

## Research Article

# Assessment of Leg Length Inequality After Total Hip Replacement: A Clinical Study

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**Abstract:** **Introduction:** Leg length inequality (LLI) is a common complication following total hip replacement (THR), affecting postoperative function, gait, and patient satisfaction. Accurate restoration of limb length is critical to optimizing outcomes, yet multiple preoperative and intraoperative factors can influence LLI. **Aim:** To identify factors contributing to leg length discrepancy in patients undergoing THR to improve prevention and treatment strategies. **Methods:** A descriptive longitudinal study was conducted over two years at VVP Rural Hospital, Loni, including 84 patients undergoing primary unilateral THR. Preoperative and postoperative leg length measurements were obtained using standardized anteroposterior pelvic radiographs. Functional outcomes were assessed with the Harris Hip Score (HHS) and patient-reported outcomes with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Associations between LLI and variables such as surgical approach, surgeon experience, and operative duration were analyzed using Chi-square and independent t-tests, with  $p < 0.05$  considered significant. **Results:** Postoperative LLI of  $< 5$  mm was observed in 55.6% of patients, 5–10 mm in 24.4%, 10–15 mm in 13.3%, and  $> 15$  mm in 6.7%. Longer surgical duration and lower surgeon experience were significantly associated with higher LLI ( $p < 0.05$ ). Functional scores improved significantly over follow-up (HHS: 42.6 preoperative to 88.5 at 12 months; WOMAC: 68.4 to 18.2). **Conclusion:** Postoperative LLI is influenced by surgical approach, surgeon experience, and operative duration. Meticulous preoperative planning and intraoperative precision are essential to minimize LLI and enhance functional outcomes.

**Keywords:** Total hip replacement, Leg length inequality, Functional outcomes.

## INTRODUCTION

Total hip replacement (THR), also known as total hip arthroplasty, is one of the most successful and commonly performed orthopedic procedures worldwide, particularly for the management of end-stage degenerative hip disorders.<sup>(1)</sup> Leg length inequality (LLI), also referred to as leg length discrepancy (LLD), occupies a central position due to its complex etiology, multifaceted clinical implications, and the challenges associated with its prevention and management.<sup>(2)</sup>

Leg length inequality after THR is a well-recognized and extensively discussed postoperative phenomenon, with reported incidences ranging from 1% to more than 30%, depending on the definition used, measurement technique, and the surgical approach adopted.<sup>(3)</sup> Even small discrepancies in leg length can produce biomechanical alterations affecting gait, posture, and load distribution across joints of the lower limb and spine.<sup>(4,5)</sup>

Despite the advances in modern orthopedic practice, there remain gaps in the literature regarding the predictors, prevention, and long-term impact of leg length inequality following THR.<sup>(6-9)</sup> Studies vary in their definitions of significant LLI, measurement methods, and thresholds for intervention, making

comparison difficult. Moreover, patient perception and satisfaction, although critically important, are subjective and may not correlate directly with objective measurements.<sup>(10)</sup>

In conclusion, leg length inequality following total hip replacement remains a clinically significant complication with far-reaching implications for postoperative function, patient satisfaction, and medico-legal outcomes. Awareness of the risk factors, meticulous preoperative planning, precise surgical execution, and attentive postoperative care are essential in minimizing discrepancies.

**Aim:** To identify factors contributing to leg length discrepancy in patients undergoing THR to improve prevention and treatment strategies.

## MATERIALS AND METHODS

**Study design:** Descriptive longitudinal study

**Study area:** Patients attending Orthopedics department of VVP Rural Hospital Loni.

**Study population:** Patients undergoing fixation of distal end of radius fracture under Department of Orthopedics and having inclusion criteria.

**Study duration:** 2 years

**Sample size:** 84 cases.

Patients attending Orthopedic OPD and those who fulfill inclusion criteria and give consent for surgery were included in the study.

**Inclusion Criteria:**

- Adults aged 18 years or older.
- Patients undergoing unilateral total hip replacement.
- Patients undergoing their first hip replacement surgery (primary total hip replacement).
- Patients who provide informed written consent and agree to follow-up assessments.

**Exclusion Criteria:**

- Patients with bilateral total hip replacements.
- Patients with a history of previous hip or pelvic surgeries.
- Patients with severe pre-existing neuromuscular or skeletal conditions.
- Patients unable or unwilling to complete follow-up assessments

This prospective study was conducted over a two-year period at Dr. BVP Pravara Rural Medical College, Loni, and included all eligible patients undergoing total hip replacement who were treated on both outpatient and inpatient bases. Preoperative and postoperative

assessment of leg length discrepancy (LLD) was performed using standardized anteroposterior pelvic radiographs obtained in a standing position with neutral abduction, flexion, and 15° internal rotation. Postoperative radiographs were taken at discharge and during follow-up visits at 6, 12, 24, and 52 weeks. True LLD was determined by measuring the absolute difference between the operated and contralateral limbs using multiple pelvic and femoral anatomical landmarks. Measurements were carried out independently by two investigators using mediCAD 2D software with appropriate calibration methods. Functional and clinical outcomes were evaluated using the Harris Hip Score (HHS) and WOMAC questionnaire preoperatively and during follow-up. Additional parameters such as pelvic obliquity, femoral and tibial length, ASIS-to-floor distance, and head centre measurements were assessed on weight-bearing radiographs. Each parameter was measured twice by an orthopedic fellow and a surgical planning engineer using RadiAnt DICOM Viewer to evaluate measurement reliability and repeatability. All collected data were compiled in Microsoft Excel. Data analysis was performed using OpenEpi software version 2.3.1.

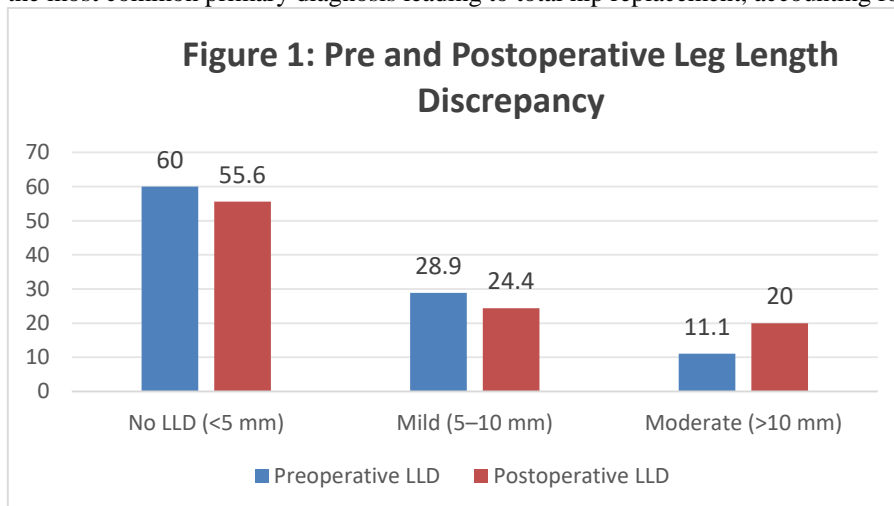
**RESULTS**

The age distribution of the study participants showed that the majority belonged to the 51–60 years age group (33.3%), followed by 41–50 years (28.9%). Participants aged 18–40 years constituted 20.0% of the sample, while those older than 60 years accounted for 17.8%. The overall mean age of the study population was 52.4 ± 9.6 Years.

**Table 1: Distribution depending on Diagnosis**

Diagnosis	Number	Percentage
Osteoarthritis	46	51.1
Avascular necrosis	28	31.1
Fracture neck femur	10	11.1
Rheumatoid arthritis	6	6.7
Total	90	100

Osteoarthritis was the most common primary diagnosis leading to total hip replacement, accounting for 51.1% of cases.



Preoperatively, the majority of patients (60.0%) had no significant leg length discrepancy (<5 mm). Mild leg length discrepancy of 5–10 mm was observed in 28.9% of participants, while moderate discrepancy greater than 10 mm was present in 11.1%. Overall, most patients had minimal or no preoperative leg length inequality and Postoperatively, more than half of the patients (55.6%) had no clinically significant leg length discrepancy (<5 mm). A discrepancy of 5–10 mm was noted in 24.4% of cases, while 13.3% had a discrepancy of 10–15 mm. Only a small proportion of patients (6.7%) demonstrated a leg length discrepancy greater than 15 mm.

**Table 2: Association Between surgeon experience and Postoperative LLD**

Surgeon experience	LLD present	LLD absent	Total
<5 years	14	8	22
5 to 10 years	18	18	36
>10 years	12	20	32
Chi square	6.02	P=0.02*	

A statistically significant association was observed between surgeon experience and postoperative leg length discrepancy ( $\chi^2 = 6.02, p = 0.02$ ). Surgeons with less than 5 years of experience had a higher proportion of cases with LLD compared to those without LLD. In contrast, surgeons with more than 10 years of experience demonstrated fewer cases of LLD, indicating improved outcomes with greater experience.

**Table 3: Harris Hip Score (HHS) and WOMAC score Over Follow-up**

Time point	Harris Hip Score (HHS)	WOMAC score
	Mean $\pm$ SD	Mean $\pm$ SD
Preoperative	42.6 $\pm$ 8.4	68.4 $\pm$ 10.2
6 weeks	71.2 $\pm$ 9.1	38.6 $\pm$ 8.9
12 months	88.5 $\pm$ 6.3	18.2 $\pm$ 6.4

The mean Harris Hip Score showed a marked improvement following surgery compared to the preoperative period. Scores increased from 42.6  $\pm$  8.4 preoperatively to 71.2  $\pm$  9.1 at 6 weeks postoperatively. Further improvement was observed at 12 months, with a mean score of 88.5  $\pm$  6.3, indicating good functional outcomes. 18.2  $\pm$  6.4 The WOMAC score demonstrated significant improvement over the follow-up period after surgery. The mean score decreased from 68.4  $\pm$  10.2 preoperatively to 38.6  $\pm$  8.9 at 6 weeks. Further reduction to 18.2  $\pm$  6.4 at 12 months indicated substantial improvement in pain, stiffness, and functional status.

## DISCUSSION

The present descriptive longitudinal study conducted over two years on 84 patients demonstrated that postoperative leg length discrepancy (LLD) following total hip replacement was less than 5 mm in 55.6% of patients, 5–10 mm in 24.4%, 10–15 mm in 13.3%, and greater than 15 mm in 6.7%, with a mean LLD of 7.4  $\pm$  4.1 mm. These findings are comparable with those reported by Bianco Prevot L, who observed a

postoperative LLD incidence ranging from 3–30% with a mean discrepancy of 3–17 mm, emphasizing the variability of outcomes after total hip replacement. Similarly, Tassinari L found that the direct anterior approach (DAA) was associated with lower rates of LLD greater than 10 mm when compared with posterior and anterolateral approaches. In addition, Lecoanet P reported that only 8.9% of patients experienced a detrimental increase in limb length postoperatively, suggesting improved precision in limb length restoration with modern surgical techniques and intraoperative assessment methods.

Parameters	Our Study	Bianco Prevot L et al. (2025) (11)	Tassinari L et al. (2024) (12)	Lecoanet P et al. (2018) (13)
Study design	Descriptive longitudinal, 2 years, 84 patients	Prospective multicenter review	Retrospective cohort	Prospective observational
Postoperative LLD	Postoperative LLD	Incidence 3–30%, Mean	DAA: lower rates of LLD >10 mm vs	Only 8.9% had

	None (<5 mm): 55.6% 5–10 mm: 24.4% 10–15 mm: 13.3% >15 mm: 6.7% Mean LLD: 7.4 ± 4.1 mm	3–17 mm	posterior/anterolateral	detrimental increase in limb length
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The findings of the present study demonstrated that postoperative leg length discrepancy (LLD) following total hip replacement increased with prolonged surgical duration. Surgeon experience and the surgical approach significantly influenced postoperative outcomes, while functional scores showed marked improvement during follow-up. These findings are comparable with those reported by Bianco Prevot L, who emphasized the importance of meticulous preoperative planning, intraoperative techniques, and awareness of medico-legal implications in minimizing postoperative LLD.

Similarly, Tassinari L reported that the direct anterior approach (DAA) significantly reduced the incidence of LLD greater than 10 mm, highlighting the value of intraoperative measurements and imaging guidance for achieving accurate limb length restoration.

In addition, the observations of the current study are in agreement with those of Lecoanet P, who found that the DAA performed on a standard operating table allowed more precise control of leg length and that the use of advanced imaging techniques improved measurement accuracy and postoperative outcomes.

## CONCLUSION

Postoperative leg length inequality is a common and clinically significant complication following total hip replacement, influenced by factors such as surgical approach, operative duration, and surgeon experience. Our study demonstrated that longer surgeries and less experienced surgeons were associated with higher LLI, while careful preoperative planning and precise intraoperative technique minimized discrepancies. Most patients achieved satisfactory functional outcomes, as evidenced by improvements in Harris Hip Score and WOMAC scores. These findings highlight the importance of meticulous surgical technique, individualized patient assessment, and intraoperative vigilance to reduce LLI, optimize postoperative function, and enhance patient satisfaction following THR.

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