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Leg Length Discrepancy After Total HIP Replacement

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ABSTRACT

Background: Discrepancy of lower limb length after total hip arthroplasty is a frequent complication that potentially affects postoperative success. Although a number of studies have reported on factors that affect LLD, gender and preoperative factors are yet to be explored. Precise diagnosis and control of LLD are essential for facilitating successful patient recovery and preventing functional impairment. **Objective:** To determine the frequency of leg length discrepancy after total hip replacement at Khyber Teaching Hospital, Peshawar. **Study Design:** Descriptive study. **Duration and Place of Study:** The study was conducted from April 1st to October 1st, 2021, at the Orthopedics Department, Khyber Teaching Hospital (KTH), Peshawar. **Methodology:** A total of 131 participants aged 60-80 years, scheduled for unilateral total hip arthroplasty, were enrolled using a non-probability consecutive sampling method. Preoperative limb length measurements and demographic data were recorded. Postoperatively, limb length discrepancies were evaluated at one and three months using orthoroentgenogram imaging. Statistical analysis was performed using IBM SPSS version 23, with associations between limb length status and demographic factors assessed through chi-square tests. **Results:** The mean age of participants was 66.42 ± 4.69 years. Of the patients, 43.5% had a long limb, 20.6% had a short limb, and 35.9% had no discrepancy. Gender was significantly associated with short limb status, with 45.3% of females experiencing a short limb compared to 3.8% of males (p=0.000). No significant associations were found between age, ASA grade, and limb length status. **Conclusion:** Limb length discrepancy following total hip arthroplasty remains a common issue, with gender identified as a significant factor influencing the occurrence of short limbs.

INTRODUCTION

In a total hip replacement procedure (THR), a worn out or arthritic hip joint is surgically removed and replaced by a prosthetic implant.[1] The goal of total hip replacement surgery is to bring back to normal functions of the joint, reduce pain and promote better quality of life to those suffering from osteo- arthritis, rheumatoid arthritis or hip fracture.[2] In surgery the acetabulum and femoral head are cut and replaced with ceramic or metal artificial parts that imitate the normal functioning of a joint.[3] For those with greatly damaged hip joints, a total hip replacement is often superior to the traditional method in terms of pain management and movement.[4]

Marked advances are involved with total hip replacement, although it is not complication-free. Patients receiving this total hip replacement have risks of complications including; dislocation of the joint, infection, clotting of blood in the veins, nerve damage, and may fracture.[5] Besides these short-term complications, possible long-term complications might include loosening of the implant, failure of prosthetic parts, and restricted mobility.[6] Potential rehabilitation inconveniences may prolong recovery hence preventing anticipated enhancement in the patient mobility.[7] Cases such as the leg length discrepancies can be corrected by revision procedures and careful follow-up and rehabilitation.[8]

Leg length discrepancies after THR may be elicited due to factors such as wrong placement of prosthetic parts, natural human body structure, or misalignment of soft tissue.[9] Leg length discrepancy can cause issues with walking, associated lower back pain or hip problems or unbalance while trying to stand on legs.[10] There are cases when the disparity in length of the legs is not visible, but in other cases, it can significantly influence the patient's ability to do regular actions.[10] Non-surgical management strategies for leg length discrepancies following THR include orthotics or adaptive foot wear if needed and surgery such corrective surgeries if indicated.[11]

Management strategies for leg length discrepancies after performing hip replacement are specific to the degree of the discrepancy, and the symptoms experienced.[12] If the difference in leg length is minimal, orthotics or shoe lifts can correct the legs, and provide levels and balance to support walking and posture, in a conservative

treatment.[13] Suitable muscular training is another common prescription for strengthening the hips and increasing mobility.[14] If the disparity is serious or has existed for quite some time, surgical correction will have to be considered.[15]

Konyves A and colleagues conducted a study revealing that, following total hip arthroplasty, 62% of patients experienced lengthening while 32% had shortening of the limb on the surgical side.[16]

Leg length discrepancy frequently becomes a common issue after total hip replacement that has a negative effect on the satisfaction of a patient and locomotion and general functional performance. Even though surgical methods have improved, leg length discrepancy remains a common postoperative condition. Further research on this complication will be a key concern to understand where, how often, and how it has an effect and then develop approaches to reduce LLD and postoperative well-being for hip replacement patients.

METHODOLOGY

This descriptive study was conducted at the Orthopedics Department of Khyber Teaching Hospital (KTH) in Peshawar, spanning from April 1st to October 1st, 2021. A total of 131 participants were enrolled, with the sample size calculated using the WHO sample size calculator. The calculation was based on a 95% confidence interval, an 8% margin of error, and an anticipated 32% prevalence of postoperative limb shortening following total hip arthroplasty. A non-probability consecutive sampling technique was employed for patient selection.

Eligible participants were men and women aged between 60 and 80 years, classified as ASA grade I or II, and scheduled for unilateral total hip arthroplasty. Individuals with a known history of diabetes, pathological fractures, multiple fractures affecting the same limb, or open fractures were excluded from the study. Prior to enrollment, ethical approval was secured, and informed consent was obtained from all participants. Each patient's demographic and clinical baseline data—including age, gender, ASA classification, and preoperative limb length—were recorded.

All surgical procedures were performed under general anesthesia by a consultant orthopedic surgeon with a minimum of three years of post-fellowship experience. Patients were monitored postoperatively at one month and again at three months, at which point the final assessment of limb length was made using orthoroentgenogram imaging. Limb length discrepancy was measured as the variation in length of the operated limb compared to its preoperative state. A limb was considered lengthened if it showed an increase of 5 mm or more from baseline, and shortened if it showed a decrease of 5 mm or more.

Collected data were processed using IBM SPSS version 23. Quantitative variables such as age and limb length were summarized using mean and standard deviation, while categorical variables—including gender, ASA classification, and presence of a long or short limb—were presented as frequencies and percentages. To assess associations between limb length discrepancy and patient characteristics such as age, gender, and ASA classification, the chi-square test was applied, with statistical significance set at a p-value of ≤0.05.

RESULTS

The study focused on leg length discrepancy following total hip replacement, including 131 participants with a mean age of 66.42 ± 4.69 years and a mean preoperative limb length of 829.70 ± 33.23 mm (as shown in Table 1). Of the participants, 59.5% were male (n=78), and 40.5% were female (n=53). Regarding ASA grade, 74.8% (n=98) were classified as Grade I, while 25.2% (n=33) were Grade II.

Table 1

Patient Demographics (n=131)

Demographics		Mean ± SD
Age (years)		66.419 ± 4.69
Limb length (mm)		829.702 ± 33.23
Gender	Male n (%)	78 (59.5%)
	Female n (%)	53 (40.5%)
ASA Grade	I n (%)	98 (74.8%)
	II n (%)	33 (25.2%)

The distribution of limb status postoperatively revealed that 43.5% (n=57) of patients had a long limb, 20.6% (n=27) had a short limb, and 35.9% (n=47) had no limb discrepancy (as shown in Table 2).

Table 2

Frequency of Limb Status

Limb Status	Frequency	% age
Long Limb	57	43.5%
Short Limb	27	20.6%
Normal	47	35.9%
Total	131	100%

When analyzing the relationship between limb status and demographic factors (as shown in Table 3), the study found that age did not significantly affect the occurrence of long or short limbs, with p-values of 0.098 and 0.262, respectively. However, gender showed a significant association with short limb status (p=0.000), where only 3.8% of males had short limbs compared to 45.3% of females. On the other hand, gender did not have a significant relationship with long limb status (p=0.983). Regarding ASA grade, no significant association was found with long limb status (p=0.795) or short limb status (p=0.690), suggesting that the ASA grade did not influence the likelihood of limb length discrepancy following surgery.

Table 3

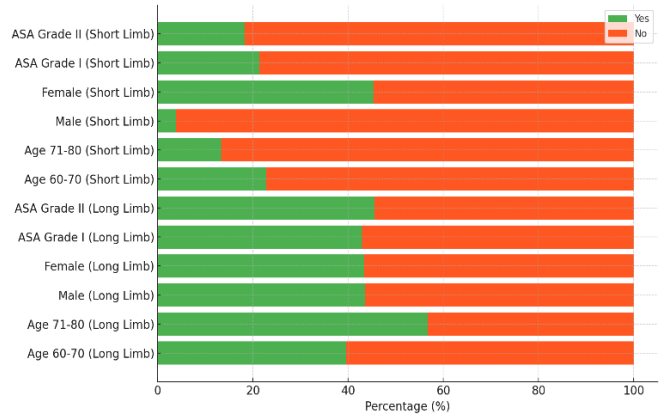
Association of Limb Status with Demographic Factors

Demographic Factors		Long Limb		p-value	Short Limb		p-value
		Yes n(%)	No n(%)		Yes n(%)	No n(%)	
Age (years)	60-70	40 (39.6%)	61 (60.4%)	0.098	23 (22.8%)	78 (77.2%)	0.262
	71-80	17 (56.7%)	13 (43.3%)		4 (13.3%)	26 (86.7%)	
Gender	Male	34 (43.6%)	44 (56.4%)	0.983	3 (3.8%)	75 (96.2%)	0.000*
	Female	23 (43.4%)	30 (56.6%)		24 (45.3%)	29 (54.7%)	
ASA grade	I	42 (42.9%)	56 (57.1%)	0.795	21 (21.4%)	77 (78.6%)	0.690
	II	15 (45.5%)	18 (54.5%)		6 (18.2%)	27 (81.8%)	

*Statistically significant

Graph 1

Stratification of Long and Short Limb Status with Demographic Factors



DISCUSSION

We discovered that 43.5% of our patients presented with a long limb, 20.6% with a short limb, and 35.9% without discrepancy. These are concordant with existing literature, demonstrating once again that LLD is a common sequela of THA, although with probable variations according to factors such as gender and surgical techniques.

The strong association with gender and short limb status, with 45.3% of women versus 3.8% of men experiencing a short limb, motivated us to conclude that female patients would be more likely than male patients to experience a discrepancy of limb length. This would be explained by anatomical variations, specifically femoral neck length and pelvic shape, which would affect surgical procedure and post-operative function. Furthermore, our finding of no significant association with age for LLD is consistent with prior studies that have indicated that age is not likely an important determinant of post-THA limb length. Finally, our finding of no significant effect of ASA grade for LLD is consistent with the precept that intra-operative factors, such as operative technique and implant placement, are more determinants for post-THA limb length than is pre-operative patient status.

Our results support and provide additional data for the literature about leg length discrepancy (LLD) following total hip arthroplasty (THA). A total of 131 participants were surveyed, with a mean age of 66.42 ± 4.69 years, and a mean preoperative limb length of 829.70 ± 33.23 mm. Comparable with El Bitar et al. [16] and Woolson et al. [17] sample, our sample included an ethnically heterogeneous sample of males and females, with males being 59.5% and females being 40.5%. The only variation of our studies with others, including those of Woolson et al.[17] and Desai et al.[18] studies, is that there is no significant relationship with age and limb status post-operation. Unlike Woolson et al.[17] finding, however, pre-operation LLD is reported by us as a predictive measure for post-operation, with a measure with high accuracy for minimal discrepancies.

Our data indicated that a high percentage of the patients (43.5%) had a long limb, 20.6% a short limb, and 35.9% no discrepancy. These findings are somewhat comparable with those of El Bitar et al.[16] who noted that all three surgical methods (robot, fluoroscopic, and conventional) reduced LLD, yet no clinically relevant differences were reported among the methods. In our studies, a number of patients had discrepancies of limb length, though our evidence showed a greater proportion with a longer limb compared with the studies, which studied LLD >3 mm or >5 mm.[16]

An important distinction within our research is with regard to gender. We observed a strong relationship between gender and short limb status (p=0.000), with a larger proportion of females (45.3%) presenting with a history of short limbs than males (3.8%). This is distinct from the observations of Woolson et al.[17] who reported no significant differences by gender within their findings, and Faldini,[19] who noted that preoperative LLD and anatomical, and not gender, were more predictive of postoperative limb length. Our findings imply that female patients are potentially more likely to develop a discrepancy of lower limb length, a process which could reasonably be explained by variations of pelvic anatomy, femoral neck length, or soft tissue compliance, although further research is required to clarify this theory.

Furthermore, ASA grade did not significantly impact either long or short lower limb likelihood within our series, consistent with evidence by Faldini,[19] which indicated that intra-operative factors (such as component positioning) are probably more important determinants of LLD compared with pre-operative risk factors such as ASA grade. Others, including Thakral et al.,[20] reiterated that extreme discrepancies (>2.5 cm) would be amenable to surgical correction if conservative measures are ineffective, but are also certain that smaller discrepancies would be non-significant, implying that clinical handling approaches must be designed around discrepancy severity and functional impact.

Although age and ASA grade were not statistically significant, surgical technique and anatomy still play significant roles. These findings are informative for future clinical practice, with further studies required to determine underlying reasons for differences in LLD by gender and further improve techniques for avoiding discrepancies with THA.

This research has a number of limitations. First, it is a single-center study, which potentially limits external validity of the findings for other institutions or patient groups with disparate surgical practice or demographics. Second, since it is an observational study, it is difficult for us to form causal relationships with demographic factors and LLD outcomes. Lastly, there is no long-term follow-up data, so it is impossible for us to examine limb length outcome durability over a period of time. Longer-term multicenter studies are required to validate these findings and explore other causative factors for LLD post-THA.

CONCLUSION

Our study has confirmed that leg length discrepancy post-total hip arthroplasty remains a common complication with a determining factor for lower limb discrepancies based on gender. Age and ASA class were unrelated to LLD, with intra-operative surgical practice and patient anatomy being a priority. Greater awareness of LLD post-THA is supported by this work and an identification of factors which are thought to influence discrepancies, such as gender. Optimization of LLD methods is additionally

needed and further research into why discrepancies are seen is undoubtedly needed.

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Authors' Contribution
The authors have each played an essential role in the development of this manuscript, as outlined below. **Dr. Waqar Ahmad** took the lead in conceptualizing the study, drafting the article, and obtaining hospital data.
Dr. Awal Hakeem was instrumental in the article's development, study design, as well as the analysis and interpretation of the data.

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