

A Comparative Study of the Functional Outcome of Dynamic Hip Screw (DHS) vs. Cannulated Cancellous (CC) Screws in Managing Femur Neck Fracture in Young Patients: A Hospital-Based Prospective Study

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Abstract:

Background: There will have been 21.3 million hip fractures globally by 2050, compared to 1.26 million in 1990. Hip fractures are linked to a number of problems, such as hospital-acquired infections, avascular necrosis, non-union, metal work failure, and death.

Objectives: The present study Compare the Functional Outcome of Dynamic Hip Screw (DHS) vs. Cannulated Cancellous (CC) Screws in Managing Fracture of the Neck of the Femur in Young Patients

Materials & Methods: The present prospective cohort study was conducted in the Department of Orthopaedics. 110 young adults (under the age of 55) of both genders with femoral neck fractures treated with DHS and CC screws were included in the current study based on predetermined inclusion and exclusion criteria after the Institutional Ethical Committee approved it.

Results: At the end of the last follow-up, in the DHS group, functional outcomes were excellent to good in 83 (75.45%) patients, whereas fair and poor outcomes were seen in 22 (20%) and 03 (2.73%) patients, respectively. A very poor outcome was seen in 02 (1.82%) patients, while in the CS group, it was excellent to good in 65 (59.09%) patients, whereas a fair and poor outcome were seen in 32 (29.09%) and 8 (7.27%) patients, respectively. A very poor outcome was seen in 5 (4.54%) patients. After applying the chi-square test, it was noted that the DHS group had a significantly ($P = 0.001$) higher proportion of satisfactory outcomes as compared to the CC Screw group

Conclusion: The results of the present study showed that the DHS group had a significantly higher proportion of satisfactory outcomes as compared to the CC Screw group in cases of femur neck fractures.

Keywords: Femur Neck Fracture, Cannulated Cancellous Screw, Dynamic Hip Screw

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Introduction

There will have been 21.3 million hip fractures globally by 2050, compared to 1.26 million in 1990 [1]. Hip fractures are linked to a number of problems, such as hospital-acquired infections, avascular necrosis, non-union, metal work failure, and death [2]. Femur neck fractures are one of the most common causes of emergency orthopaedic consultations. Elderly people are more prone to the development of femoral fractures due to various factors, including the presence of osteoporosis, impaired vision predisposing to falls, living in old homes, and the presence of neurological diseases such as dementia and Parkinson's disease [3]. Certain drugs, such as corticosteroids, phenytoin, carbamazepine, and phenobarbitone, taken over a prolonged period of time may also cause femoral neck fractures following trivial trauma due to their

osteoporosis-inducing properties [4]. One of the important factors that has also contributed to the increased incidence of femoral fractures is the increased life expectancy of individuals. Advancing age is directly proportional to the increased chances of femoral fractures following trivial trauma [5]. Not only is the mechanism of injury different in cases of young individuals with femoral neck fractures, but also the management strategy and management goals differ, as young patients are more likely to have high functional demand. It is for this purpose that more hip-preserving surgeries such as proximal femoral nailing and dynamic hip screws are used in young individuals as compared to older individuals, in whom surgeries such as hip hemiarthroplasty or total hip arthroplasty may be preferred [6]. Young patients with femoral neck

fractures are susceptible to complications like osteonecrosis and malunion; as a result, it is important to achieve anatomical reduction and stable fixation in order to prevent these complications in young patients who are anticipated to face high functional demands following surgery [7]. Dynamic hip screws (DHS) and multiple cannulated screws (CS) are typically used in patients who are not displaced or who are young. In non-displaced intracapsular fractures, CS is frequently utilised because it has excellent biomechanical features like anti-rotation and is less intrusive [8]. Dynamic hip screws work on the principle of the tension band, which is associated with the sliding of screws within the barrel and is responsible for the compression of fractures when weight-bearing ensues. Some studies have reported that dynamic hip screws are associated with an increased risk of malunion as well as osteonecrosis of the femoral head [9]. Operational Definitions: Femoral Neck Fractures: all patients with any grades in Garden's classification the outcome was measured by the modified Merle d'Aubigne score at the end of 3 months post-operatively. The outcome was taken as satisfactory if the results were excellent; otherwise, it was taken as unsatisfactory. [10]

Aims and Objectives

The present study Compare the Functional Outcome of Dynamic Hip Screw (DHS) vs. Cannulated Cancellous (CC) Screws in Managing Fracture of the Neck of the Femur in Young Patients

Materials and Methods

The present prospective cohort study was conducted in the Department of Orthopaedics at Anugrah Narayan Magadh Medical College and Hospital, Gaya, Patna, Bihar, India. 110 young adults (under the age of 55) of both genders with femoral neck fractures treated with DHS and CC screws were included in the current study based on predetermined inclusion and exclusion criteria after the Institutional Ethical Committee approved it. The duration of the study was one year (from June 2021 to May 2022). A written informed consent was obtained from patients to be part of this study. The Institutional Ethical Committee approved the study. Keeping power (1-beta error) at 80% and confidence interval (1-alpha error) at 95%, the minimum sample size required was 60 patients; therefore, we included 110 (more than the minimum required number of cases) patients in present study.

Inclusion criteria

The following criteria were included in the study:

1. All patients having femoral neck fractures with partial or complete displacement and treated with dynamic hip screws and with CC
2. Age equal to or less than 55 years of

3. Those who gave informed written consent

Exclusion criteria

The following criteria were excluded from the study:

1. Patients who refused
2. Age <18 or above 55
3. Patients with polytrauma and other life-threatening injuries requiring urgent ICU
4. Patients with conditions likely to affect functional assessment, such as pre-existing arthritis, psoriatic arthropathy, and rheumatoid arthritis.

Demographic details of all the patients, such as age, gender, occupation, socioeconomic status, and area of residence, were asked for and noted. A history pertaining to the mechanism of injury and the exact duration from injury to consultation was noted. A thorough search was conducted to look for more sinister injuries that could endanger the patient's life. Vitals such as pulse rate, respiratory rate, and blood pressure were checked and noted down. All patients underwent X-rays of both hips anteroposterior as well as cross-table lateral views.

The fractures were classified on the basis of the Garden's classification of hip fractures into incomplete fractures (Type I), complete and undisplaced fractures (Type II), complete and partially displaced fractures (Type III), and complete fractures with total displacement (Type IV)[10]. All patients underwent basic investigations such as a complete blood count, renal function tests (blood urea and serum creatinine levels), hepatic function tests (serum bilirubin, SGOT, and SGPT), blood group and Rh typing, bleeding time, clotting time, and prothrombin time. Intravenous antibiotics were given as per institutional protocol (the first dose was given just before surgery, and intravenous antibiotics were given until the 3rd post-operative day). Closed reduction and internal fixation were done using a dynamic hip screw. Patients were followed up at 3, 6, and 12 weeks, and finally at 6 months postoperatively, for functional outcome. The functional outcome was assessed using a modified Harris hip score. All patients were assessed for complications such as non-union, malunion, and osteonecrosis. A final follow-up visit for the diagnosis of osteonecrosis was done at 12 months.

Statistical analysis: It was performed using IBM's Statistical Package for Social Sciences (SPSS) version 21.0 software, Microsoft excels 16, and Pearson's chi-square test was used for the test of significance. $P < 0.05$ was taken as statistically significant.

Results

Out of 110 studied cases having femoral neck fractures, there were 75 (68.18%) males and 35 (31.82%) females with an M:F ratio of 1:0.47.

The analysis of the age distribution of patients showed that the maximum numbers of patients were between 41- 45 years (36%), followed by 36–40 years (22.67%), and below 30 years, 16% were found to have femoral neck fractures. The mean age of male patients was found to be 36.72±6.81

years, whereas the mean age of female patients was 39.02±5.62 years. The P value was found to be 0.083, and hence there was no significant difference in the mean age of male and female patients presenting with femoral neck fractures in the present study (Figure 1, Table 1).

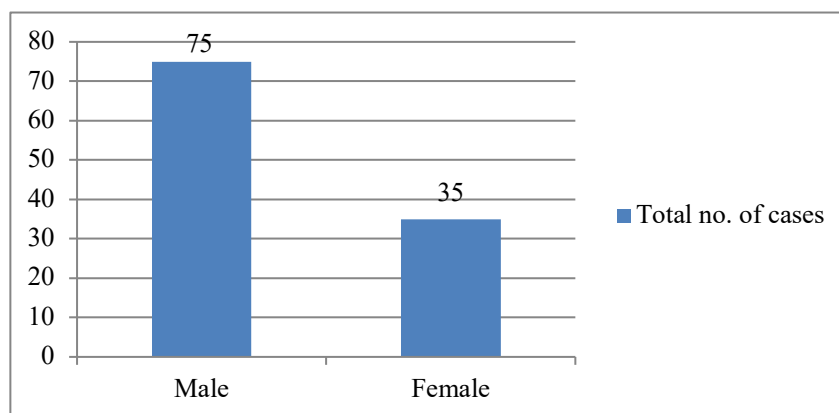


Figure 1: Gender wise distribution of cases

Table 1: Age- and gender-wise distribution of the studied cases

Age (years)	Male (N=75)		Female (N=35)	
	Number	Percentage (%)	Number	Percentage (%)
<30	12	16	3	8.57
31-35	11	14.67	5	14.29
36-40	17	22.67	8	22.86
41-45	27	36	12	34.28
>45	8	10.67	7	20
Total	75	100	35	100
Mean age	36.72±6.81 years (P=0.083)		39.02±5.62 years (P=0.083)	

In the present study, the most frequent cause of fracture was falling from a height, with 70 cases (63.64%), followed by road traffic accidents in 36 cases (32.72%). There were four patients who had a femoral neck fracture following a direct assault

(3.64%). Most of the patients had a left-sided femoral fracture of 72 (65.45%) of the femur, followed by a right-sided fracture of 38 (34.55%). There was no case with bilateral femoral neck fractures (Table 2).

Table 2: Types of mode of injury and affected side

Characteristics	Types	No. of cases	Percentage(%)
Mode of injury	Fall from height	70	63.64
	Road traffic accidents	36	32.72
	Assault	04	03.64
Affected side	Right	72	65.45
	Left	38	34.55

Table 3: Type of fracture, associated injuries, and fracture to surgery time in cases

Characteristics	Types	No. of cases	Percentage (%)
Type of fractures (Garden’s classification)	Complete fracture with partial Displacement (Type III)	66	60
	Complete fracture with total displacement (Type IV)	44	40
Associated injuries	Anterior cruciate ligament tear	04	3.64
	Rib fracture	05	4.54
	Humerus fracture	03	2.73
	Tibial fracture	03	2.73
	Meniscal tear	01	0.09
Fracture to surgery time	Within 48 h	70	63.64
	After 48 h	40	36.36
Mean duration of surgery	120±25 min, (P value=0.28)		

After analysis of Table 3, the cases on the basis of type of fractures showed that out of 110 studied cases, 66 (60%) patients had a complete fracture

with partial displacement (Type III), and the remaining 44 (40%) patients had a complete fracture with total displacement (Type IV). Associated inju-

ries were seen in 16 (14.54%) patients. The most common associated injury was rib fractures, which were seen in 5 (5.54%) patients, whereas anterior cruciate ligament tears were seen in 4 (3.64%), and humerus fractures and tibial fractures were seen in 3 (2.73%) patients each. Meniscal tears were seen in 1 (0.09%) patient each. Seventy (63.64%) patients were operated on within 48 hours of injury, whereas the remaining 40 (36.36%) patients were operated on after 48 hours of injury. The mean duration of surgery was found to be 120 ± 25 min, and it seemed to be not significant (p value 0.092).

The analysis of the cases for complications showed that out of 110 cases operated and internal fixation done by dynamic hip screws, local surgical site infection was seen in 9 (8.18%) patients, whereas varus reduction and shortening of affected limbs were seen in 6 (5.45%) and 4 (3.64%) patients, respectively. Non-union was seen in 3 (2.73%) cases. Fourteen (12.73%) cases of avascular necrosis of the femoral head were seen in our study (Ta-

ble 3). The total number of cases with complications was 36. Out of these, there were 28 (77.75%) males and 8 (22.22 % females).

Out of 14 patients with avascular necrosis of the femoral head, 12 (85.71%) were operated on after 48 hours of injury, whereas only 2 (14.28%) patients were operated on within 48 hours of injury. All patients with avascular necrosis had a complete fracture with total displacement (Type IV). Avascular necrosis of the femoral head was more common in males as compared to females; however, there was no statistically significant difference ($P = 0.7104$). Avascular necrosis of the femoral head was more common in patients in whom surgery was done more than 48 hours after injury as compared to those in whom surgery was done earlier than 48 hours after injury, and the difference was statistically significant ($P = 0.002$). All patients had avascular necrosis, which was a complete fracture with total displacement (Type IV) (Table 4).

Table 4: Complications in present studied cases

Complications	No. of patients	Percentage (%)
Local surgical site infection	9	8.18
Varus reduction	6	05.45
Shortening of affected limb	4	03.64
Non-union	3	02.73
Avascular necrosis of femoral head	14	12.73
Total	36	32.73

A post-operative X-ray was taken. Patients were allowed to do partial weight-bearing and walk with support immediately after surgery. Full weight-bearing was allowed during follow-up on the basis of radiographs after the assessment of callus formation. A modified Harris hip score was used to assess functional outcomes in the studied cases. At the end of the last follow-up, in the DCS group, functional outcomes were excellent to good in 83 (75.45%) patients, whereas fair and poor outcomes were seen in 22 (20%) and 03

(2.73%) patients, respectively. A very poor outcome was seen in 02 (1.82%) patients, while in the CS group, it was excellent to good in 65 (59.09%) patients, whereas a fair and poor outcome were seen in 32 (29.09%) and 8 (7.27%) patients, respectively. A very poor outcome was seen in 5 (4.54%) patients. After applying the chi-square test, it was noted that the DCS group had a significantly ($P = 0.001$) higher proportion of satisfactory outcomes as compared to the CS group (Figure 2, Table 5).

Table 5: Comparison of outcome between dynamic hip screw and cannulated screw in management of femoral neck fracture by using Modified Harris hip score

Outcome	DHS (n=110)	CC screw (n=110)	P value
Excellent to good	83 (75.45%)	65 (59.09 %)	0.001
Fair	22 (20%)	26 (23.64%)	
Poor	03 (2.73%)	12 (10.90%)	
Very poor	02 (1.82%)	07 (6.36%)	

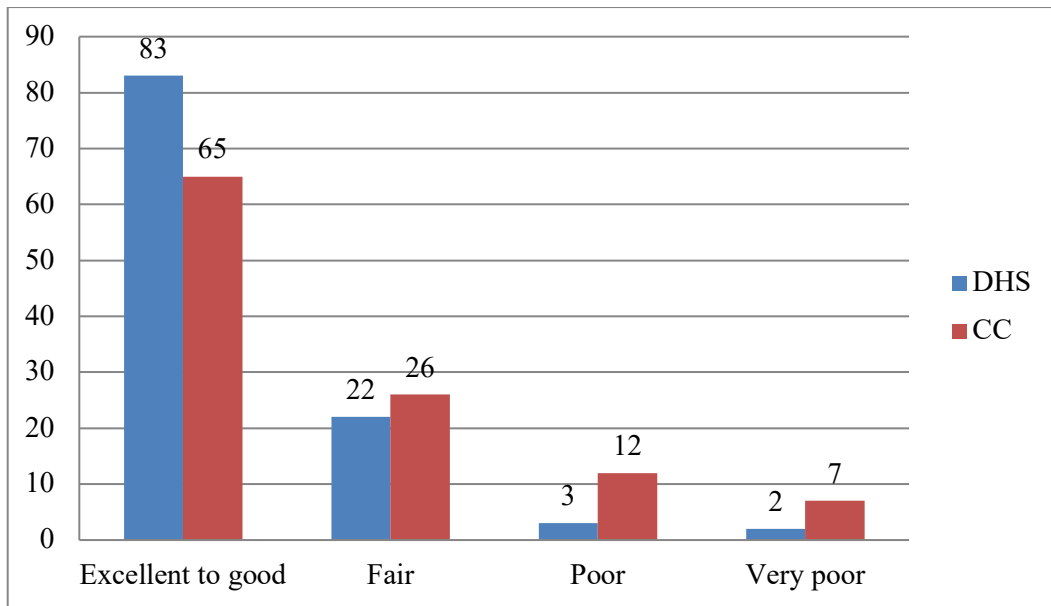


Figure 2: Comparison of outcome between DHS and CC screw



Figure 3: Preoperative anteroposterior radiograph of a 40-year-old male femoral neck fracture and fixed with DHS



Figure 4: Anteroposterior radiograph at 9-month follow-up after DHS

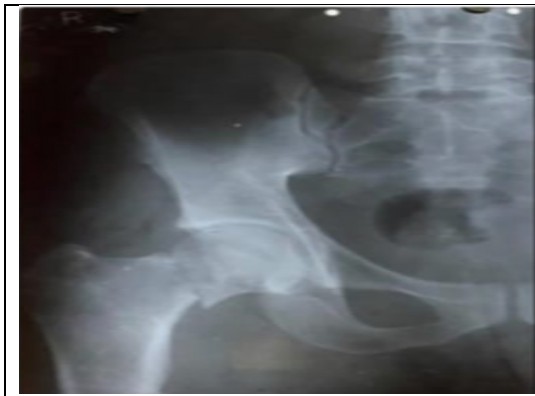


Figure 5: Preoperative anteroposterior radiograph of a 30-year-old male femoral neck fracture.



Figure 6: Radiograph showing femoral neck fracture with complete displacement (left)



Figure 7: Anteroposterior radiograph at 9-month follow-up after CCS



Figure 8: Lateral view, radiograph at 9-month follow-up after CCS

Discussion

Dynamic hip screws are commonly used in young patients with femoral neck fractures. It is particularly important in young patients where radical surgeries such as hip hemiarthroplasty or total hip arthroplasty are usually avoided. We have used two dynamic hip screws for internal fixation. Although in the majority of cases, a single screw is used for fixation, many authors, such as Schwartsmann et al., have used and recommended more than one screw for internal fixation [11].

Young adults rarely suffer from femoral neck fractures, which typically happen after serious trauma. Approximately 2–3% of all femoral neck fractures occur in patients under the age of 50 [12].

When treating a femoral neck fracture, the osseous and vascular structure, mechanism of injury, related injuries, fracture pattern, and therapeutic objectives are all taken into account [13].

In our study, out of 110 studied cases having femoral neck fractures, there were 75 (68.18%) males and 35 (31.82%) females with an M:F ratio of 1:0.47. The mean age of male patients was found to be 36.72 ± 6.81 years, whereas the mean age of fe-

male patients was 39.02 ± 5.62 years, respectively. The P value was found to be 0.083.

The male preponderance is understandable in young patients; the cause of femoral neck fracture is usually falling from height or road traffic accidents. Manoj et al. [14] conducted a study to analyse the functional and radiological outcome of femoral neck fractures treated by calcar buttressed screw fixation. In this study, out of 43 patients, there were 31 males and 12 females with an M:F ratio of 1:0.38. In the study of Ahmad et al. [15], a total of 90 patients with fractures of the femur of the neck were selected, and the age range was 15–55 years. Out of 90 patients, males were 83.3%, while females were 16.7%. In another study by Niemann et al. [1], a total of 31 patients with fractures of the femur of the neck were selected; 16 were females and the rest were males, and the mean age was 62.81 ± 15.05 years.

In a retrospective study, Gumustas et al. [16] studied young patients with femoral neck fractures. The mean age in this study was found to be 40.04 ± 9.63 years, which was similar to our study.

In the present study, the most frequent cause of fracture was falling from a height, with 70 cases

(63.64%), followed by road traffic accidents in 36 cases (32.72%). There were four patients who had a femoral neck fracture following a direct assault (3.64%). Most of the patients had a left-sided femoral fracture of 72 (65.45%) of the femur, followed by a right-sided fracture of 38 (34.55%). There was no case with bilateral femoral neck fractures.

Unlike in older individuals, where trivial trauma can cause a femoral neck fracture, the usual cause in young adults is usually high-energy trauma such as falling from a height or road traffic accidents. Studies such as those done by Raj et al. [17] and Pauyo et al. [18] found that the common causes of femoral neck fracture in young adults were road traffic accidents and falls from heights. In comparison to young adults, low-energy falls are the main cause of femoral neck fractures in elderly patients [19].

Out of 110 studied cases, 66 (60%) patients had a complete fracture with partial displacement (Type III), and the remaining 44 (40%) patients had a complete fracture with total displacement (Type IV). Associated injuries were seen in 16 (14.54%) patients. The most common associated injury was rib fractures, which were seen in 5 (5.54%) patients, whereas anterior cruciate ligament tears were seen in 4 (3.64%), and humerus fractures and tibial fractures were seen in 3 (2.73%) patients each. Meniscal tears were seen in 1 (0.09%) patient each. Seventy (63.64%) patients were operated on within 48 hours of injury, whereas the remaining 40 (36.36%) patients were operated on after 48 hours of injury. The mean duration of surgery was found to be 120 ± 25 min, and it seemed to be not significant (p value 0.092).

The time duration from fracture to surgery is an important factor in determining the outcome of patients with femoral neck fractures. Many studies have found that those patients who had been operated on early had a better outcome and reduced complications such as avascular necrosis of the femoral head as compared to those who had been operated on late. Karaeminogullari et al. [20] conducted a study of patients with femoral neck fractures in which 28 patients with 30 femoral neck fractures who underwent internal fixation and completed a minimum of 2 years' follow-up were retrospectively analysed.

Out of 14 patients with avascular necrosis of the femoral head, 12 (85.71%) were operated on after 48 hours of injury, whereas only 2 (14.28%) patients were operated on within 48 hours of injury. All patients with avascular necrosis had a complete fracture with total displacement (Type IV). Avascular necrosis of the femoral head was more common in males as compared to females; however, there was no statistically significant difference ($P = 0.7104$). Avascular necrosis of the femoral head

was more common in patients in whom surgery was done more than 48 hours after injury as compared to those in whom surgery was done earlier than 48 hours after injury, and the difference was statistically significant ($P = 0.002$). All patients had avascular necrosis, which was a complete fracture with total displacement (Type IV).

The rates of avascular necrosis as well as non-union were 12.5% and 25%, respectively, among patients who underwent surgery before 12 hours had elapsed and 14% and 27% among those who underwent surgery after that time. The rates of avascular necrosis and non-union associated with fracture displacement were 6% and 18%, respectively, among patients with undisplaced (Garden Stages 1 and 2) fractures and 23% and 38% among those with displaced (Garden Stages 3 and 4) fractures. The increased incidence of AVN in patients with complete fractures with total displacement (Garden Stage 4) and in those cases in whom surgery was delayed was found to be similar to our study. However, authors such as Upadhyay et al. [21] concluded that a delay of more than 48 hours before surgery did not influence the rate of union or the development of AVN when compared with an operation within 48 hours of injury.

In the present study, functional outcomes found in the DCS group were excellent to good in 83 (75.45%) patients, whereas fair and poor outcomes were seen in 22 (20%) and 03 (2.73%) patients, respectively. A very poor outcome was seen in 02 (1.82%) patients, while in the CS group, it was excellent to good in 65 (59.09%) patients, whereas a fair and poor outcome were seen in 32 (29.09%) and 8 (7.27%) patients, respectively. A very poor outcome was seen in 5 (4.54%) patients. After applying the chi-square test, it was noted that the DCS group had a significantly ($P = 0.001$) higher proportion of satisfactory outcomes as compared to the CS group.

In a study by Arfee et al. [22], DHS was found to give superior results to CCS fixation in femoral neck fractures. In the study of Singh et al. [23], a total of 43 patients with fractures of the neck and femur were recruited. In the DHS Group, the outcome was satisfactory in 85.7% of patients, and in the CCS Group, it was 59%.

In the study of Tolga et al. [24], in the DHS group and the CCS group, the outcomes were satisfactory in 91% of patients and 85% of patients, respectively. In another study by Stephen et al. [25], the DHS group and CCS group had satisfactory outcomes in 75% and 70% of patients, respectively.

In a study by Nitharwal et al. [26], among the 30 patients in the DHS group and the 30 patients in the CS group, satisfactory outcomes were noted in 86.66% of patients and 83.33% of patients. So the

DHS group has a slightly higher proportion of satisfactory outcomes than the CS group.

Limitations of the study

The small sample size and short duration of the study A comparative study that compares other methods of managing displaced femoral neck fractures, such as proximal femoral nailing and CC screw stands alone, would have been further beneficial in comparing the complication rates, particularly osteonecrosis of the femoral head.

Conclusion

The results of the present study showed that the DHS group had a significantly higher proportion of satisfactory outcomes as compared to the CC screw group in cases of femur neck fractures. Most of the patients were between 41 and 45 years of age, but the difference in satisfactory outcome between the DHS group and the CC screw group was not significant. Femoral neck fractures in young patients treated by dynamic hip screws and augmented with two CC screws have been found to have excellent functional results in the majority of cases. Increased time duration between fracture and surgical interventions as well as a complete fracture with total displacement were the factors associated with an increased risk of avascular necrosis.

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