



Evaluation of Extreme Hip Joint Movement after Total Hip Arthroplasty: A Retrospective Study

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Abstract

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BACKGROUND: The number of total hip arthroplasty (THA) is increased every year in our country. Mobility of the hip joint after THA is important to achieve. Subject's expectation to perform daily activity, moreover extreme hip movement is crucial for some particular populations.

AIM: This study aimed to evaluate patient's functional outcome and ability to perform extreme hip joint movement.

METHODS: This is a retrospective study of patients who received total hip arthroplasty in our center. Evaluated factors include age, gender, body mass index (BMI), socio-economic status, diagnosis, physical therapy, radiographic acetabular inclination, acetabular cup diameter, and head diameter. Clinical evaluation was performed with Harris hip score (HHS). Extreme hip joint movement evaluation was performed with patient's ability to perform squatting and *Salat* (Muslim prayer). The *Chi-square* and *Mann-Whitney* tests were used for data analysis.

RESULTS: We collected data from a total of 22 subjects. All patients (100%) could perform squatting postoperatively. Among the subjects, there were 11 patients (11/22, 50%) could perform *Salat* activity in excellent manner, while the rest (11 patients) need some modification of movement during *Salat* activity. All patients have significant improvement of HHS compared to preoperative condition. Further, we tried to compare factors between the two groups for possible difference. No significant difference in age, gender, BMI, comorbidities, preoperative diagnosis between two groups of patients.

CONCLUSION: Subject receiving THA can be expected to perform extreme hip joint movement post-operatively. However, some patients still could not perform *Salat* activity in excellent manner. Age, gender, BMI, and comorbidities seem to be had no effect on the patient's ability to perform extreme hip movement post-operatively. Further study is needed to more understand causal factors associated with patient's ability in performing extreme hip joint movement.

Introduction

Total hip arthroplasty (THA) reported as one of the most successful surgery in the field of orthopedic. The number of THA is increased every year in our country.

Mobility of the hip joint after THA is important to achieve. Subjects expect to perform daily activity, including thus with extreme hip joint movement: squatting, Muslim prayers (*Salat*), and even sport activities.

Extreme movement describes as motion with a high risk of impingement that can lead to dislocation which becomes the main reason for clinical failures [1]. This common cause leads some orthopedic doctors educate subject not to perform an extreme movement. Meanwhile, people demand to be able to perform extreme movement are always questioned. Sugano *et al.* [2] through their study report that daily activity between Japanese-style and western-style are quite different.

Saputra *et al.* [3] found the impingement and dislocation have greater risk in picking up activities. Other studies by Yoshimine and Ginbayashi mention about factors that determine the range of motion (ROM) which a THA can achieve, four of these are associated with prosthetic component orientation: (1) Acetabular cup anteversion, (2) acetabular cup inclination, (3) femoral stem version and (4) femoral component neck axis away from the transverse plane which is dependent upon femoral stem varus–valgus within the femoral canal and femoral component neck-shaft angle [4].

There are various factors that may increase the risk of impingement or dislocation of THA prosthesis; except the subjects themselves, factors that we cannot choose. Performing activity without limited motion is inevitable for the patients even after the information after surgery. The number of studies discussed about subjects capability to perform a daily activity with extreme movement related to high risk of impingement and dislocation are still limited. The present study aimed to compare factors which may affect the ability

of the patients receiving THA to perform an extreme hip joint movement in daily living.

Methods

This was a retrospective study to subjects from our institution who received total hip arthroplasty surgery from January 2019 to April 2020. Our study has been approved by ethic commission with letter number LB.02.02/XXX.3.1.2/6523/2020. The inclusion criteria were adults performed THA, no complication during and after the operation, primary THA, and no socio-economic problem. This study focused on the analysis of the subjects ability to perform extreme hip joint motion daily. There were a total of 22 subjects during this period received THA. Evaluated factors include age, gender, body mass index (BMI), socio-economic status, diagnosis, physical therapy, radiographic acetabular inclination, acetabular cup diameter, and head diameter. Clinical evaluation performed with Harris hip score. Extreme hip joint movement evaluation performed with patient's ability to perform squatting and *Salat* (prayer). We also compare the time needed (onset) to perform first-time extreme movement from the day of surgery. Patient's ability to perform extreme hip joint movement was categorized into two categories: Excellent group and modified group. Excellent outcome defined when subject able to perform an extreme hip movement (prostration, bowing, and sitting position) in *salat* activity. "Modified" outcome are those with limited movement and unable to perform a normal movement in *Salat* activity. All surgery was performed with the posterior-lateral approach in lateral decubitus position with the use of cementless prosthesis both on acetabular and femoral component. Post-operative rehabilitation includes early joint motion, muscle strengthening, and partial weight-bearing as pain tolerated. Full-weight bearing is allowed after 4 weeks. Radiographic examination obtain on several subjects in excellent group using Philips Digital-Diagnostic Value Room. Minimum of follow-up is 6 months. The *chi-square* and *Mann-Whitney* tests were used for data analysis.

Results

There was a total of 22 subjects included in this study with the age range 26–61 years old. We found 9 (40.9%) male, and 13 (59.1%) female. Comorbidities in subjects such as 100 diabetes mellitus and hypertension. Other comorbidities like stroke or neurologic disorder were excluded in this research. We

found 11 subjects had excellent category in extreme hip joint movement and the rest of 11 subjects had modify in performing extreme hip joint movement. Subject characteristics showed in Table 1.

Table 1: Characteristic research subjects

Characteristic	Result (n = 22)
Gender	
Male	9 (40.9%)
Female	13 (59.1%)
Age	48.09 ± 12.92
BMI	23.93 ± 3.40
Comorbidity	
None	18 (81.8%)
Present	4 (18.2%)
Trauma History	
None	9 (40.9%)
Yes	13 (59.1%)
Diagnosis	
Primary	10 (45.5%)
Secondary	8 (36.4%)
Other	4 (18.2%)

The data showed that the mean age of subject with excellent mobility is 47.64 ± 9.45 and 48.55 ± 16.15 in modified group. BMI also gives a lower value by 22.84 ± 2.67 in excellent mobility group compared to 25.01 ± 3.81 in the modified patients (Table 2). The median size of acetabulum had been used in excellent group shows larger size compared to modified group (Table 3). No significant different on femoral head and acetabulum diameter between the two groups. Radiologic evaluation in extreme position (prostration, bowing, sitting position, and squatting) performed on a subject with excellent group. Possible impingement site can be revealed through radiology evaluation as seen in Figure 1. Radiographic examination obtained from excellent subjects in Figures 2 and 3.

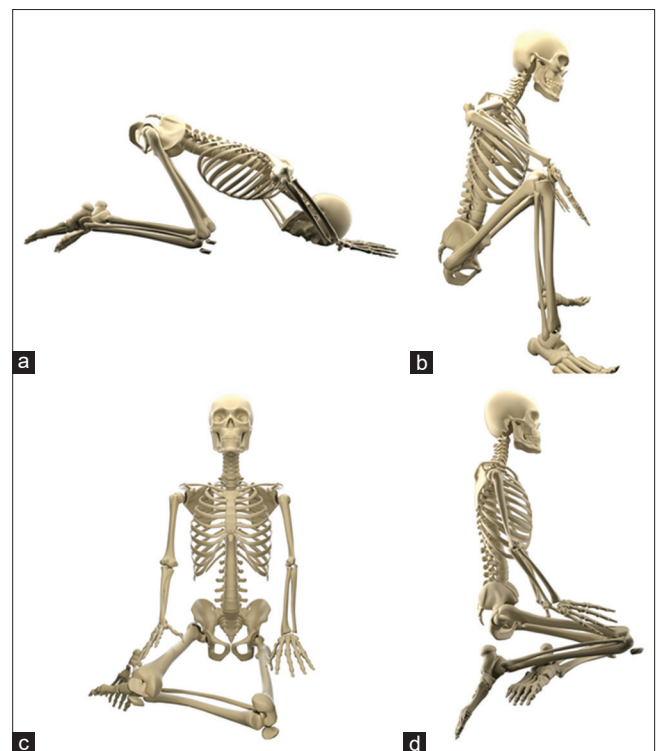


Figure 1: Illustration of skeleton in several extreme hip joint movements. (a) Prostration, (b) Squatting, (c) Sitting (anterior view), (d) Sitting (lateral view)

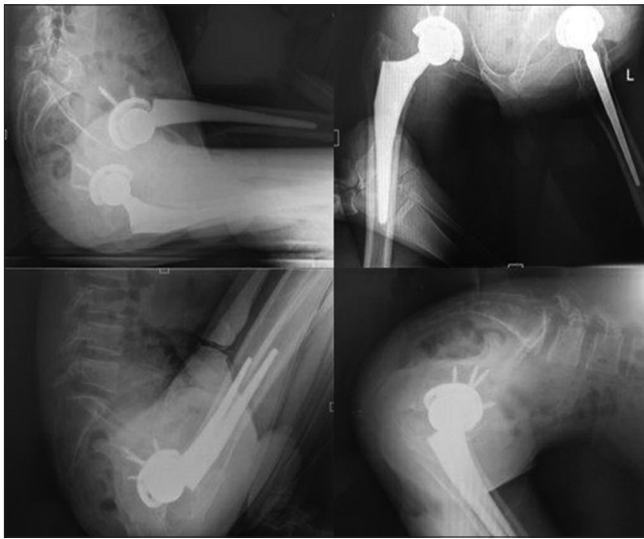


Figure 2: Radiograph of patients with bilateral THA performing extreme positions in Salat activity

Discussion

This study focused on identifying factors which may affect the ability of a patient to perform an extreme hip movement after THA. We found gender is not related to functional outcomes after THA (p-value: 0.665). Age also not significantly related to outcomes in extreme movement after THA. Subject with excellent mobility has mean age 47.64 ± 9.45 and 48.55 ± 16.15 for in modified group. In contrast with a study by Vincent *et al.*, they stated either age



Figure 3: Radiograph of patients with unilateral THA performing extreme positions in Salat activity

or sex was a significant main effect for functional outcome after THA. Their study showed that woman and subject older than 85-year-old provide longer hospitalization while younger subject gives early discharge from hospital [5]. A meta-analysis by Buirs *et al.* found about age related to functional outcome, 60% of studies report a significant negative association. In correlation with gender differences, provide inconsistent evidence with functional outcome after THA [6].

Table 2: Characteristic subjects of excellent 236 and modified group

Gender ^a			X ² = 0.188	0.665
Male	5 (45.5%)	4 (36.4%)		
Female	6 (54.5%)	7 (63.6%)		
Age ^c	47.64 ± 9.45	48.55 ± 16.15	t = -0.161	0.874
BMI ^c	22.84 ± 2.67	25.01 ± 3.81	t = -1.542	0.139
Comorbidity ^a			X ² = 0.000	1.000
Present	9 (81.8%)	9 (81.8%)		
None	2 (18.2%)	2 (18.2%)		
Trauma history ^a			X ² = 0.188	0.665
None	4 (36.4%)	5 (45.5%)		
Yes	7 (63.6%)	6 (54.5%)		
Diagnosis ^b			Z = -0.426	0.670
Primary	5 (45.5%)	5 (45.5%)		
Secondary	5 (45.5%)	3 (27.3%)		
Other	1 (9.1%)	3 (27.3%)		

^aNominal categorical data tested by Chi-square test; frequency (%). ^bOrdinal categorical data were tested by Mann Whitney test; frequency (%). ^cnormally distributed numerical data were tested by t-test; mean ± sd.

The study by Hakim *et al.* showed that functional outcomes in correlation with BMI of subjects which shows no different between subject with or without overweight status [7]. This result is in line with our findings. Although the results of our recent study showed that the majority of subject in excellent group has smaller BMI, while higher BMI was found in modified group (p-value: 0.874). However, study by Polat *et al.* showed that most of patient underwent THA have increasing of BMI due to immobilization. Those with higher BMI after operation give smaller functional outcomes compare to subject with no increase of BMI [8]. Therefore, the correlation or effect of obesity in clinical and functional outcomes after THA still controversial.

Comorbidities present in both group, modified and excellent outcomes have a similar prevalence of comorbidities. Our finding is in accordance with metaanalysis from Buir *et al.* which included 13 studies about comorbidities in relation to functional outcomes. There were 11 studies showed no effect of comorbidities to functional outcome. These provide strong evidence

Table 3: Comparison between size of acetabulum, head and time to perform extreme movement on subject with excellent and modified outcomes

Variable	Group		Statistic	p-value
	Excellent (n = 11)	Modified (n = 11)		
Acetabulum size				
44-46	3 (42.9%)	4 (57.1%)	Z = -1.764	0.078
48-50	5 (62.5%)	3 (37.5%)	Z = -2.049	0.040*
52-56	3 (42.9%)	4 (57.1%)	Z = -0.935	0.350
Head size				
24	1 (100.0%)	0 (0.0%)	-	-
28	7 (46.7%)	8 (53.3%)	Z = 0.000	1.000
32	3 (50.0%)	3 (50.0%)	Z = 0.000	1.000
Onset of extreme hip movement (month)	3 (2-6)	3 (2-9)	Z = -1.413	0.158

Numerical data not normally distributed were tested with mann whitney; median (min-max).

of a negative correlation between comorbidities and functional outcomes [6].

Probably the optimal cup size for Indonesia people is 48–50. The usage of a bigger size of cup acetabulum gives significance result for a subject with excellent outcomes. The previous finding, Kelley *et al* found that acetabular diameter (>56 mm) have significant risk of dislocation compare to a smaller size (<54 mm) [9], Peter *et al.* also support this hypotized through their finding, subject with cup diameter >56mm provide 2 times risk of dislocation [10]. Our results provide no significance results between all groups. Study by Smoesh *et al.* stated dislocation rate decreased significantly as the size of the head increased in primary THA [11]. Another study showed that larger heads (22–32 mm) have not been proved to be clinically superior with regard to dislocation in the primary THA setting [12] and smaller head tends to have optimal wear but more likely to dislocate [13].

There were no significance differences in age, gender, BMI, comorbidities, and implant size. Most of the study provide the position of the implant might have the most crucial factors influencing joint motion after THA. Impingement results when two non-articular surfaces come into contact during a joint ROM that might lead to dislocation. According to Glen *et al.* in his study stated the healthy normal benchmark for hip flexion is 120° with an additional 5–10° concluded as soft tissue impingement [14]. Zhou *et al.* examine the mean flexion angle in the subject who underwent THR, which is 121.3° [15]. According to our measurement in the excellent group, the average hip flexion is 131°. High flexion angle results to impingement of implant and might lead to the durability of an implant. Further study about extreme movement after THA and its durability is needed.

This study has some limitations include small number of subjects. Radiographic also evaluation could not be performed to all subjects, hence did not include in the analysis.

Evaluation of extreme movement more focused only on movement in *Salat* activity (Muslim prayer), therefore, subject who has to different religion was excluded in this study.

Conclusion

Subject receiving THA can be expected to perform extreme hip joint movement post-operatively. Age, gender, BMI, and comorbidities seem to be had no effect on the patient's ability to perform extreme hip movement post-operatively.

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