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# COMPARATIVE ANALYSIS BETWEEN DYNAMIC HIP SCREW AND CANCELLOUS CANNULATED SCREW FIXATION IN FRACTURE OF NECK OF FEMUR

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**ABSTRACT** **Introduction:** Fractures of the femoral neck are common injuries. Even though numerous studies have evaluated dynamic hip screw (DHS) vs multiple cannulated cancellous screw (CCS) fixation for fractured neck of femur, no consensus has been reached. We sought to compare DHS and CCS fixation for femoral neck fractures.**Methodology:** Total 60 patients who received DHS/CCS fixation for a femoral neck fracture at our hospital were enrolled in this prospective study. All patients were randomly and equally divided patients into group A (DHS, n=30) and group B (CCS, n=30) and a conventional NOF protocol was administered. All patients were followed for one year. **Results:** No significant differences in clinic-demographic factors were observed across groups. Both groups reported a comparable length of union. More complications were observed in group B than in group A. The mean Harris hip score in group A was significantly greater than in group B (p=0.0124*). Most patients in group A scored excellent, whereas group B scored good (p=0.0298*). **Conclusion:** In our study, dynamic hip screw (DHS) fixation of femoral neck fracture appeared to be better than the multiple cannulated cancellous screw (CCS) fixations.

**KEYWORDS :** Cannulated Cancellous Screw, Dynamic Hip Screw Fixation, Neck of Femur Fracture, Harris Hip Score, Garden Classification.

## INTRODUCTION

Fractures of the hip are a common injury, and femoral neck fractures are a kind of intracapsular hip fracture. Connecting the femoral shaft to the femoral head is the femoral neck. The hip joint is where the femoral head articulates with the acetabulum. The placement at the juncture makes the femoral neck susceptible to fracture. The blood supply of the femoral head goes via the femoral neck and is crucial for displaced fractures and younger patients. Approximately 20% of orthopaedic surgeons' surgical cases involve hip fractures. [1] Every year, around 1,7 million people, primarily the elderly, have a hip fracture. [2] The risk of hip fractures is significant, ranging from 40 to 50 per cent in women and 13 to 22 per cent in males. [3] After a fall, intracapsular femoral neck fractures are common in the elderly. Fractures of the femoral neck in young adults are uncommon. The Dynamic Hip Screw (DHS) or Sliding Hip Screw may be used to fixate fractures of the neck of the femur. This is typically explored for fractures outside the hip capsule (extracapsular), most commonly stable intertrochanteric fractures. [4,5] This is because there is a lower risk of blood supply interruption to the femoral head, so it may be possible to preserve the joint. However, it may also be appropriate for younger patients with hip capsule (intracapsular) fractures if there is a high likelihood that the blood supply will be preserved, hence minimizing the danger of avascular necrosis. For various fracture patterns, cannulated screws are a frequent type of fixation utilized by orthopaedic surgeons. These screws may be cannulated or "hollow" to enable placement over a guidewire for improved alignment before drilling or insertion. After removing the guidewire, the screw is left in place. Cannulated screws provide temporary stability via guidewires, can be administered using a less invasive technique, and result in more precise, reproducible fixation. However, due to the possibility of avascular necrosis of the femoral head and subsequent femoral head collapse, some surgeons opt for alternate procedures such as arthroplasty or a sliding hip screw. [6,7] However, minimal clinical evidence suggests that one implant is superior to the other in terms of avascular necrosis, nonunion, and the requirement for revision surgery. This study aimed to compare the functional outcomes of dynamic hip screws with numerous cannulated screws in the treatment of such fractures.

## MATERIAL AND METHODS

This Prospective (cohort) study was carried out at the Department of Orthopedics, Hind Institute of Medical Sciences & Hospital, Barabanki, from 2020-2021. All patients with a Neck of Femur fracture who came to the Department of Orthopedics, Hind Institute of Medical Science and Hospital, Barabanki. Patients with pathological, sub-capital and extracapsular fractures were excluded from the study. Patients were allotted into two groups on a random number basis. Each group had 30 patients. Group A was treated with a standard Dynamic Hip Screw (DHS), and Group B was treated with a standard three cancellous cannulated screw of 6.5mm, as used in standard neck femur osteosynthesis. Patients were given spinal/epidural/general anaesthesia according to the patient's fitness and the time required for surgery. The patient was taken in a supine position on the fracture table. The close reduction was made using Leadbetter or Whitman Technique. Sterile dressing was done on 2$^{nd}$ and 5$^{th}$ day and Stitches were removed on the 14$^{th}$ day. Non-weight-bearing mobilization was initiated on the second day, whereas patient weight-bearing was started depending on the type of fracture reduction. Patients were followed up at the monthly interval. Clinico-radiological and modified Harris Hip Score were recorded and compared.

**Statistical Analysis**:

Data were entered in Microsoft Excel and analyzed using statistical software SPSS version 26 (SPSS Inc., Chicago, IL, USA). The continuous variables were evaluated by mean (standard deviation) or range value when required. The dichotomous variables were presented in number/frequency and were analyzed using the Chi-square test. For comparison of the means between the two groups, analysis by Student T-test was used. A p-value of <0.05 or 0.001 was regarded as significant.

## RESULTS

Both study populations were well-matched in terms of patient demographics. The male/female population in the DHS group was equal (15/15), while in the CCS group, female dominance was noted (11/19). Most patients were 41-50 years old in the DHS group (40.00%) and CCS group (50.00%); however, the demographical parameters were not statistically significant. [TABLE-1] The mean time interval for the fracture to management was [13.03±5.88] in group A and [13.03±5.66] in group B. No significant difference was found in terms of the laterality of the procedure (p=0.3017) or type of fractures according to Garden's classification (p=0.8714). [TABLE-1] The majority of the patients in both groups [16(53.33%)] had 13-21 days of the time interval. The mean union time was recorded as [13.33±0.83] weeks in group A and [13.43±0.88] weeks in group B, where most of the patients in both groups showed improvement at the 13$^{th}$ week. [TABLE-2] In group A, only 3 patients had complications such as Avascular necrosis (n=1), cut-out phenomenon (n=1) and superficial infection (n=1). At the same time, 7 patients had complications in group B, such as Avascular necrosis (n=3) and non-union (n=4). Statistically, a non-significant difference was observed in complications except for non-union (p=0.0384*). [TABLE-3] A significant difference was noted among groups in Harris Hip Score (p=0.0124*). [TABLE-4; FIGURE-1] The mean follow-up duration was [8.07±2.60] in group A and [7.08±2.42] in group B. In group A, most of the patients had excellent remarks [16(57.14%)], followed by fair remarks [8(28.57%)]. At the same time, in group B, most of the patients had good remarks [10(40.00%)], followed by fair remarks [9(36.00%)]. [TABLE-5; FIGURE-2] Statistically, a substantial difference was observed among groups (p=0.0298*).

## DISCUSSION

In the present study, the majority of the patients were aged between 41-50 years in both group A [12(40.00%)] and group B [15(50.00%)], followed by 51-60 years in both group A [10(33.33%)] and group B [9(30.00%)]. Only 2 patients were noted under the age group of 21-30 years in both groups. In group A, an equal number of male [15(50.00%)] and female patients [15(50.00%)] were noted. At the same time, in group B, most patients were females [19(63.33%)]. Overall female preponderance was noted in the present study. Similarly, most patients belonged to the age group of 38-43 years in the DHS and CCS groups. [8] In contrast, male dominance was noted in the study by Venkatesh S. [8]. Similar to the present study, female dominancy was also observed in the study of Griffin XL et al. [9] and others. [10-12] No studies reported these variables' role in fracture treatment outcomes. In the present study, we also observed that these variables had no role in fracture treatment outcomes. The mean time interval for the fracture to management was [13.03±5.88] in group A and [13.03±5.66] in group B. The majority of the patients in both groups [16(53.33%)] had 13-21 days of the time interval whereas [14(46.67%)] patients in both groups had 5-12 days of interval for the fracture to the management. Most patients had a time interval of 14 days in the DHS group and 15 days in the CCS group. [8] We observed that most patients had type II fracture in both group A [18(60.00%)] and group B [16(53.33%)], followed by type I fracture in both group A [7(23.33%)] and group B [8(26.67%)]. In group A, [5(16.67%)] patients had type III fractures, while group B had [6(20.00%)] patients. Similarly, Venkatesh S observed the majority of the patients had type II fractures in both the DHS group [7(46.7%)] and CCS group [9(60.00%)]. [8] Further, most of the patients with type II classification were in the DHS group [26 (63.4%)] and CCS group [19 (59.4%)]. At the same time, the least patients were noted in type I classification in both the DHS group [15 (36.6%)] and CCS group [13 (40.6%)]. [10] Group A had most patients with left-side fractures [17(56.67%)], followed by right-side fractures [13(43.33%)]. At the same time, in group B, most patients had right-side fractures [17(56.67%)], followed by left-side fractures [13(43.33%)]. Similarly, another study noted that in the DHS group, the majority of the patients [10(66.7%)] had left-side fractures, followed by right-side fractures [5(33.7%)].83 While in the CCS group, most of the patients had right-side fractures [9(60.00%)], followed by left-side fractures [6(40.00%)]. In contrast, Cullen SE et al. [10] noted the majority of the patients had right-side fractures in both the DHS group [23(56.1%)] and the CCS group [19(59.4%)]. In the present study, the mean union time was recorded as [13.33±0.83] in group A and [13.43±0.88] in group B, which was comparable. In most of the patients of group A [18(60.00%)] and group B [13(43.33%)], the time of union was 13 weeks. [5(16.67%)] patients in group A and group B [9(30.00%)] had time of union was 14 weeks. In [4(13.33%)], patients of both groups had a union time of 15 weeks. In the present study, in group A, only 3 patients had complications such as Avascular necrosis [1(33.33%)], cut-out phenomenon [1(33.33%)] and superficial infection [1(33.33%)]. At the same time, 7 patients had complications in group B, such as Avascular necrosis [3(42.86%)] and non-union [4(57.14%)]. We have found that DHS is more stable and permits greater compression across the fracture, allowing for early mobilisation and union. Patients treated with DHS did not develop non-union, but 4 patients treated with CC screws had non-union. These findings are similar to those of Lakhani AA et al. [13]. Similarly, 13.8 and 13.5 weeks as the time of union were recorded in the DHS and CCS groups, respectively. [8] In our study, the average time for the union was 13 weeks for patients in groups A and B. Still, the number of patients in group A were more compared to group B. We recommend using DHS with a derotation screw for treating all patients with femoral neck fractures, early union, and decreased risk of non-union. [13] In another study, the risk variables for fracture non-union following internal fixation of intracapsular femoral neck fractures observed that a displaced fracture, borderline and unsatisfactory reduction, and a more centralised screw location were risk factors for non-union and implant failure. [13] Poor reduction and fracture displacement are the most consistent predictors of non-union after the repair of intracapsular femoral neck fractures. In most research, including ours, age and gender are not risk factors for non-union. The relationship between fracture site and fracture level was not found. Two of the three patients treated with CC screws who developed non-union were fixed in borderline retroversion, while the third was repaired in varus in the study by Bonnaire FA et al. [14] In the present study, the union rate with DHS was 100%. Significant compression and impaction produced throughout the fracture site contributed to the high union rate in the DHS group. AVN was seen in 4 cases in our study. One patient was treated with DHS, whereas 3 patients were treated with CC screws. None of the patients who developed AVN required additional surgical treatment in the form of hip replacement until follow-up. Minor complications such as superficial infection and cut-out phenomenon were noted; however, they were treated with medicine. It was determined that none of these minor complications affected the overall functional outcome. [13] In contrast, they found the same non-union rate of 8.6% and 8% in DHS and CCS, respectively, [13] which was similar to the studies by Gupta M et al. [15], Chen C et al. [16] and Jettoo P et al. [17] At the same time, many studies have reported the rate of AVN in the CSS group was much lower than in the DHS group, and heterogeneity dropped from 39 to 0%. We believe that the primary explanation for this is the advantage of a larger sample size, and two large sample studies [18,19] confirm our position. We believed that the reduced AVN rate in the CSS group was due to less intrusive procedures that protected the blood supply to the greatest extent possible [20,21]. In addition, the incidence rate of AVN would vary greatly based on the displacement of the femoral neck at the time of injury, and the incidence of AVN in displaced fractures was significantly higher than in non-displaced fractures. [22] The mean follow-up duration in our study was [8.07±2.60] in group A and [7.08±2.42] in group B. In group A, most of the patients were followed up for 8-12 months [17(60.71%)], followed by 4-7 months [11(39.29%)] while in group B, most of the patients were followed up for 4-7 months [17(65.38%)], followed by 8-12 months [9(34.62%)]. Similarly, a longer follow-up period of 10 months in the DHS group. At the same time, the CCS group had follow-ups for 9 months. [8] In contrast, Siavashi B et al. [23] followed-up patients for 12-36 months. Sørensen JL et al. [12], Watson A et al. [24] and Christie J et al. [25] have also noted a follow-up duration of more than 12 months. We recorded a higher mean Harris hip score in group A [85.79±7.24] compared to group B [81.20±6.52]. In group A, most of the patients had excellent remarks [16(57.14%)], followed by fair remarks/outcomes [8(28.57%)] and good remarks [4(14.29%)]. At the same time, in group B, most of the patients had good remarks [10(40.00%)], followed by fair remarks [9(36.00%)] and excellent [6(24.00%)]. Similarly, another study observed excellent results in 61.3 % of the patients managed with DHS, while only 25.8 % of patients managed with CC screw showed excellent results. [87] In contrast to our study, 9.7 % of patients managed with CC screw showed poor results, while none of the patients managed with DHS

showed poor results. [87] Likewise, a higher Harris hip score was recorded in patients treated with DHS than in patients treated with CCS.83 In the DHS group, most of the patients [n=8] had excellent outcomes, followed by good [n=4] and fair [n=2]. In the CCS group, most patients had good outcomes [n=6], followed by excellent [n=4]. Further, Siavashi B et al. [23] recorded a higher mean harris hip score (HHS=83) in the DHS group compared to the CCS group (HHS=92).

## CONCLUSION

We conclude that patients treated with DHS had a higher union rate and lesser rate of complications with marked compressive effect leading to increased fracture healing. The fractured neck of the femur treated with Dynamic Hip Screw fixation results in an excellent functional outcome. Both groups observed a significant difference in non-union, Harris Hip Score, and remark. However, this study had several drawbacks, such as short monitoring time and single institute nature. Hence, more longitudinal studies in different geographical regions are needed.

## TABLES AND FIGURES

**TABLE-1: Clinico-Demographical parameters of enrolled patients (n=60).**

| | | GROUP-A | | GROUP-B | | P-VALUE |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| AGE | 21-30 | 2 | 6.67% | 2 | 6.67% | X=0.7860 p=0.8528 |
| | 31-40 | 6 | 20.00% | 4 | 13.33% | |
| | 41-50 | 12 | 40.00% | 15 | 50.00% | |
| | 51-60 | 10 | 33.33% | 9 | 30.00% | |
| GENDER | FEMALE | 15 | 50.00% | 19 | 63.33% | X=1.086 p=0.2974 |
| | MALE | 15 | 50.00% | 11 | 36.67% | |
| GARDEN CLASSIFICATION | TYPE I | 7 | 23.33% | 8 | 26.67% | X=0.2752 p=0.8714 |
| | TYPE II | 18 | 60.00% | 16 | 53.33% | |
| | TYPE III | 5 | 16.67% | 6 | 20.00% | |
| LATERALITY | LEFT | 17 | 56.67% | 13 | 43.33% | X=1.067 p=0.3017 |
| | RIGHT | 13 | 43.33% | 17 | 56.67% | |
| | Grand Total | 30 | 100.00 % | 30 | 100.00% | |

**TABLE-2: Time Interval to management and time of union in enrolled patients (n=60).**

| | | GROUP-A | | GROUP-B | | P-VALUE |
|---|---|---|---|---|---|---|
| | | N/MEAN | %/SD | N/MEAN | %/SD | |
| TIME INTERVAL (IN DAYS) | MEAN ±SD | 13.03 | 5.88 | 13.03 | 5.66 | t=0.000 p>0.9999 |
| | 5-12 | 14 | 46.67% | 14 | 46.67% | -- |
| | 13-21 | 16 | 53.33% | 16 | 53.33% | |
| TIME OF UNION (IN WEEKS) | MEAN ±SD | 13.33 | 0.83 | 13.43 | 0.88 | t=0.4528 p=0.6524 |
| | 12 | 3 | 10.00% | 4 | 13.33% | X=2.092 p=0.5535 |
| | 13 | 18 | 60.00% | 13 | 43.33% | |
| | 14 | 5 | 16.67% | 9 | 30.00% | |
| | 15 | 4 | 13.33% | 4 | 13.33% | |
| | Grand Total | 30 | 100.00 % | 30 | 100.00 % | |

**TABLE-3: Complications in enrolled patients.**

| COMPLICATION | GROUP-A | | GROUP-B | | P-VALUE |
|---|---|---|---|---|---|
| | N | % | N | % | |
| AVN | 1 | 33.33% | 3 | 42.86% | X=1.071 p=0.3006 |
| CUT OUT PHENOMENON | 1 | 33.33% | 0 | 0.00% | X=1.017 p=0.3132 |
| NON-UNION | 0 | 0.00% | 4 | 57.14% | X=4.286 p=0.0384* |
| SUPERFICIAL INFECTION | 1 | 33.33% | 0 | 0.00% | X=1.017 p=0.3132 |
| Grand Total | 3 | 100.00% | 7 | 100.00% | |

**TABLE-4: Harris Hip Score of enrolled patients.**

| HARRIS HIP SCORE | GROUP-A | | GROUP-B | | P-VALUE |
|---|---|---|---|---|---|
| | N/MEAN | %/SD | N/MEAN | %/SD | |
| MEAN±SD | 85.79 | 7.24 | 81.20 | 6.52 | t=2.580 p=0.0124* |

**TABLE-5: Follow-up duration and remarks of enrolled patients.**

| | | GROUP-A | | GROUP-B | | P-VALUE |
|---|---|---|---|---|---|---|
| | | N/MEAN | %/SD | N/MEAN | %/SD | |
| FOLLOW-UP DURATION (IN MONTHS) | MEAN± SD | 8.07 | 2.60 | 7.08 | 2.42 | t=1.527 p=0.1323 |
| | 4-7 | 11 | 39.29% | 17 | 65.38% | X=3.678 p=0.0551 |
| | 8-12 | 17 | 60.71% | 9 | 34.62% | |
| REMARKS | EXCELLENT | 16 | 57.14% | 6 | 24.00% | X=7.028 p=0.0298* |
| | FAIR | 8 | 28.57% | 9 | 36.00% | |
| | GOOD | 4 | 14.29% | 10 | 40.00% | |
| | Grand Total | 28 | 100.00 % | 25 | 100.00 % | |

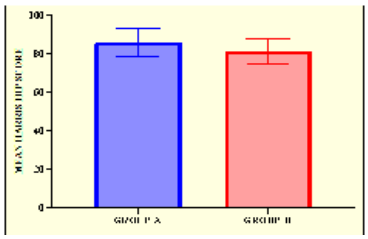


**FIGURE-1: Mean Harris hip score of patients among the groups**

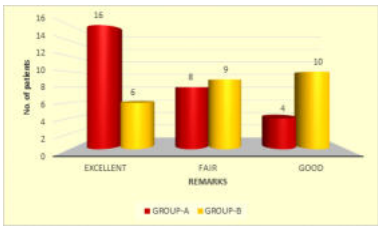


**FIGURE-2: Remarks of patients enrolled among the groups**

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