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ORIGINAL ARTICLE

A comparative study between multiple cannulated screws and dynamic hip screw for fixation of femoral neck fracture in adults: radiological and functional outcomes

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ABSTRACT

Keyword: Dynamic Hip Screw, Canulated Screw, Neck of Femur.

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Background: Management of Neck Of Femur fractures is associated with high rates of complications, The common methods of fixations are the Dynamic Hip Screw and Cannulated screws. **Objectives**: to evaluate and compare the result of two surgical techniques regarding fracture Stability, Union Rates, complications, and radiological and Functional outcomes. **Subjects and methods:** Thirty patients with femoral neck fractures were enrolled in the study and divided into two groups. Multiple Canulated screws treatment for group A and Dynamic Hip Screw treatment for group B. This prospective study was conducted at the orthopedic department of Aswan University Hospital. Functional outcome is determined by the Harris Hip Score at the final follow-up. **Results**: The union time was significantly longer in the Cannulated Screw group (5.4 ± 1.33 months) than in the Dynamic Hip Screw group (4.5 ± 0.52 months). no significant differences between the two groups regarding the nonunion, avascular necrosis, & the Harris Hip Score. **Conclusion**: the Dynamic Hip Screw has the advantage of a rapid union rate and more stable fixation

INTRODUCTION

High privilege of avascular necrosis (AVN) & nonunion because of the operative fixation of the fractured neck of the femur (NOF) makes it a challenge. Different types of fixation types and techniques are described, each of which has its advantages and disadvantages. Canulated screws (CS) and dynamic hip screws (DHS) are the two most widely used types of fixations. [1] CS was preferred because they are a minimally invasive technique that reduces the risk of AVN when compared to DHS, especially in non-displaced fractures as it achieves fracture stability while preserving the blood supply to the femoral head, which is crucial in preventing AVN. [2, 4] As regard to complex NOF fractures, DHS offers more mechanical stability and load sharing capabilities, although it has higher rates of AVN in comparison to CS. [2,3,5] Recent systematic reviews and meta-analyses reported that the management of fracture NOF with both CS and DHS have similar rates of complications such as mortality and non-union, while the DHS has better outcomes compared with the MCS, especially in the union time as the DHS is more biomechanically stable providing higher healing rates, while CS demonstrated a significantly lower incidence of AVN. Careful evaluation of fracture type and patient factors is essential for optimal treatment selection.[4, 5,6] We hypothesize that the DHS achieves more rapid time for union and functional recovery than CS, while both methods are similar in AVN rate.

In this current study, we compare the two surgical techniques (CS and DHS) regarding fracture Stability, Union Rates, complications, and radiological and Functional outcomes.

PATIENTS AND METHODS

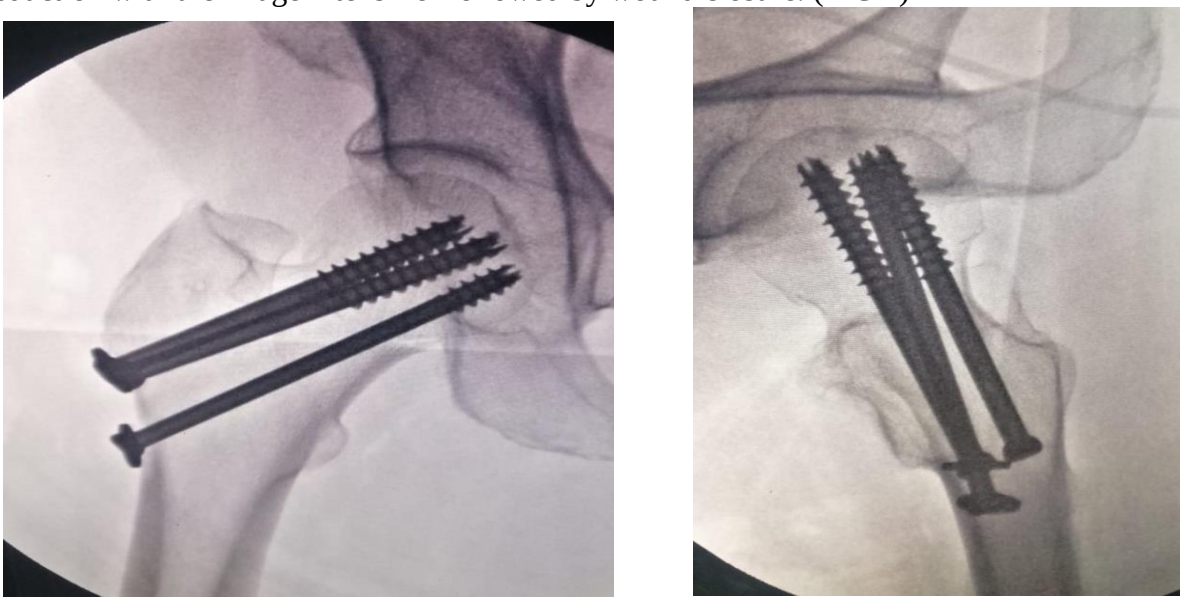
Thirty patients were conducted in this comparative prospective cohort study. For these patients suffering from fracture NOF managed in the orthopedic department at Aswan University Hospital, the participants were divided into two groups. Group A (15 patients) was treated with the CS, and Group B (15 patients) was treated with the DHS. Inclusion criteria: 1) Patients with NOF fracture (all types of garden classification) [7], 2) Patient's ages range from 16 to 60 years. 3) Recent (less than 1 month) fracture. Exclusion criteria: 1) Associated head or acetabulum fractures, 2) pathological fractures, 3) old neglected fractured neck femur more than 1 month, 4) AVN of femoral head. 5) Previous Hip Surgeries, 6) immune-compromised patients

Surgical Techniques

Patient positioned supine in a radiolucent traction table, spinal anesthesia is administered to nondisplaced fractures fixed in situ while displaced fractures are reduced by external rotation, abduction, longitudinal traction, internal rotation, and adduction [10, 11].

Cannulated screw.

Using small (2-3 cm) incisions at the lateral side of the thigh three guide wires were placed through the neck & head up to the subchondral bone, the wires arranged in a triangle configuration one inferior wire & the other two is posterior superior & anterior superior. The verification of the position of the wire using the image intensifier [11]. The guide wire's depth is measured to determine the screw length. A 3.6 mm cannulated drill bit is to provide the passage for the core diameter of the screws, then the CS with washers is introduced over the guide wire and delivered to the subchondral bone to increase compression over the fracture site. Take off the guide wires. The final location of the screws and fracture reduction with the image intensifier followed by wound closure. (FIG 1)



(A)

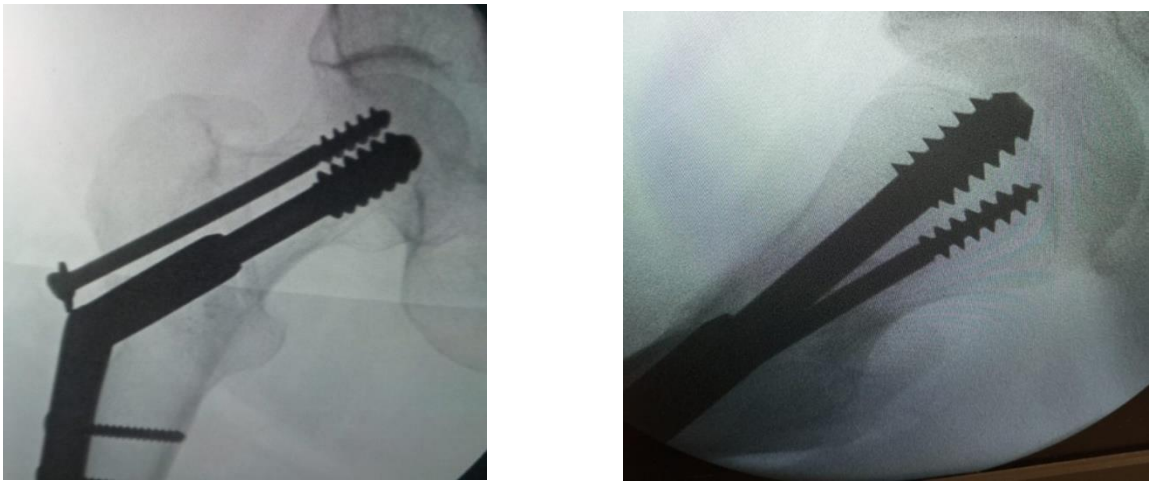
(B)

Figure 1: 45-year-old male patient with NOF fracture Garden III. C- arm image shows the fixation of the fracture with 3 CS. (A) ap view & (B) lateral view

Dynamic Hip Screws (DHS):

Using the lateral approach starting from the greater trochanter to 8-10 cm distally, where the deep dissection is performed to reach the proximal femur. The anatomical reduction of the fracture is confirmed by the image intensifier, then a guide pin is inserted through the femoral neck to the

center of the head, followed by canulated reamer is used to create the pathway of the DHS lags screw which is inserted over the guide pin, then 4 holes DHS plate placed over the lag through its parallel and fixed at the lateral aspect of the femur by using 4 cortical screws. Then An additional anti-rotational screw is inserted parallel and superior to the lag screw to prevent rotational movement of the femoral head and neck. This screw provides extra stability to the fixation, and finally, the wound is sutured in layers [12,14]



(A) **(B)**

Figure 2: 19 -year-old male patient with NOF fracture Garden III . C- arm image shown fixation of fracture with DHS

Postoperative follow up :

Pre-operative data: Age, sex, mode of trauma, comorbidities, fracture side, and type. Post-operative hip x-ray at 1st, 3rd, 6th, and 12th months to assess union and fracture stability. Other post-operative data including time of radiological union, malunion, non-union, infection, and AVN, and the Harris Hip score (HHS) for the Functional outcome .[8]

Statistical Analysis

IBM Inc.'s SPSS v28 (Armonk, NY, USA) is used for data analysis. In order to compare the quantitative variable means and standard deviations (SDs) between the two groups, an unpaired Student's t-test was employed. Qualitative variables were reported in terms of frequency and percentage (%). Fisher's exact test or the Chi-square test was used to analyze the data when appropriate. If the two-tailed P value was less than 0.05, the result was designated as statistically significant.

Ethical consideration:

Written consent was obtained from each patient to perform surgery and participate in the research. This research was approved by the Ethics Committee of Aswan University.

RESULTS

This study included 30 patients with fracture NOF that were divided into 2 groups: group (A) treated with the Cs & group (B) treated with DHS. The mean age for the CS group is (37.9 ± 13.84) while for the DHS was (36.6 ± 11.61) that revealed no statistical significance. Ten (66.67%) patients were males in the Cs group and 13 (86.67%) were in the DHS group. Four (26.67%) patients of the CS, while 2 (13.33) in the DHS group suffered from comorbidities; diabetes mellitus (DM) and hypertension (HTN). Seven (46.67%) patients of the CS were smokers, while 6 (40%) of the DHS. (Table,1).

As regards the fracture type in the CS group; 5(33.33%) were Garden type I , 4(26.67%) Garden II, and 6(40% Garden III. Between the DHS group; 1(6.67%) case garden I , 8(53.33%) Garden II , 4(26.67%) is Garden III and 2(13.33%) is garden type Vl .

The time of radiological union in the Cs group was (5.4±1.33) months and in the DHS group (4.5±0.52) months, which was significantly longer than with CS group (P value 0.029).

There were no significant differences between groups as regards the non-union, mal-union, AVN, failure of fixation, infection, and HHS. Where, nonunion was recorded in 2(13.33%) cases in the CS group and 1(6.67%) in DHS group, where hip arthroplasty was done for these 3 patients. No recorded cases of mal-union in both groups. AVN of the femoral head was recorded in 7(46.67%) cases in the CS group and 5(33.33%) in the DHS group.AS regards to the failure of fixation we recorded 3(20%) cases in the CS group and 1(6.67) of the DHS group. The infection rate was 0 in both groups. The HHS was 65.1±25.08 in the CS group and 77.5±22.99 in the DHS group. Table 2 shows the postoperative and follow-up data. (Table,2)

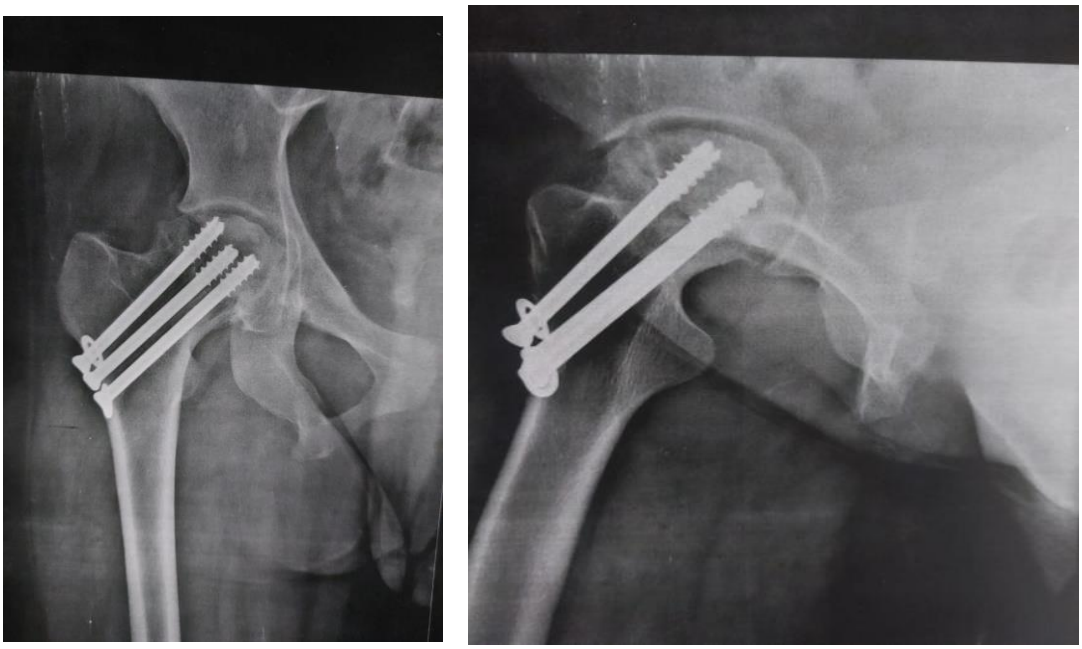
Table 1: Comparison between the two studied groups regarding preoperative data :

		Cannulated group (n=15)	DHS group (n=15)	P value
Age (years)	Mean ± SD	37.9 ± 13.84	36.6 ± 11.61	0.788
	Range	19 – 57	18 – 55	
Sex	Male	10 (66.67%)	13 (86.67%)	0.195
	Female	5 (33.33%)	2 (13.33%)	
Comorbidities	No	11 (73.33%)	13 (86.67%)	0.496
	DM	2 (13.33%)	1 (6.67%)	
	DM& HTN	0 (0%)	1 (6.67%)	
	On steroids	0 (0%)	1 (6.67%)	
	Hyperthyroidism	1 (6.67%)	0 (0%)	
Smoking	Smoking	7 (46.67%)	6 (40%)	0.712
	Non smoking	8 (53.33%)	9 (60%)	
Type of fracture	Garden type 1	5 (33.33%)	1 (6.67%)	0.094
	Garden type 2	4 (26.67%)	8 (53.33%)	
	Garden type 3	6 (40%)	4 (26.67%)	
	Garden type 4	0 (0%)	2 (13.33%)	

Table 2 : Comparison between the two studied groups regarding Follow-up

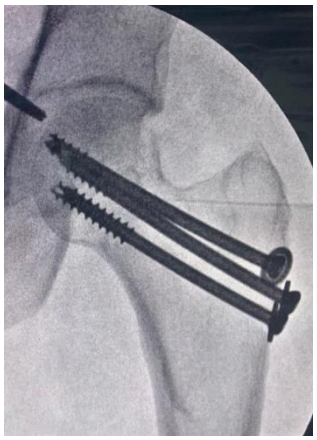
		Cannulated group (n=15)	DHS group (n=15)	P value
Time of full union (Months)	Mean ± SD	5.4 ± 1.33	4.5 ± 0.52	0.029*
	Range	4 – 9	4 – 5	
Non-union	United	13 (86.67%)	14 (93.33%)	0.542
	Non united	2 (13.33%)	1 (6.67%)	

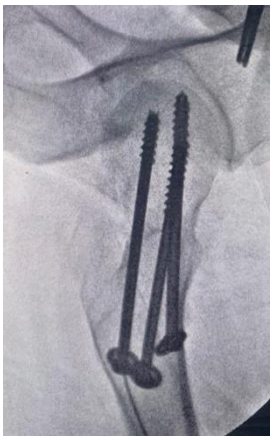
Avascular necrosis	AVN	7 (46.67%)	5 (33.33%)	0.581
	No	8 (53.33%)	10 (66.67%)	
Failure of fixation	Failure	3 (20%)	1 (6.67%)	0.282
	No	12 (80%)	14 (93.33%)	
Infection	Infection	0	0	--
	No	15 (100%)	15 (100%)	
Harris Hip Score	Mean ± SD	65.1 ± 25.08	77.5 ± 22.99	0.169
	Range	17 – 95	0 – 95	



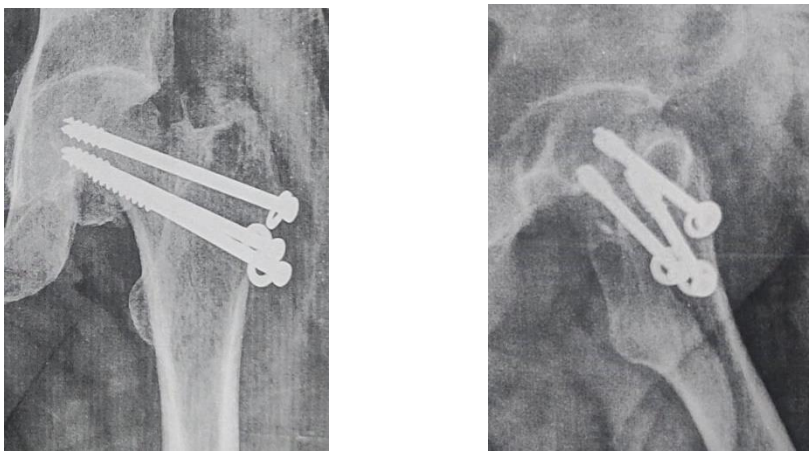
(A) **(B)**

figure (3) a female pt. .25 y with AVN hip after NOF fixation by CS , (A) AP view, (B) lateral view



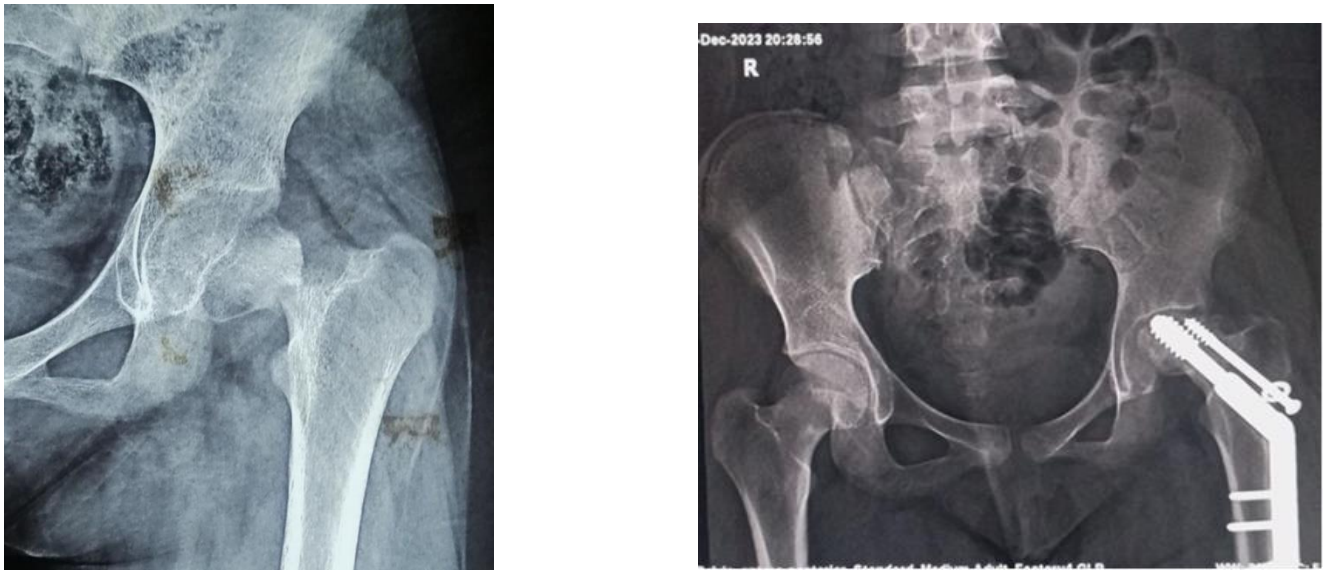


(A) **(B)** **(C)**



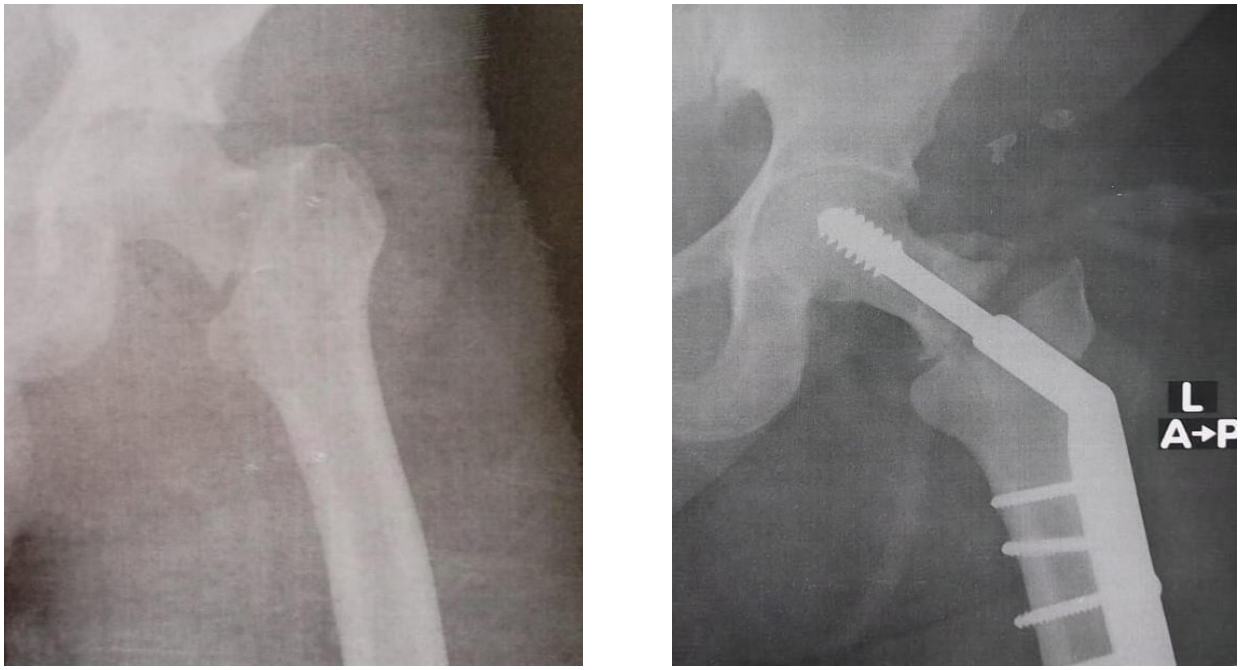
(D) (E)

Figure (4) a male pt. .31 y with non-united NOF fracture after fixation by CS, (A) preoperative x-ray, (B),(c) intra-operative image (D), (E) 6 months follow up



(B) (A)

Figure (8) , 20 year Female patient , with motor car accident , (A) : x ray shows NOF fracture with Garden type IV ,(B) the 1year follow up with AVN of the Head femur .



(A) **(B)**

Figure (8), 33 year Male patient, with a motor car accident, (A): x ray shows NOF fracture with Garden type III, (B) the 6 months follow-up with non-union of the fracture.

DISCUSSION

When it comes to managing fracture NOF, CS and DHS have comparable rates of complications, however, DHS has a better outcome than CS, as regards union period and functional recovery; in contrast, CS showed a significantly lower incidence of AVN. Still, the patient's characteristics and the type of fracture are important factors that affect the decision of fixation method and outcome. [18]

In our study, there was no significant difference between the two groups in terms of non-union, mal-union, AVN, fixation failure, infection, or Harris Hip Score. However, the union time was significantly longer with the CS group than the DHS group (P value 0.029).

Our prospective study involved 30 patients with NOF fractures divided equally into group A (CS) and group B (DHS), Their mean age is (37.9 ± 13.84) in the CS group, and (36.6 ± 11.61) in the DHS.

Regarding the Time of full radiological union in our study was significantly longer in the CS group (5.4 ± 1.33 months) compared to the DHS group (4.5 ± 0.52 months), with a p-value of 0.029. This finding aligns with the studies of Khan et al. and Bhandari et al., which reported that DHS may provide more stable fixation, thereby promoting quicker healing.[9] While Al-Kelabi et al. reported that, there was no significant difference ($p>0.05$) in the healing time between the two groups regarding Complication Rates. [10]

In the current study, the incidence of non-union, malunion, AVN, failure of fixation & infection, and HHS show no significant difference between the two groups. The non-union occurred in 13.33% of the CS group and 6.67% of the DHS group, while AVN rates were 46.67% and 33.33%, respectively. Similarly, Khan et al., Koval et al., have reported no difference in the rate of these complications between fixation methods.[11,12] Lim et al. reported that, the nonunion rate was higher in the CS group than in the DHS group.[14] Sahin et al., nonunion rates of 12% and 21% were reported in the DHS and CCS groups, respectively. [15]

In our study, the prevalence of revisions was insignificantly different between both groups, like with Li et al. [16]

Regarding the functional outcome, the Harris Hip Score was insignificantly different between both groups (CS: 65.1 ± 25.08; DHS: 77.5 ± 22.99). This suggests that both fixation techniques yield similar functional recovery, which is supported by previous studies of Bhandari et al; Koval et al., that have reported comparable functional outcomes. [13,17]

RECOMMENDATION:

1- To better understand the effects associated with various femoral neck fracture types, think of classifying patients according to their fractures (e.g., Garden classification). 2- Conduct multicenter studies to gather data from diverse populations and surgical practices. 3-Emphasize patient education regarding post-operative care and rehabilitation protocols.

Limitation of the study:
Small sample size, short-term follow-up, one-center study, and differences in surgical experiences between the surgeons.

CONCLUSION

Fixation of fracture NOF using DHS or CS has a similar rate of complication and functional outcome. However, the union time is longer with CS than with DHS.

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Authors contribution:
Hesham Hamed Refae : data analysis, writing, and reviewing the manuscript
Ahmed Mohammed Abdelwahab: performing operations, collecting data & writing the manuscript
Mohamed Salman: data analysis, writing, and reviewing the manuscript
Ebeed Yasin: writing the manuscript, reviewing the manuscript.

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