Comparison Of Stem Alignment Between Anterolateral Approach And Posterolateral Approach In Total Hip Arthroplasty Using Short Anatomical Stem

Takeshi Ogawa[1], Wataru Ando[1], Shoya Abe[1], Ryo Orito[1], Ema Nakahara[1], Tsuyoshi Koyama[1], Takayuki Tsuda[1]
[1] Kansai Rosai Hospital, Amagasaki, Japan
takeshi_0206@hotmail.com

Disclosures: Takeshi Ogawa (N), Wataru Ando (N), Shoya Abe (N), Ryo Orito (N), Ema Nakahara (N)**,** Tsuyoshi Koyama (N), Takayuki Tsuda (N)

INTRODUCTION: Accurate implant alignment is important for achieving successful reconstruction in total hip arthroplasty (THA). Previous reports have delineated the impact of surgical approach on implant alignment in THA [1, 2]. The anatomical stem which can be inserted along the shape of the femur is expected to be implanted according to preoperative planning. Nevertheless, it has been reported that the sagittal alignment of the anatomical stem (Centpillar stem, Stryker) was subjected to the influence of the chosen surgical approach [1]. The Mainstay stem (Kyocera), modeled closely after the design of the Centpillar stem albeit with a reduced stem length, may demonstrates improved facilitation of femoral insertion. However, due to its shorter length, it presents the potential for greater susceptibility to variations in stem alignment attributable to surgical approach, in contrast to the Centpillar stem. In the present study, we retrospectively examined the patients who underwent THAs using a short anatomical stem (Mainstay stem) and clarified the factors related to the surgical approach.

METHODS: In total, 67 hips of 63 consecutive patients (57 women and 6 men), who underwent primary THA for secondary osteoarthritis with Mainstay stems at our institution between April 2020 and March 2021, were included in this study. The minimum follow-up period was 2 years. The mean age at surgery was 67.4±8.7 years, and the mean BMI was 24.3±3.4 kg/ m^2. We divided patients into two groups based on the surgical approach, and compared the surgical time, blood loss, Japanese Orthopaedic Association (JOA) Score as clinical outcomes, preoperative and postoperative stem alignment, and complications including infections, dislocations, femoral fractures, and nerve palsy between the two groups. In addition, the difference in the stem alignment between preoperative planning alignment and actual alignment of the implant was evaluated. For the CT-based preoperative planning, the stem alignments (varus angle, anteversion, and flexion angle) were investigated. The postoperative CT images were imported into the CT-based navigation software used for preoperative planning, and the same coordinates of the femur were defined as in the preoperative planning. The computer-aided design data of the stem was overlaid onto images of the actual implant, and the postoperative alignment was measured. Statistical analyses were performed using Fisher's exact test and Mann–Whitney U-test. Statistical significance was set at $p < 0.05$.

RESULTS: Forty-eight THAs were operated through the posterolateral approach (PLA group), and nineteen THAs were performed through the anterolateral approach (ALA group). There were no significant differences in age, height, body weight, BMI, blood loss, preoperative JOA score, and complications between the PLA group and the ALA group (Table 1). Surgical time in the ALA group was significantly longer than that in the PLA group. However, the postoperative JOA score was higher in the ALA group than in the PLA group. The mean postoperative stem flexion angle was 11.6±2.7° and 9.7±2.8° in the PLA group and the ALA group, respectively. The mean differences in stem flexion angle between the preoperative planning angle and the postoperative angle were -0.1±2.5° and -2.0±2.4° in the PLA group and the ALA group, respectively. There were significant differences in the postoperative stem flexion angle and the change of the postoperative stem flexion angle compared to the preoperative plan. The two groups had no significant differences in stem varus angle, stem anteversion, and preoperative stem flexion angle (Table 2).

DISCUSSION: The postoperative sagittal alignment of the stem was significantly more extension direction in the ALA group than in the PLA group. The stem was implanted in the more extension direction with a mean of 2 degrees compared to the preoperative plan in the ALA group. Notably, a variance in the flexion angle of the stem relative to the planning did not yield adverse clinical outcomes. This observation can be attributed to the absence of statistically significant differences in complications between the two groups. Surgical time in the ALA group was longer than that in the PLA group because it was thought to be more difficult for the surgical technique in the ALA group than in the PLA group. The postoperative clinical score exhibited a statistically significant elevation within the ALA group when compared to the PLA group. This observation was due to the ALA approach's characteristic preservation of the muscles surrounding the hip joint, which is postulated to potentially exert a beneficial influence on enhancing postoperative hip function. Previous literature has documented the heightened challenge associated with the insertion of the stem in a neutral position along the sagittal alignment utilizing the direct anterior approach, as opposed to the posterolateral approach [1]. In this study the orientation of the short anatomical stem was similarly affected by different surgical approaches. This similarity is attributed to the challenges associated with elevating the femur using the anterolateral approach, which aligns with previous reports highlighting variations in the exposure of the proximal femur based on the chosen surgical approach [2]. When THA is performed by the ALA approach using a short anatomical stem, surgeons should pay attention to the sagittal alignment of the stem.

SIGNIFICANCE/CLINICAL RELEVANCE: The anatomical stem with a reduced stem length remains unaffected by the surgical approach, with the exception of the sagittal alignment of the stem.

IMAGES AND TABLES:

Table 1 Patients demographic data and complications

	PLA group	ALA group	P value
Hips, *n*	48	19	
Male/Female, *n*	3 / 42	3 / 15	0.34
Age (years)	67.5 ± 8.5	67.2 ± 9.2	0.88
Height (cm)	155.2 ± 5.4	155.3 ± 7.0	0.49
Body Weight (kg)	59.4 ± 9.3	56.8 ± 7.1	0.37
BMI (kg / m^2)	24.7 ± 3.7	23.5 ± 2.2	0.28
Surgical time (minitues)	101.7 ± 21.2	120.5 ± 23.3	<0.01*
Blood loss (ml)	333.4 ± 156.2	276.4 ± 133.8	0.24
Preoperative JOA score	49.5 ± 14.6	50.1 ± 19.3	0.98
Postoperative JOA score	92.1 ± 8.0	97.4 ± 3.5	<0.01*
Complications			
Infection	0	0	1
Dislocation	2	0	1
Femoral Fracture	1	1	0.5
Nerve palsy	1	0	1
Total	4	1	1

*Statistically significant difference
P values were calculated with Fisher's exact test or Mann-Whitney U-test
PLA: Postero Lateral Approach
ALA: Antero Lateral Approach
JOA: Japanese Orthopaedic Association

Table 2 Comparison of stem alignment between PLA group and ALA group

		PLA group	ALA group	P value
Stem varus angle (Coronal alignment)	preoperative	0.3 ± 1.4	0.3 ± 1.6	0.88
	postoperative	0.8 ± 1.9	0.9 ± 2.5	0.75
	difference	0.4 ± 1.4	0.7 ± 1.8	0.76
Stem anteversion	preoperative	27.6 ± 11.3	27.6 ± 10.5	0.98
	postoperative	26.5 ± 9.1	27.8 ± 10.8	0.67
	difference	-1.1 ± 7.9	0.2 ± 6.0	0.5
Stem flexion angle (Saggital alignment)	preoperative	11.7 ± 1.9	11.7 ± 1.4	0.88
	postoperative	11.6 ± 2.7	9.7 ± 2.8	0.02*
	difference	-0.1 ± 2.5	-2.0 ± 2.4	0.01*

*Statistically significant difference
P values were calculated with Mann-Whitney U-test
PLA: Postero Lateral Approach
ALA: Antero Lateral Approach