



Total Hip Arthroplasty versus Hemiarthroplasty in Fracture Neck Femur : Meta-Analysis Study

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ABSTRACT

This systematic review study on human subjects studied in different literatures in whom comparison between Total Hip Arthroplasty (THA) versus Hemiarthroplasty (HA) was performed for patients with fracture neck femur. Ten (10) literatures were found to provide a better management for fracture neck femur. This study demonstrated multiple studies comparing differences in implant design, surgical approach, blood loss or transfusion rates, and complications. The study showed that the HA (65.71%) was more than THA (34.29%). Females were more prone to fracture neck femur than males. In THA, 68.76% females compared to 31.24% males and in HA, 67.67% females compared of 32.33% males. The average ages of the THA and HA groups were 72.48 7.95 and 72.63 8.91 years, respectively, with no statistically significant difference. Modified Harris Hip Score (HHS) for pain showed more improvement in THA than HA. Based on our findings, we concluded that total hip arthroplasty has been shown to offer superior results over hemiarthroplasty. THA was found to have greater difficulties than HA, which may be taken into consideration.

Keywords: Total Hip Arthroplasty; Hemiarthroplasty; Neck Femur Fracture; Complications

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Introduction

A femoral neck fracture is a common injury accounting for 23.8% of all fractures and often accompanied by displacement (1).

Chronic medical conditions may weaken the bone, such as intestinal disorders which can decrease absorption of both vitamin D and calcium. Endocrinal disorders like overactive thyroid may make the bone fragile. Cardiovascular disease as heart failure also is considered as risk factor for fracture neck femur (2).

The patient suffers from many symptoms as inability to get up after any fall or inability to walk in a routine state. Patient will be disabled to bear weight on the leg especially on the side of the injured hip. Severe pain,

bruising and swelling spread in and around the fractured hip. The fracture may cause a shorter leg on the injured side of the hip than the other normal side (3).

Up till now, Garden and Pauwels systems of classification are considered as a practical cornerstone of femoral neck fracture description that help in recommending the convenient treatment (4).

Currently, the optimal treatment for femoral neck fractures is a vigorously debatable problem. Some scholars found that hemiarthroplasty is superior to total hip arthroplasty for fewer reoperations and better function outcomes (5,6).

This systemic metaanalysis study aimed to provide a better management for fracture neck femur.

PATIENTS AND METHODS

The study represents a meta-analysis of literatures that compare between two treatment modalities; Total Hip Arthroplasty (THA) versus Hemiarthroplasty (HA) in treatment of fracture neck femur to compare the outcomes of both techniques.

This study demonstrated multiple studies comparing differences in implant design, surgical approach, blood loss or transfusion rates, and complications. These aspects of surgical techniques were not included in the analysis of this study because we only focus on the outcome of both techniques.

Points of comparison:

- Number of cases with sex differentiation.
- Patient characteristics
- Patients reported clinical and functional outcome.
- Radiological outcomes.
- Complications.

Selection of domains of outcomes to be investigated:

The outcome measures were identified after discussion groups in our unit, about patients who had previously undergone knee arthroplasty surgery. We also took into account the most commonly used measures of outcome from recent publications.

Domains included risk of early complications (myocardial infarction, stroke, venous thromboembolism, or deep infection) or early mortality. Success of operation: range of movement achieved or kneeling ability, reduction in pain, improvement in function. Reoperation or revision rate and rate of recovery.

Evidence of publication bias was sought using the funnel plot method:

A funnel plot is the simplest scatter plot of the intervention effect estimates from individual studies against some measure of each study's size or precision.

Statistical considerations:

This study was conducted in accordance with the MOOSE (meta-analysis of observational studies in epidemiology) and PRISMA (preferred reporting items for systematic reviews and meta-analyses) flowchart were produced based on the search results and the inclusion/exclusion criteria. We studied the risk of bias for each study using (Cochrane collaboration tool for assessing the risk if bias). Data were presented as Mean \pm SD for quantitative variables & number and percentage for qualitative variables. Data were coded, entered and analyzed by computer software package (version 10). Categorical data were compared using chi-square and calculated. The significance level was considered at P-value <0.05 for ANOVA and t-student test was used to differentiate between two different variables.

RESULTS

The study showed that the HA (65.71%) was more than THA (34.29%). Females were more prone to fracture neck femur than males. In THA, 68.76% females compared to 31.24% males and in HA, 67.67% females compared to 32.33% males. So, the rates in female were nearly double that of males (**Figure 1**). The study showed that the incidence of HA was significantly higher ($p < 0.001$) than THA in the studied literature in females and males as well as total cases. However, females were more common than males in femoral neck fractures (**Figure 2,3**).

The average ages of the THA and HA groups were 72.48 7.95 and 72.63 8.91 years, respectively, with no statistically significant difference ($p > 0.05$) (**Figure 4**).

Regarding Laterality of THA and HA, there was no significant difference between the studied literatures (**Table 1**).

There is no difference between the two techniques regarding bone classification ($p > 0.05$). Also, bone quality was similar in the two groups regarding normal and mild Singh's

index, while borderline quality was more significant in HA group and moderate bone quality was more in THA group ($P < 0.05$) (**Table 2**).

Drain and total blood loss, and transfusion units were more significant in THA than HA group (**Table 3**).

Modified Harris Hip Score (HHS) for pain showed more improvement in THA than HA ($p = 0.022$) (**Figure 5**).

There was no significant difference between the studied groups as regard the functional outcome (**Table 4**).

THA had more complications and more serious complications than HA ($p < 0.001$) (**Table 5**).

Pooling of studies using random-effects method (REM) with 95% CI. There is a considerable heterogeneity ($I^2 = 99.1\%$), statistically highly significant difference ($p < 0.001$) in transverse comparison between THA and HA (**Figure 6**).

There is no evidence of publication bias with symmetrical funnel plot. Rank correlation test & regression analysis for funnel plot asymmetry were highly significant ($p = 0.001$), for longitudinal comparison between THA and HA, operative values (**Figure 7**).

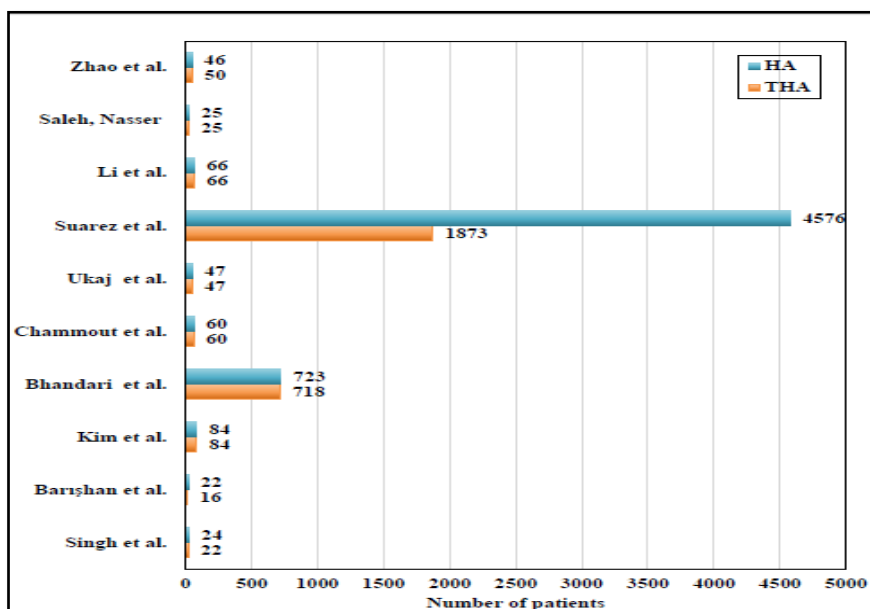


Figure (1): Distribution of patients in each studied literature.

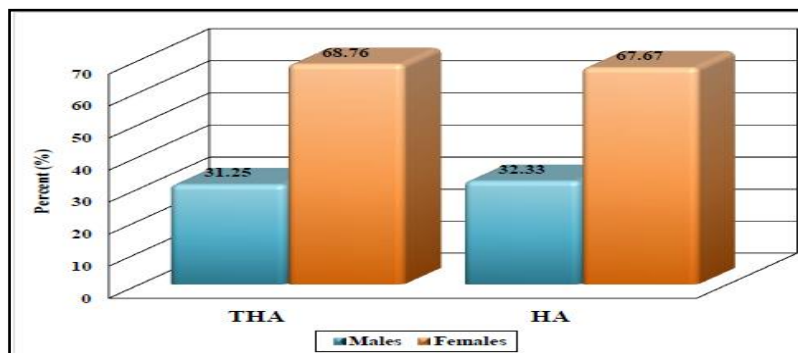


Figure (2): Sex distribution of THA and HA in the studied literatures.

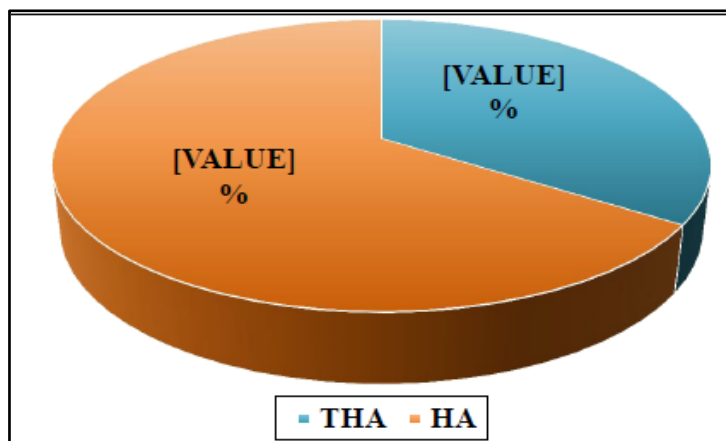


Figure (3): Incidence of THA and HA in total studied literatures.

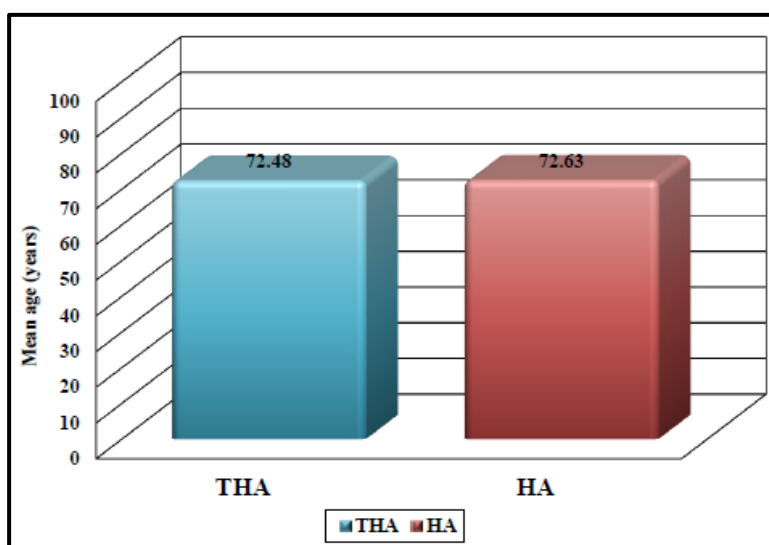


Figure (4): Mean age of THA and HA in the studied literatures.

Table (1): Laterality of THA and HA in the studied literatures.

Right side	THA	HA	t	P
Range	48 – 54.5	51.33 – 53.03		
Mean ±SD	51.35 ± 3.27	52.18 ± 0.85	0.045	0.855
Left side				
Range	45.46 – 52.0	46.97 – 48.67		
Mean ±SD	48.64 ± 3.27	47.82 ± 0.85	-0.046	0.853

t= unpaired t-test, p >0.05: non-significant; Laterality of groups were similar (p >0.05).

Table (2): Bone type and classifications of the studied literatures.

Classification	THA	HA	t	P
Garden Type (%):				
II	-	8.33 ± 1.23		
III	53.6 ± 13.55	53.73 ± 12.1	0.009	0.917
IV	46.4 ± 13.55	44.18 ± 13.76	0.087	0.724
ASA:				
1-2%	69.98 ± 17.35	67.56 ± 29.7	0.045	0.855
3-4%	30.02 ± 17.35	32.43 ± 29.7	0.075	0.874
Bone Quality				
Singh's index [#] :	36.36	33.3	0.492	0.061

Normal	18.18	25.0	-1.468	0.008*
Borderline	31.82	37.5	-0.499	0.058
Mild	13.64	4.17	2.719	0.000*
Moderate				

t= unpaired t-test, p <0.05: significant. #: one study only.

Table (3): Blood loss and transfusion in THA and HA operations.

Transfusion units	THA	HA	t	P
Range	0.14 – 2	0.13 – 0.9		
Mean ±SD	1.07 ± 1.32	0.515 ± 0.54	0.745	0.039*
Total loss				
Range (ml)	178.2 – 1520	125 – 650		
Mean ±SD (ml)	521.1 ± 466.2	331.8 ± 185.5	1.976	0.001*
Drain				
Range (ml)	96 – 227.29	62 – 209.2		
Mean ±SD (ml)	161.6 ± 92.84	135.6 ± 104.1	0.747	0.038*

t= unpaired t-test, *p <0.05: significant, <0.001: highly significant.

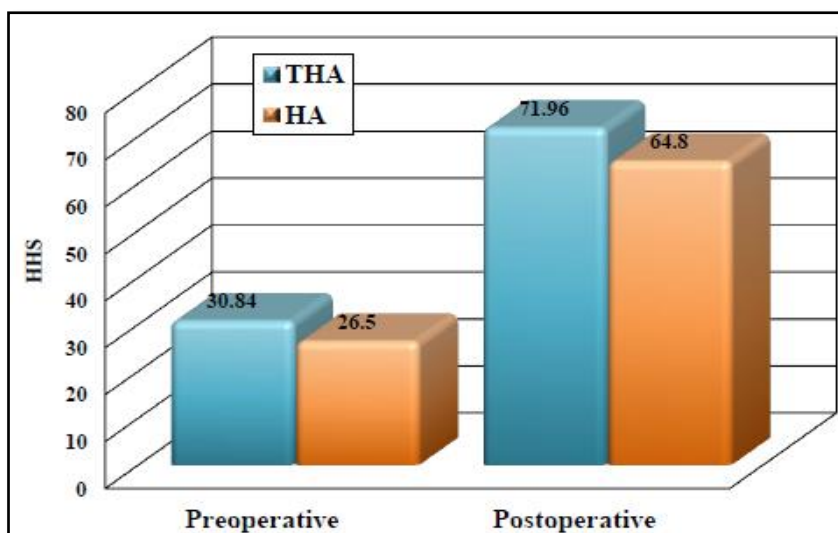


Figure (5): Harris Hip Score in the two operative techniques.

Table (4): Functional outcome (hip joint score) of THA & HA techniques.

Functional outcome	THA	HA	t	P
Range	42.32 – 84.94	40.09 – 83.9		
Mean ± SD	70.22 ± 24.17	71.62 ± 21.12	0.087	0.781

t= unpaired t-test, p >0.05: non-significant.

Table (5): Postoperative complications of THA and HA techniques.

Early Complications	THA (%)	HA (%)	t	P
Hematoma	4.54	8.33		
Respiratory problems	4.58	7.82		
Wound gab	4.54	4.16		
Infection	5.159	8.89		
Dislocation	6.15	4.32		
Late complications				
Hip pain	5.3	13.97		
Stem loosening	3.85	4.58		
Superficial infection	3.37	4.05		
Deep infection	2.4	8.06		

Delayed union	1.67	1.52		
Acetabular erosion	0	8.715		
Subluxation/dislocation	3.88	2.56		
Restricted ROM	9.09	16.67		
Pre-prosthetic fracture	5.3	4.8		
Wound healing problem	0.8	0.7		
Pressure ulcer	1.52	3.03		
Abduction failure	0.1	0.4		
Implant break	0.1	0		
Neurovascular injury	0.3	2.3		
Lower limb discrepancy	8	20		
Deep venous thrombosis	8	2.76		
Revision	4.78	5.82		
Serious complications	27.57	19.1		
Minor complications	7.1	11.95		
Total complications	56.3	27.3	2.391	0.000*
Mortality	8.3	8.56		

t= unpaired t-test, *p <0.001: highly significant.

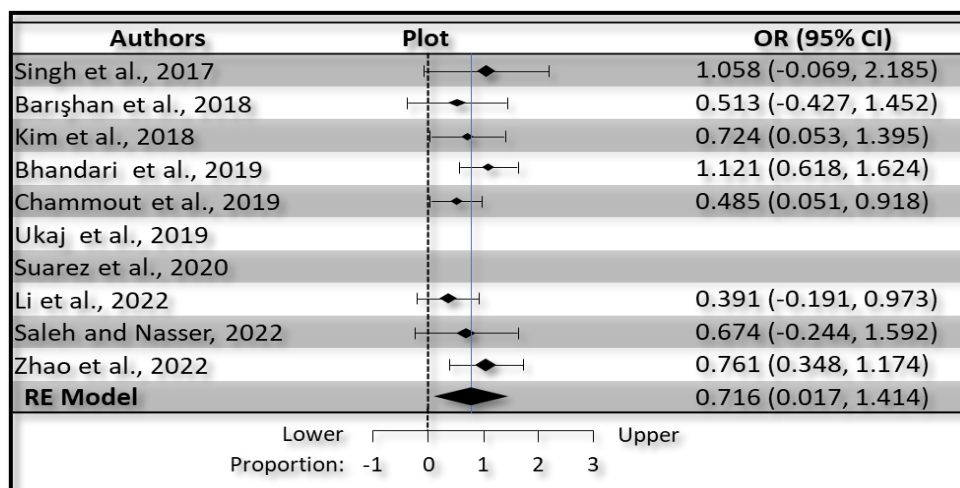


Figure (6): Forest plot for the total postoperative complications of both THA and HA.

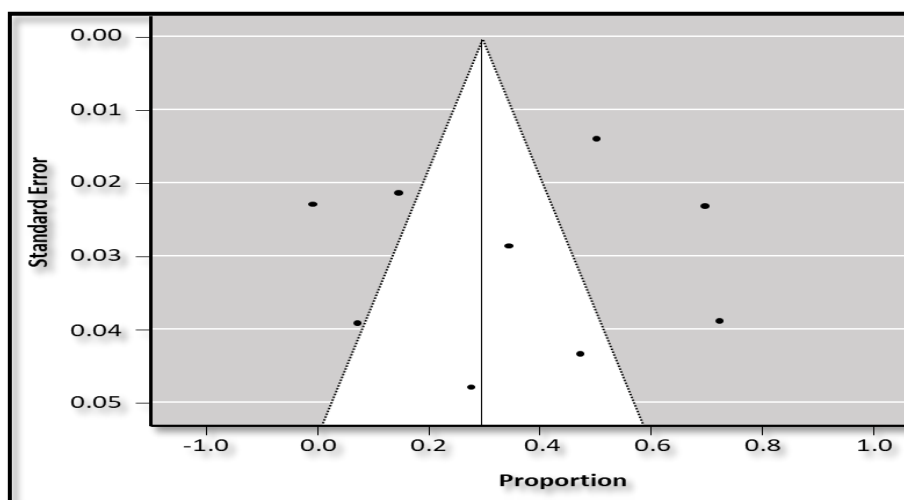


Figure (7): Funnel plot for the postoperative complications for THA and HA.

DISCUSSION:

The risk of femoral neck fracture increases with age, especially for those with over 60 years old. A femoral neck fracture can result in non-union or avascular necrosis, which is among the top 10 causes of disability and death in adults (7).

Two major surgical options for femoral neck fractures are total hip arthroplasty and hemiarthroplasty. Which treatment is the better choice for femoral neck fracture has been controversial for many years (8).

Many surgeons are convinced that femoral neck fracture should be treated by total hip arthroplasty for better outcomes (9).

There still has been some uncertainty about the effect of total hip arthroplasty for femoral neck fracture compared with hemiarthroplasty. Other surgeons believe that hemiarthroplasty is the best method of treatment for a fracture of the femoral neck, with the advantages of reduced dislocation rate, less infection chance, lower reoperation rate, and fewer thromboembolic event (10).

Therefore, the purpose of this study is to compare between THA and HA techniques regarding outcomes and complications. We suppose that this study provides more useful evidence for clinical decisions.

This systematic review study on human subjects studied in different literatures collected from different medical websites to compare between total hip arthroplasty and hemiarthroplasty that performed for patients with fracture neck femur. Ten (10) literatures had fulfilled the study criteria were included in this study.

A meta-analysis study on 9 literatures of total 631 participants with nearly equal patients in the two techniques, 301 THA and 330 HA (11).

Our findings are in agreement with a study had incidence of HA more than THA, 784 (55.25%) and 671 patients (44.75%), respectively and females were more operated than males (12).

Some authors found that there was no significant difference in hip function and life quality between the two procedures in patients with a mean age over 75 years, with better prosthetic survivorship and a trend of fewer hip complications in the HA group (13-15).

A systematic review indicated that both procedures are reasonable in patients over 80 years because of the nonsignificant differences in hip function, reoperation rate, and mortality rate (6).

Increased postoperative activity level provided enormous benefits both physically and mentally (16). Macaulay et al. (17) reported that the co-morbid condition was a factor affecting mortality.

Boukebous et al. (18) and Fahad et al. (19) claimed that dual mobility of THA is associated with reduced risk of dislocation without increasing the mortality.

We theorize that although the lower physical demand of patients over 75 years, THA can still provide less pain even in the short term due to the fewer acetabular wear, which may mainly contribute to the superior in total HHS and the quality of life (20).

The EQ-5D index score was higher in the THA group with a mean follow-up of 18 months, indicating that the improvement of hip function by THA could still significantly improve the quality of life despite the lower activity level (21).

Similar to our results, Liu et al. (22) found that the HHS pain in both groups (173 with THA and 195 with HA). Also, Hedbeck et al. (23) and Tol et al. (24) assessed the HHS function in both groups (173 with THA and 192 with HA).

Moreover, Liu et al. (22) divided the data into two subgroups according to the follow-up duration (within 1 year and from 1 to 5 years). The HHS function within 1 year ($I_2 = 57\%$), and the data tended to favor the THA group (MD 1.39, 95% CI - 1.52-4.30). Two studies assessed the HHS function from 1 to 5 years of follow-up ($I_2 = 35\%$), and the data tended to favor the THA group (MD 2.79, 95% CI - 0.04-5.61). Liu et al. (22-24).

In the present study, there is more incidences of complications in THA than HA. Our finding are in agreement with previous studies; Boukebous et al. (18); Bensen et al. (25), and Kim et al. (26) reported a much lower dislocation rate treated with total hip arthroplasty than that with hemiarthroplasty.

Total hip arthroplasty improved range of motion, reduced impingement, and provided stability. (27)

However, Baker et al. (16) and Macaulay et al. (17) noticed that the occurrence of dislocation with hemiarthroplasty is fewer than that of total hip arthroplasty. Many junior surgeons prefer hemiarthroplasty to total hip arthroplasty.

Similar studies used dual mobility cup, which were not prone to dislocation and therefore the percentage of dislocation events was reduced (8,25).

In addition, the selection bias was attributed to the surgical approach, surgeon's experience and enhanced repair of posterior soft tissue (17).

There were some limitations to consider in this meta-analysis, which should be taken into account. First, the analysis was based on only ten studies, which had a relatively small sample size that may affect results. For limited English language studies, there still had been publication bias in the trials. Second, some unpublished and missing data may have biased the pooled effect. Third, the methodological quality had some problems in the included studies, such as unattainable double-blinding, which may decrease the strength of results. Fourth, there was selection bias. Some unmeasured factors such as preinjury activity level, average age, health conditions, and level of self-sufficiency, nutritional status, and psychological well-being of patients were not considered into our study.

Finally, we could only perform subgroup analyses according to age because of not enough data for the subgroup analyses based on comorbidities and ASA score. Pooled data were analyzed, as individual patient data

was not available, precluding more in-depth analyses.

CONCLUSION:

Based on our findings, total hip arthroplasty has been shown to offer superior results over hemiarthroplasty. THA was found to have greater difficulties than HA, which may be taken into consideration.

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