

Primary Total Hip Arthroplasty versus Open Reduction and Internal Fixation in Displaced Fracture of Femoral Neck in Adults

Kamran Asadi¹, Yasaman Soleimanmanesh², Arman Keymoradzadeh³, Nazanin Soleimanmanesh^{2,*}

¹ Associate Professor, Department of Orthopedics, Guilan Road Trauma Research Center, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran

² General Practitioner, Guilan Road Trauma Research Center, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran

³ Medical Student, Guilan Road Trauma Research Center, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran

*Corresponding author: Nazanin Soleimanmanesh; Guilan Road Trauma Research Center, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran. Tel: +98-9112348186, Email: n.soleimanmanesh@yahoo.com

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Abstract

Background: Femoral neck fracture as a prevalent skeletal injury accounts for 7% of orthopedic hospital admission. The aim of the present study is to evaluate the functional outcome of patients with femoral neck fracture treated with total hip arthroplasty (THA) and compare them with those undergoing fixation treatment.

Methods: In this study, we reviewed patients in the age range of 45-60 years old with femoral neck fracture during 2007-2017. The subjects were assigned to either THA or fixation group. The primary outcome was hip function, evaluated with the Harris Hip Scale (HHS). Secondary outcomes included pain, local infection, avascular necrosis (AVN), thromboembolic event, loosening of the prosthetic and internal fixation device, prosthetic dislocation, non-union, and delayed-union.

Results: In this study, 34 patients with displaced fracture of femoral neck were treated with acute THA and 38 patients were treated with fixation. The HHS was higher in the THA group compared to the fixation group ($P < 0.050$). The results of the present study indicated no significant difference in early postoperative complications over the first month between the two groups, but frequency of complications such as non-union, AVN, pain and loosening of the internal fixation device in the fixation group were significantly higher than the THA group after six months ($P < 0.050$).

Conclusion: Over a period of six months, THA provided better hip function and significantly fewer postoperative complications compared to fixation.

Keywords: Total Hip Replacements; Femoral Neck Fracture; Internal Fixations; Fracture Open Reduction

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Background

Femoral neck fracture, as a relatively common skeletal injury, constitutes 7% of orthopedic hospital admissions. In old patients, it usually occurs following minor trauma in the osteoporotic bone. In young patients, it occurs due to high-velocity trauma. With improving the life expectancy as a result of medical technology advancements and an increase in vehicular traffic, these fractures occur in higher frequency with each passing year (1).

Displaced intracapsular hip fractures in the old patients are generally managed by femoral head resection and hip joint replacement (1). One of the most common operations in patients above 60 years with displaced femoral neck fractures is hemiarthroplasty of the hip joint. Despite a return to mobility and pain relief with this operation, the medical instructions have recently advocated total hip arthroplasty (THA) instead of hemiarthroplasty (2). However, the existing evidence suggests that this recommendation is poorly complied with, and THA is applied to below one-third of patients eligible for this operation (3). End-stage osteoarthritis is also highly common in older patients with hip fracture, and the more active patients in this population might subsequently need a hemiarthroplasty conversion to THA. It has been observed that total hip arthroplasties are related to better long-term function and relief of pain compared to hemiarthroplasty (4, 5). Nevertheless, THA is a more invasive operation with a

longer duration than hemiarthroplasty, with higher potential of blood loss and dislocation (4, 6-9).

On the contrary, retaining the highest possible healthy cartilage is imperative for patients below 60 years, as this group of patients are younger. Hence, hip replacement is regarded as the last resort (10), particularly given the increased levels of activity in them (11). Therefore, it is preferred to achieve anatomic reduction and fixation, hence preserving the femoral head in this group (12). Reduction of the fractured femoral neck could be performed by closed or open means (13). Closed reduction internal fixation (CRIF) is the preferred treatment for patients with good perfusion of the femoral head while the open reduction internal fixation (ORIF) should be selected for those with poor perfusion and major displacement at the fracture site (14).

Choosing between arthroplasty and internal fixation for patients at the age of 60-80 years is still a matter of debate (1). It has been shown that THA following ORIF of proximal femur fractures is associated with higher complication rate than primary THA in the native joint (15, 16). The age cut-off after which primary THA is preferred to internal fixation is not exactly clear. ORIF might result in osteonecrosis or nonunion that require a revision procedure, while an arthroplasty in a lower age, more probably will need revision during the patient's life time (17). The aim of the present study is to compare the functional outcome of patients with femoral neck fracture treated with THA with those who undergo fixation treatment.



Methods

Population: In this study, we reviewed patients with femoral neck fracture (n = 125) during 2007-2017. Femoral neck fracture was diagnosed on the basis of orthopedic examinations, imaging examination, femur plain radiography, and clinical symptoms. Subsequently, the patients were evaluated based on the Garden classification. The following inclusion criteria were applied: Patients with grade 3 or 4 of Garden classification and the age of 45-60 years old.

Garden Classification: Subsequently, the participants with grade 3 (completely and partially displaced) or 4 (completely and fully displaced) (18) were selected (n = 72) based on the Garden classification.

Follow-up: Follow-up evaluations were performed at months one and six after the intervention. Over the duration of follow-up, patients of the fixation group were excluded from the study if reoperation was required due to any complications.

Data Collection: Patient demographics and relevant fracture characteristics were defined and collected via chart review.

Primary Outcome: The primary outcome of our study is patient-reported functional outcome as defined by the Harris Hip Scale (HHS). The HHS was developed for the assessment of the results of hip surgery, and is an easy way to evaluate various hip disabilities and methods of treatment in an adult population. The covered domains are pain, function, absence of deformity, and range of motion (ROM). The pain domain measures pain severity and its effect on activities and need for pain medication. The function domain consists of daily activities (stair use, using public transportation, sitting, and managing shoes and socks) and gait (limp, support needed, and walking distance). Deformity takes into account hip flexion, adduction, internal rotation, and extremity length discrepancy. ROM measures hip flexion, abduction, external and internal rotation, and adduction. The score has a maximum of 100 points (best possible outcome) covering pain (1 item, 0-44 points), function (7 items, 0-47 points), absence of deformity (1 item, 4 points), and ROM (2 items, 5 points) (19).

Secondary Outcomes: The secondary outcomes included rates of re-operation and complications. Complications included bleeding, pain, local infection, avascular necrosis (AVN), thromboembolic event, loosening of the prosthetic and internal fixation device, prosthetic dislocation, non-union, delayed-union, AVN, late infection, and loosening of the prosthesis or failure of fixation. Follow-up consisted of either an in-person or telephone evaluation.

Ethical Considerations: The study was confirmed by the Ethics Committee, Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1396.477). Moreover, written informed consent of all patients was obtained before their entry to the study.

Statistical Analysis: Continuous variables were described as mean and standard deviation (SD). Dichotomous variables were described as percentages of the total. Mann Whitney U test, independent t-test, and chi-square test were used to compare the two groups. P < 0.05 was considered significant. All analyses were performed using SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA).

Results

In this study, 34 patients with displaced fracture of the femoral neck were treated with primary THA and 38 patients were treated with fixation. The mean age of the patients in the THA group (60.56 ± 3.42) was significantly higher than that of the fixation group (51.18 ± 6.04) ($P < 0.001$). As shown in table 1, additional characteristics, including gender, fracture type, and the main mechanism of trauma were significantly different between the two groups ($P < 0.050$).

		THA group (%)	Fixation group (%)	P
Gender	Male	29.4	63.2	0.004
	Female	70.6	36.8	
	Total	100	100	
Age	40-49	0.0	44.7	< 0.001
	50-59	38.2	50.0	
	> 60	61.2	5.3	
	Total	100	100	
Fracture type	Type 3	26.5	65.8	0.001
	Type 4	73.5	34.2	
	Total	100	100.0	
Mechanism of trauma	Falling	73.5	31.6	0.001
	Sport injury	2.9	18.4	
	Car accident	23.5	50.0	
	Total	100	100	

THA: Total hip arthroplasty

Based on the results of the present study, the functional status of patients in the THA group was significantly better than that of the ORIF group ($P < 0.050$) (Table 2).

Table 2. Functional status of patients within six months in total hip arthroplasty (THA) and fixation groups

	Functional status (HHS)				Total	Mean rank	P
	Poor	Partial	Good	Excellent			
THA group (%)	11.8	5.9	41.2	41.2	100	44.41	0.002
Fixation group (%)	34.2	23.7	23.7	18.4	100	29.42	0.002
Total (%)	23.6	15.3	31.9	29.2	100		0.002

HHS: Harris Hip Scale; THA: Total hip arthroplasty

As shown in table 3, the average HHS in the fixation group was significantly lower than that of the THA group ($P < 0.050$). Additionally, the average HHS in females was statistically significantly lower compared to the male patients ($P < 0.050$).

Table 3. Harris Hip Scale (HHS) score in total hip arthroplasty (THA) and fixation groups

Group	HHS		
	Mean	SD	Median
THA (%)	83.00	18.57	87.50
Fixation (%)	71.71	19.35	75.00
P	0.002		

HHS: Harris Hip Scale; SD: Standard deviation; THA: Total hip arthroplasty

Based on the data analysis, there was not any significant difference in the early postoperative complications over the first month in the two groups (Table 4).

Table 4. Early postoperative complications within the first month in total hip arthroplasty (THA) and fixation groups

Complication	THA group (%)	Fixation group (%)	P
Bleeding	14.7	2.6	0.076
Pain	52.9	55.3	0.844
Local infection	11.8	2.6	0.146
AVN	0.0	7.9	0.141
Thromboembolic event	8.8	2.6	0.266
Loosening of the prosthetic and internal fixation device	2.9	7.9	0.351
Prosthetic dislocation	8.8	0.0	0.999

THA: Total hip arthroplasty; AVN: Avascular necrosis

As shown in table 5, frequency of complications such as non-union, AVN, pain, and loosening of the prosthetic and internal fixation device in the fixation group were significantly higher than those in the THA group ($P < 0.050$).

Complication	THA group (%)	Fixation group (%)	P
Non-union	0.0	34.2	0.001
Delayed union	0.0	5.3	0.275
AVN	0.0	23.7	0.002
Pain	8.8	34.2	0.010
Late infection	2.9	2.6	0.725
Loosening of the prosthetic and internal fixation device	0.0		
	0.0	13.2	0.036

THA: Total hip arthroplasty; AVN: Avascular necrosis

Discussion

In the current study, the efficacy of THA and internal fixation was compared in patients suffering from femoral neck fracture at the age of 40-65 years old. It was indicated that the clinical status in patients in the THA group was significantly better compared to patients in the fixation groups within six months. Moreover, THA had significantly lower complications compared to fixation.

The present study findings demonstrated significantly better clinical status in the THA group compared to the fixation group within six months, according to HHS. Currently, THA is the therapeutic approach that is accepted for the active old patients suffering from a displaced femoral neck fracture (20). There is controversy on THA longevity, particularly in more active and younger patients. According to previous studies, the outcomes following arthroplasty are better compared to internal fixation with respect to quality of life (QOL), function of abductor muscles, overall functional scores, and independent ambulation (20-22). The patient's age is among the factors influencing the therapeutic results of a femoral neck fracture. Numerous studies were conducted in this area in patients with varying age ranges. According to a previous study, primary THA is an economical approach compared to ORIF in treating displaced femoral neck fractures in the age of 45-65 years old (17). In addition, another study investigated the treatment of femoral neck fracture with primary THA in 37 patients with mean age of 70 years or younger. 18 (49%) patients had re-operation or were waiting for it during a mean follow-up period of 56 months (ranging from 12 to 112 months). This study was in contrary to the results of primary THA for treatment of displaced femoral neck fracture in younger patients without any prior hip diseases (23). Another study (24) reviewed patients above 60 years old, and they reported an association between arthroplasty and higher QOL related to health, better functional outcome, and higher independence compared to internal fixation. A randomized controlled trial was carried out by Blomfeldt et al. during four years to compare internal fixation with total hip replacement for displaced fractures of femoral neck (25). 102 patients (mean age = 80 years) were assigned randomly in two groups for treating acute displaced fractures of the femoral neck by THA and internal fixation. In a research work, a 48-month follow-up was evaluated for hip function and it was found that hip function is better in a significant way, and the arthroplasty group showed less health-related QOL decline compared to the fixation group at 4, 12, and 24-month follow-up periods. The study population included the old patients 70 to 96

years suffering from displaced fracture of femoral neck. It was discovered that primary total hip replacement offered better functional outcomes in comparison to internal fixation. In the current study, the arthroplasty group provided a significantly better functional result within an 18-month follow-up. Nevertheless, for finding a persistent statistically significant difference in functional outcome between the two groups, longer follow-ups should be conducted (25).

Moreover, the present study findings indicated that THA had significantly fewer complications compared to fixation following six months. An arthroplasty is a treatment approach for treating displaced femoral neck fracture, which provided significantly less risk of revision operation and higher infection rate, operative time, and blood loss compared to internal fixation (1). In a study with a 48-month follow-up period, THA had 4% hip complication rate, and it was 42% in internal fixation treatment, with reoperation rates as 4 and 47% (25). Despite elimination of AVN risks of the femoral head, malunion, and nonunion by the selection of arthroplasty over internal fixation, some other complications emerge, such as prosthetic hip joint dislocation, infection, sciatic nerve palsy, loosening femoral stem, mortality, and thigh pain (26).

Pain was the most prevalent early and late complications of THA group in the current study. Thigh pain is more prevalent in uncemented arthroplasty (27). Furthermore, uncemented arthroplasty could cause higher hip scores. However, it seems that risk of later femoral fractures is higher in uncemented arthroplasty (28). Moreover, pain was the most common early complication in patients of the fixation group, while non-union and pain were the most common late complications. It has been reported that nonunion incidence following femoral neck fixation was between 10-33 percent, which is consistent with the current findings (29).

One limitation of the present study was the low sample size. The sample size is of paramount importance. It may not be adequately large to show the expected differences between the two groups. Moreover, patients above 65 years were not included in the present study, although they have a higher susceptibility to both femoral neck fracture and subsequent morbidities and complications.

Conclusion

We found that over a period of six months, THA provided better hip function and significantly fewer postoperative complications compared to fixation. Besides, there was not any significant difference in early postoperative complications over the first month between the two groups, but frequency of complications such as non-union, AVN, pain, and loosening of the prosthetic and internal fixation device in the THA group were significantly higher than the THA group after six months.

Conflict of Interest

The authors declare no conflict of interest in this study.

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