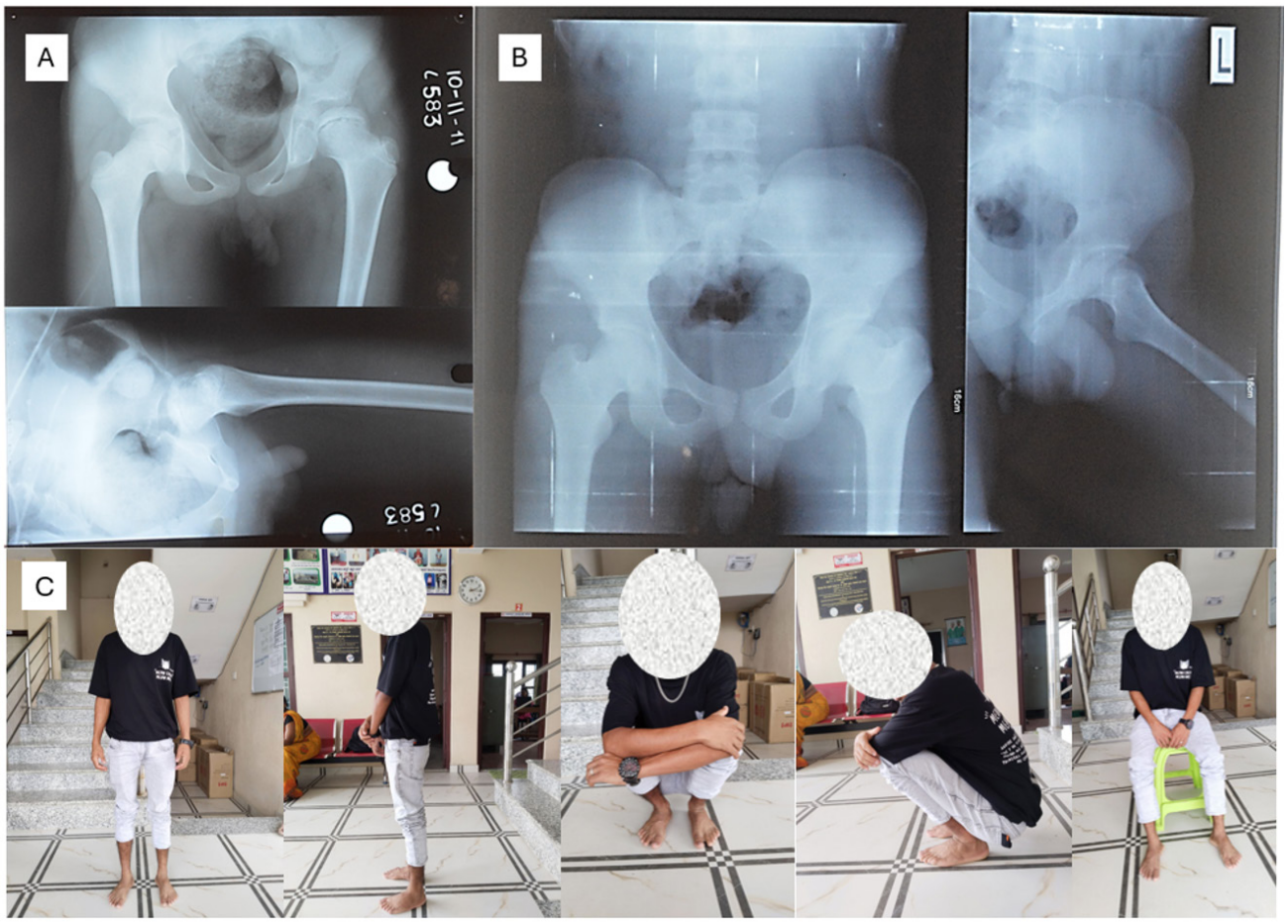



**Figure 2** A - Anteroposterior and lateral pelvis radiographs of a 8 year old patient LCPD of left hip managed conservatively. B - Anteroposterior and lateral pelvis radiographs of the same patient after 12 years of follow-up. C – Excellent functional outcome following the conservative treatment in the same patient.

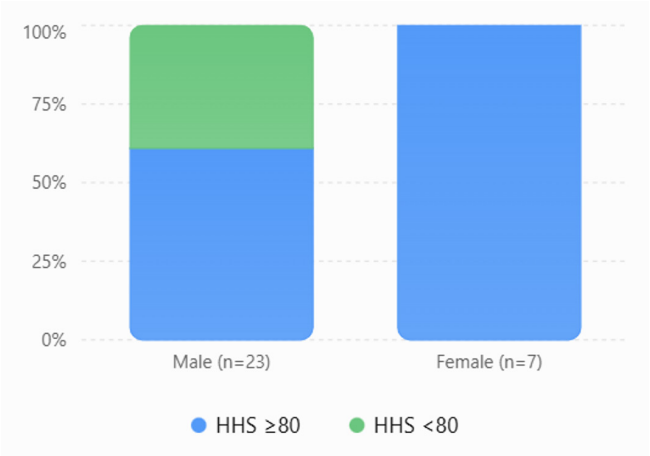



**Figure 3** Functional outcome according to sex among children with Legg-Calvé-Perthes disease.

Age group was not significantly associated with outcome in this cohort. This contrasts with the broader literature identifying younger age at onset as an important prognostic factor.[8,9] The lack of Herring lateral pillar grading and other radiographic severity measures limits interpretation because age and disease severity are closely related determinants of treatment response.

Laterality and follow-up duration were also not significantly associated with outcome. All five children with bilateral involvement achieved HHS ≥80, although the difference was not statistically significant. The small sample size limits the ability to detect meaningful subgroup differences.

This study provides data from a low-resource South Asian setting in which published outcome evidence is limited. Its strengths include the use of a defined conservative-treatment cohort and a standardized functional outcome measure. However, the sample size of 30 patients limits statistical power and generalizability. The retrospective cross-sectional design introduces selection bias, particularly because patients with incomplete records or unavailable follow-up were excluded. Radiographic severity and final femoral head morphology were not available for analysis, and HHS, although widely used, was developed for adult hip assessment and may not capture all pediatric-specific functional domains.[12] Follow-up duration also varied between participants.

Future studies should prospectively record disease stage and Herring lateral pillar classification, standardize conservative treatment protocols, and use validated pediatric hip-specific patient-reported outcome measures. Multicenter studies across Nepal and South Asia could provide larger cohorts and allow more reliable assessment of prognostic factors.

## Conclusion

Conservative management of LCPD at a tertiary pediatric orthopedic center in Nepal was associated with good-to-excellent functional outcome in 70% of children. Sex was the only statistically significant factor associated with outcome in this cohort, but the finding should be interpreted cautiously because of the small subgroup size. Prospective multicenter studies incorporating radiographic severity grading and pediatric-specific outcome measures are recommended.

**Conflict of Interest:** None
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