

A prospective clinical study of Limb Length Discrepancy in THR using lateral surgical approach

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Abstract

Total Hip Replacement surgery is a common surgery in end stage hip arthritis. Limb Length Discrepancy (LLD) in THR is an inevitable complication if not in all but few certain patients with THA. Also, it is an Important yet least studied aspect as a complication following this surgery. Hence to, understand the factors which cause & influence this condition, this study was conducted with an objective to know the implications of clinical parameters like hip movements & their range of motions, preoperative limb length measurements of affected arthritic hips & change in limb length after Total hip replacement surgery. Moreover LLD studies in Indian patients are very few.

This Study included 36 Total hip replacement surgeries from 34 patients (with 2 patients having bilateral involvement). Standard lateral surgical approach was used in all the patients. Most common cause of pathology affecting the hip arthritis was AVN (osteonecrosis) of hips[3]. The definitive difference between preoperative and post-operative limb length was noted. Change in LLD from preoperative to postoperative interval was significant with p-value of 0.001 so the groups had a highly significant difference in LLD measurement. The change in all the movements of operated hips showed a gradual increase in further follow-ups and flexion component having better improvement in range of motions. Average Preop LLD of 15 mm was found and post-op, the median LLD noted was just 5mm which signifies good improvement.

Keywords: Total hip replacement, limb length discrepancy

Introduction

Total Replacement Arthroplasty of an diseased hip is an surgical procedure which involves removal of damaged / diseased articular (joint) surfaces of acetabular side and femoral head of an arthritic hip and implantation of artificial prosthesis (implants) ^[1, 2]. Goal is to relieve pain & restore joint function. Usual indications are primary & secondary hip osteoarthritis owing to avascular necrosis, posttraumatic hip arthritis ^[3] secondary to fractures of femoral head, neck, acetabulum, or neglected & developmental hip dysplasias & certain childhood hip disorders & other seropositive & seronegative inflammatory hip conditions, rare oncological causes.

Surgical classification of Total Hip Replacement can be done in various ways but most commonly it is done as per replaced joint types & combination of materials used for the surgery or as per the bearing surfaces used inside ^[4] Examples:

1. MOP-Metal on Polyethylene
2. COP-ceramic on polyethylene
3. COC-ceramic on Ceramic
4. MOM-metal on metal

Other classification is as per use of cemented or uncemented implants in THA ^[5,6]

1. Cemented THA: Both acetabular polyethylene shell & femoral metallic stem is fixed using bone cement.
2. Uncemented: Prosthesis is fixed as a press fit concept & as per principles of bone growth over the implant.
3. Hybrid: Uncemented cup & cemented stem.
4. Reverse hybrid: Cemented cup & uncemented stem.

Whatever the classification, all surgeons aim to achieve the biomechanics of the hip joint ^[2, 3, 7]. By re-establishing the hip off sets, accurate component orientation, and equal leg length to optimize the outcome after surgery.

Similarly, complications associated with total hip arthroplasty can be divided into those that are directly related to the surgical procedure in the intraoperative ^[7, 8], early postoperative, and late postoperative periods ^[2, 3].

Some of the procedure related complications are also associated with surgical approaches & each approach has its own advantages & disadvantages. Generally lateral & posterior approaches with mild variations are used most routinely and these are as per surgeons choice, skill & training dependent with some exceptions.

Achieving stability is of paramount importance in any THR surgery & this has led to resultant LLD intraoperatively & postoperatively if not in all cases but in some patients it has caused sufficient dissatisfaction & suboptimal surgical outcomes.

In recent times dissatisfied patients seek medicolegal negligence suits for post-surgical LLD causing sufficient concern among the orthopaedic fraternity making it highly relevant in contemporary surgical practice.

There are some ways how classification of LLD is done & its types are ^[9]:

Type 1 as True (structural) results from the cumulative length of osseous structure.

Type 2 as Apparent (functional) is unilateral asymmetry of the lower extremity without any shortening of the osseous components; like Postural asymmetry from soft tissue contractures or pelvic obliquity.

Besides clinical measurements a radiographic measurement of leg length can help determine what kind of LLD is occurring.

As such, in the management of postoperative LLD revision surgery is endeavoured in rare cases if the non-operative treatment measure like contralateral shoe raise fails.⁹

LLD in THR is an inevitable complication if not in all but few certain patients with THA. Also, it is an important yet least studied aspect as a complication following this surgery. Hence to, understand the factors which cause & influence this condition, this study was conducted with an objective to know the implications of clinical parameters like hip movements & their range of motions, preoperative limb length measurements of affected arthritic hips & change in limb length after Total hip replacement surgery. Moreover LLD studies in relation to Indian patients are very few.

Materials & Methods

A total number of 40 patients of age 18 years and above of either sex with painful hip arthritis were included in the study who were from tertiary care hospital in Belagavi. Patients with pre-existing infections in hip joint: septic arthritis and with compromised cardio-pulmonary functions unfit in pre anesthetic checkup were excluded. All the 40 patients underwent Total Hip Replacement (THR) and followed up to subsequent 6 months. Amongst them attrition of 4 patients were noted (hence these 4 patients with irregular follow ups were excluded) Final study included 34 patients & 36 Total Hip Replacement surgeries with two patients having bilateral THR surgeries done.

The clinical measurements were noted for movements in the hip like rotations and any limb length discrepancy or shortening pre-operatively and at subsequent intervals like post operatively at 2 weeks, 6 weeks, 3 months and 6 months using standard measurement tapes and goniometer. SOP for clinical measurements was followed i.e., True limb length is measured from anterior superior iliac spine (ASIS) to medial malleolus in both the lower limbs in centimetres, using a standard measuring tape. All patients underwent routine pre-operative and post-operative x-rays confirming the diagnosis & limb length discrepancies. Standard hospital protocols for surgical clearance like pre anaesthetic check-ups and any necessary fitness for surgery were taken.

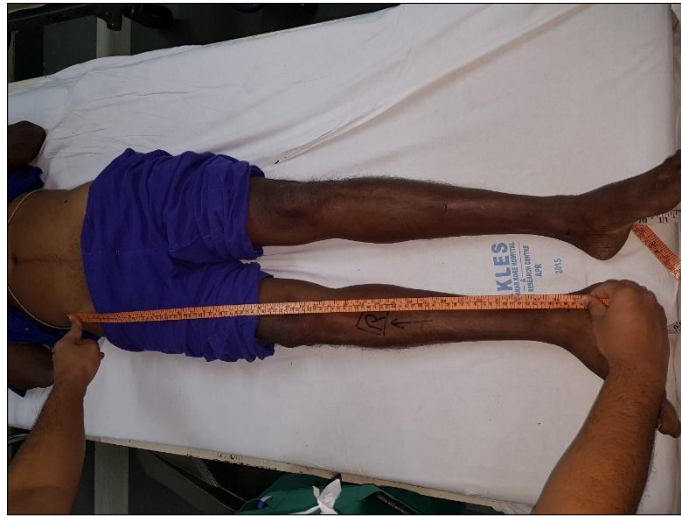
Post-operative protocol: All patients were given compulsory walker for 2 weeks with weight bearing as per individual tolerance. Routine IV antibiotics & DVT prophylaxis was ensured with LMWH/low molecular weight heparin subcutaneously 40mcg in initial postoperative periods or aspirin tablets in standard dosages/day for 3 months /none of the patients suffered any major complications like infection/dislocations/periprosthetic fractures/overwhelming minor causes of complaints leading to revisions in immediate postop periods.

Institutional ethical clearance for conduction of study were obtained and proper informed consents for surgery from individual subjects were also obtained.

Clinical measurement pictures



1) Pre-operative LLD: showing left limb one cm increased as compared to right (affected hip).



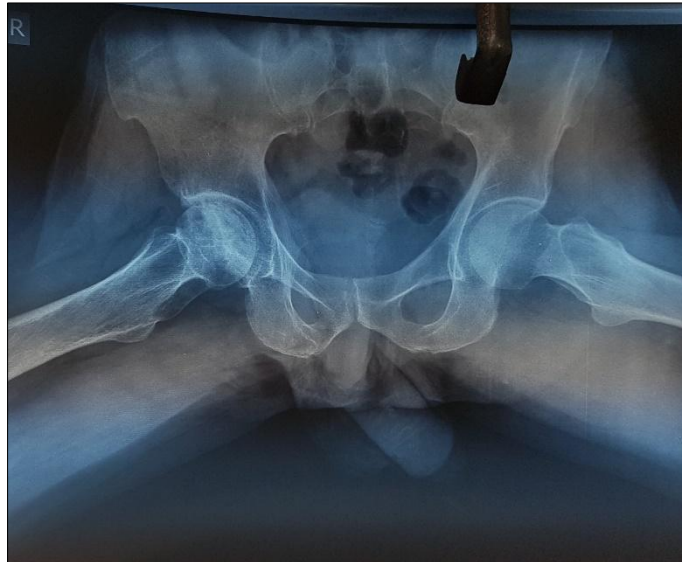
2) Pre-operative LLD in affected hip: showing right affected limb shortening one cm.



3) Post-operated LLD: showing increase in 5mm in length of right limb.



4) Pre-operative x-ray of both hips AP view with right hip AVN arthritis.



5) Pre-operative x-ray of both hips lateral view /secondary OA of AVN right hip



6)) Post-operative x-ray of THR right hip Hybrid type implantation.



7) Pre-operative clinical shortening depicted on the right side in knee flexed positions with distance noted between the knee & placed measuring tape over both knees.

Results

Statistical tool used to analyse the data was SPSS. 26 version.

Sex & age wise distribution results were obtained as following tables:

Sex				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2.7	2.7	2.7
Female	13	35.1	35.1	37.8
Male	23	62.2	62.2	100.0
Total	37	100.0	100.0	

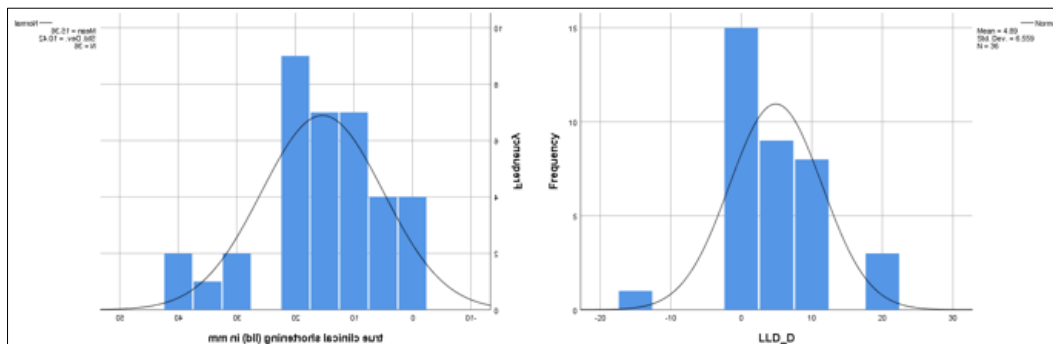
Totally, there were 36 patients. Male were 23(62.2%) and female were 13(35.1%).

Q01_Age_Cod e	Freq.	Percent	Cum.
17-40	11	30.56	30.56
41-60	16	44.44	75.00
61-80	9	25.00	100.00
Total	36	100.00	

As per Age distribution three groups were identified : Thus totally, there were 36 patients in the three groups:

- “17-40” - 11 patients (30.56%)
- “41-60” -16 patients (44.4%)
- “61-80” - 9 patients (25%)

From the histogram, it is clearly evident that LLD pre and post THR has not satisfied Normality Assumption. There is no normality in the data hence Non-parametric Test were applied.



Median Pre Op LLD of 15 mm was noted. While post-op median LLD noted was just 5mm which signifies good improvement at the end of 6 months among the post operative group.

		true clinical shortening (lld) in mm	LLD_A	LLD_B	LLD_C	LLD_D
N	Valid	36	36	36	36	36
	Missing	0	0	0	0	0
Mean		15.36	5.31	5.00	4.78	4.89
Median		15.00	5.00	5.00	5.00	5.00
Std. Deviation		10.420	6.915	6.936	6.629	6.559
Range		40	35	35	35	35
Minimum		0	-15	-15	-15	-15
Maximum		40	20	20	20	20
Sum		553	191	180	172	176

Table:1- LLD distribution.

	LLD_A - true clinical shortening (lld) in mm	LLD_B - true clinical shortening (lld) in mm	LLD_c - true clinical shortening (lld) in mm	LLD_D - true clinical shortening (lld) in mm
Z	-3.314 ^b	-3.338 ^b	-3.528 ^b	-3.512 ^b
Asymp. Sig. (2-tailed)	.001	.001	.000	.000
Exact Sig. (2-tailed)	.001	.001	.000	.000
Exact Sig. (1-tailed)	.000	.000	.000	.000
Point Probability	.000	.000	.000	.000

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.

Table:-2 The difference between the Pre and Post (LLD).

This was assessed with Wilcoxon Signed Rank Test (Non-Parametric Data) which shows highly significant result with p value =0.001

Clinical Assessment

The Range of Motion (ROM) of affected hip joint gradually increased after the surgery comparing to the pre surgery measurements. All the affected hip had loss of internal rotation pre operatively with median value equal to zero and after surgery by 6 months the median

value of internal rotation improved to 15 degree which signifies a full recovery & gain in lost ability to internally rotate the hip. Similarly, improvement in adduction abduction flexion and external rotation was also significant. Also, achieved movement of extension from zero to 10 degree is significant as shown in the table 3 & graph 2.

Table 3:-ROM of affected pre & post op hips.

Pre-post op days	Adduction in degree	Abduction	Flexion	Extension	External rotation	Internal rotation
Pre op	5	10	52.50	00	10	00
Post op 14-21 days	21	30	70	10	15	10
Post op 6 weeks	30	30	85	10	15	15
Post op 3 months	30	40	90	10	20	15
Post op 6 months	30	40	90	10	20	15

Graph 2:-Representation of ROM improvement.

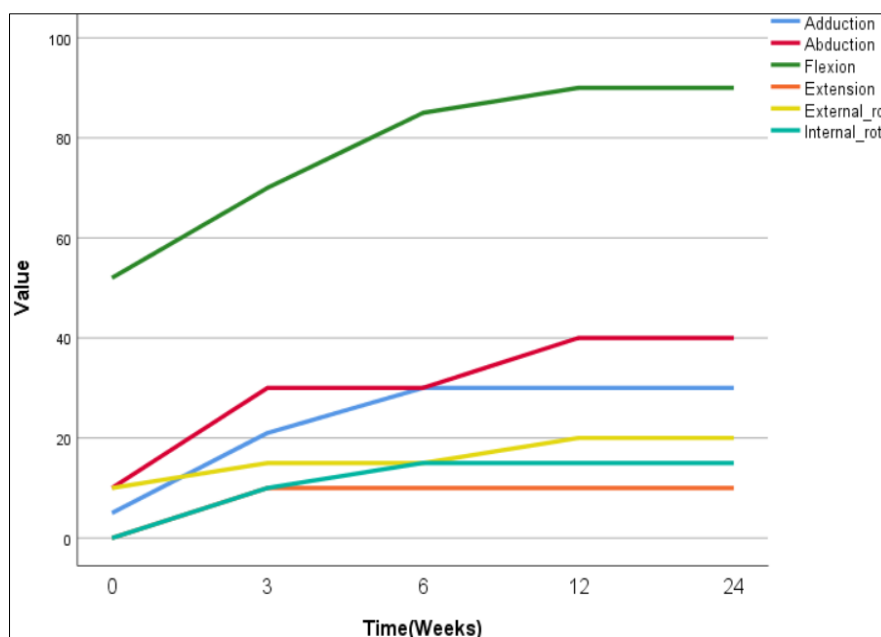


Table 4:-

The difference between the Pre and Post (ROM) was assessed with Wilcoxon–Mann–Whitney test which shows significant result with p value =0.05

ROM (Range of Motion)	Pre-op	Post-op 6 months	Difference	Rank	Man Whitney u test
Adduction in degree	5	30	25	4	W=21 Mean = 10.5 Sd=4.76 Test statistics = 2.20 Calculated > table at 95% CI p<0.05
abduction	10	40	30	5	
Flexion	52.5	90	37.5	6	
Extension	0	10	10	1.5	
External rotation	10	20	10	1.5	
Internal rotation	0	15	15	3	

Major limitation of this study is its nonrandomized nature. As such this was a prospective study with subsequent objective clinical assessment at frequent regular follow up intervals till 6 months, all patients were studied for improvement in hip ROM movements along with LLD.

Results clearly showed that 10 pts with pre-operative shortening of less than 11mm had similar results like those with other 26 pts having more severe shortening of 11mm to 40mm, provided that the hip was restored to its normal biomechanics.

This study suggests patients essentially need to have improvement in ROM of hip movements including restoration of internal rotation & extension along with improvement in flexion to

achieve good results. Patients were satisfied in all groups irrespective of the preoperative hip pathology or even having lengthening (LLD) of 20 mm in post-operative period & suggested that gained LLD was well tolerated even in such set of patient groups.

We believe that data & results generated from this study will be useful for comparing similar studies in other parts including Indian patients.

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