



Original Article

## A Comparative Study on Functional Outcomes and Union Rates of Femoral Neck Fractures Treated with Cannulated Cancellous Screws Alone versus Combined with Fibular Grafting

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### ABSTRACT

**Background:** Cannulated Cancellous Screw(CCS) is the preferred method in fresh cases of fracture neck of femur in young patients.CCS alone may not always provide satisfactory outcomes, particularly in cases of displaced fractures, where there is a higher risk of non-union or AVN. There has been growing interest in combining fibular grafting with CCS to enhance fracture healing. This combination enhance union and early restoration of function. Hence the present study aim to assess the functional outcome and fracture union of Femoral Neck Fracture using cannulated cancellous screws alone versus cancellous screws combined with fibular grafting and to compare complications associated with the two methods.

**Methodology:** About 52 femoral neck fractures classified as type III and IV based on Garden classification were grouped into 2. Group A was treated by closed reduction and internal fixation (through lateral approach) with 2 or 3 cancellous screws alone and Group B with two or three cannulated cancellous screws supplemented by a fibular graft.

**Results:** The mean age of study population in Group A was  $46.23 \pm 11.389$  yrs and Group B was  $48.15 \pm 9.632$  yrs. The mean fracture union time was slightly shorter in group B at  $9.92 \pm 5$  weeks compared to  $11.08 \pm 7.11$  weeks in group A though not statistically significant. Postoperatively, the mean Harris score was  $71.58 \pm 20.68$  in group A and  $80.27 \pm 19.19$  in group B, with no statistically significant difference between the groups. Functional outcomes favoured group B, with excellent results observed in 11 patients (42.3%) compared to only 4 patients (15.4%) in group A.

**Conclusion:** In conclusion, adding fibular grafting to CCS appears to improve functional outcomes and reduce complications in femur neck fracture treatment, though further studies may be needed to confirm the findings due to the lack of significant difference in fracture union rates.

**Keywords:** Femur neck fracture, cannulated cancellous screws, Fibular graft.

### INTRODUCTION

Femoral neck fractures(FNF) are the most significant orthopaedic injury related fractures that have limited healing potential because they lack a periosteal layer, being instead surrounded solely by synovial fluid. FNF exhibit a bimodal distribution

pattern. They result from low-energy falls in older adults and high-energy trauma in younger individuals. However, the majority of these fractures occur in older adults with underlying osteoporosis.<sup>1</sup>

Although most hip fractures occur in the geriatric population, more and more young patients are surviving motor vehicle accidents and presenting with high-energy injuries about the hip. The approach to treatment is different in these two groups, in that an attempt is made to reduce and fix almost all femoral neck fractures in young adults, while most displaced fractures in elderly patients are treated with arthroplasty.<sup>2,3</sup>

Despite significant advancements in implant design, imaging techniques, and surgical methods, femoral neck fractures continue to present a major challenge for modern orthopaedic surgeons. Complication rates remain high, with avascular necrosis of the femoral head reported in 15-33% of cases, and non-union occurring in 10-30% of cases.<sup>4</sup>

Various osteo-synthetic fixation procedures with multiple cancellous cannulated screw, valgus osteotomy and fixation with double angle barrel/blade plate, dynamic hip screw, displacement osteotomies, muscle pedicle grafts, and free fibular graft (vascularized or non-vascularized) with internal fixation are available.<sup>5</sup>

Osteosynthesis with partially threaded multiple cancellous cannulated screw (CCS). It is preferred method in fresh cases of fracture neck of femur in young patients with screws placed in upright or inverted triangle pattern. CCS being one of the most commonly used fixation techniques provides mechanical stability to the fracture and allows early mobilization, which is crucial in reducing the risks of prolonged immobility in elderly patients. However, despite its widespread use, CCS alone may not always provide satisfactory outcomes, particularly in cases of displaced fractures, where there is a higher risk of non-union or AVN.

In recent years, there has been growing interest in combining fibular grafting with CCS to enhance fracture healing. Fibular strut graft is used along with multiple cancellous cannulated screws to enhance union and early restoration of function. As insertion of fibular strut graft offers advantage of stability, osteo-inductive and osteoconductive properties thus enhancing union, it also prevents avascular necrosis and collapse of head of femur. The fibular graft serves as a source of mesenchymal stem cells, promoting the revascularization process vital for optimal healing.<sup>6</sup> Moreover it is technically easy to harvest the graft.<sup>7</sup>

This combined approach has been proposed to improve union rates and overall functional outcomes, especially in more complex or high-risk fractures. Despite the theoretical advantages of adding a fibular graft, there is limited evidence comparing the outcomes of CCS alone versus CCS combined with fibular grafting in the treatment of femoral neck fractures. Hence This study aims to fill this gap by comparing the union rates and functional outcomes in patients treated with these two techniques based on the rate of fracture healing, functional recovery as measured by standard scoring systems, and the incidence of complications such as non-union and AVN.

Understanding of which method offers better clinical results will help guide orthopaedic surgeons in selecting the most appropriate treatment modality for these challenging fractures.

## OBJECTIVES:

4. To assess the functional outcome in management of Femoral Neck Fracture using cannulated cancellous screws alone versus cancellous screws combined with fibular grafting
5. To compare fracture union between the two methods.
6. To study the complications associated with two methods.

## METHODOLOGY

A comparative study on management of Femoral neck fractures was conducted in Department of Orthopaedics, Maharajahs Institutes of Medical Sciences, Vizianagaram during July 2024 to October 2024.

According to study done by Kumar S et al.,<sup>7</sup> functional outcome was in favour of group A (Cannulated cancellous screws) with excellent results in 30 (66.6%) patients as compared to only 12 (28.5%) patients of group B (Cannulated cancellous screws with fibular graft). Considering  $P_1$  as 66.6% and  $P_2$  as 28.5% by comparing proportions the sample size derived was 52 (with 26 in each group).

About 52 femoral neck fractures classified as type III and IV based on Garden classification were grouped into 2. Group A was treated by closed reduction and internal fixation (through lateral approach) with 2 or 3 cancellous screws alone and Group B with 2 or more cannulated cancellous screws supplemented by a fibular graft.

Each patient underwent a comprehensive clinical and radiological examination, along with standard haematological investigations.

The study included all patients aged 20 to 60 years with fresh type III and IV femoral neck fractures according to Garden's fracture type classification, presenting within three weeks of trauma to the Orthopaedic OPD or Emergency between March 2024 and October 2024. Exclusion criteria were patients with associated medical complications like diabetes mellitus, infection at the surgical site, evidence of avascular necrosis, prior surgeries around the affected joint, polytrauma, or fractures requiring open reduction and pathological fractures.

A total of 52 patients were taken into the study. The patients were randomly selected as per random allocation table to receive either of the above operative management into group A & B respectively. Institutional ethics committee approval was taken prior to commencement of study. Patients were informed about the procedures of treatment plan and were enrolled in the study after taking written informed consent.

Technique:

Surgery can be performed in Spinal or general anaesthesia. The patient is positioned supine on a fracture table. The unaffected limb is secured in slight abduction, while the affected limb is prepared for manipulation and traction. A C-arm fluoroscope is positioned to provide anteroposterior (AP) and lateral views to guide the procedure.

**Closed Reduction:** Gentle manipulation techniques, such as the Whitman or Leadbetter technique, are applied to achieve proper alignment of the fracture. Reduction is assessed with the C-arm, using Garden's alignment index to confirm alignment. If closed reduction is unsuccessful, an open reduction may be considered.

**Cannulated Screw Fixation (CCS):** Incision and Screw Placement: After achieving satisfactory reduction, a small incision is made near the hip. Two or three cannulated screws are typically inserted parallel to each other across the femoral neck and into the head, with each screw being guided by guidewires placed under fluoroscopic control. The screws are positioned to ensure they span the fracture site and provide optimal stabilization. The screws are tightened to compress the fracture fragments, promoting stability and enhancing the healing process.

**CCS with Fibular Grafting :** A segment of the fibula is harvested from the patient's leg, taking care to preserve surrounding structures. The fibular graft is prepared and then inserted alongside the cannulated screws, extending from the lateral cortex of the femur across the fracture site into the femoral head. This provides additional structural support to reduce the risk of non-union and enhance stability, especially in cases of osteoporotic bone.

**Securing the Graft and Screws:** The graft is secured in place with the cannulated screws, integrating it into the fixation construct.

**Postoperative Care:** Monitoring is done by performing Postoperative X-rays or CT scans to confirm alignment and fixation. Partial weight-bearing is often advised initially, progressing to full weight-bearing as the fracture heals, guided by clinical and radiographic assessments. Initial follow-ups were conducted at six-week intervals until bony union was achieved, followed by assessments every three months. Evaluations included detection of any complications hip pain, evidence of bone union, presence of avascular necrosis, graft incorporation, and the positioning of screws or grafts or implant failure. Functional outcomes were assessed using the Harris hip score.

Statistical analyses were performed using SPSS, version 25. Data that includes nail withdrawal rate, fracture non-union rate, and femoral head necrosis rate, were expressed as percentages (%) and analysed using the Chi-square test. Operation time, intraoperative blood loss, fracture healing time, preoperative Harris score, and postoperative VAS score were presented as means with standard deviations and analysed with an independent sample t-test, with a significance threshold of  $P < 0.05$ .

## RESULT

In the present study 52 patients with Fracture femoral neck was considered. The mean age of study population in Group A ( internal fixation with 2 or 3 cancellous screws alone) was  $46.23 \pm 11.389$  yrs and Group B (internal fixation with 2 or more cannulated cancellous screws supplemented by a fibular graft) was  $48.15 \pm 9.632$  yrs. Majority (76.9%) were males and 23.1% were females.

**Table 1: Demographic and Characteristics of the study groups**

	CATEGORY	GROUP A	GROUP B	TOTAL
AGE	<30yrs	4(15.4%)	2(7.7%)	6(11.5%)
	31- 40 yrs	6(23.1%)	4(15.4%)	10(19.2%)
	41-50yrs	5(19.2%)	8(30.8%)	13(25%)
	51-60 yrs	11(42.3%)	12(46.2%)	23(44.2%)
GENDER	FEMALE	7(26.9%)	5(19.2%)	12(23.1%)
	MALE	19(73.1%)	21(80.8%)	40(76.9%)
SIDE OF INJURY	LEFT	10(38.5%)	13(50%)	23(44.2%)
	RIGHT	16(61.5%)	13(50%)	29(55.8%)
MODE OF INJURY	FALL	13(50%)	9(34.6%)	22(42.3%)
	RTA	13(50%)	17(65.4%)	30(57.7%)
FRACTURE CLASSIFICATION	III	9(34.6%)	13(50%)	22(42.3%)
	IV	17(65.4%)	13(50%)	30(57.7%)
COMPLICATIONS	AVN	3(11.5%)	1(3.8%)	4(7.7%)
	MIGRATION OF SCREW	1(3.8%)	0(0%)	1(1.9%)
	NON-UNION	4(15.4%)	4(15.4%)	8(15.4%)

Based on Garden's classification, 22 cases (42.3%) were classified as type III, with 9 patients in group A and 13 in group B. The remaining 30 cases (57.7%) were type IV, with 17 patients in group A and 13 in group B. In group A, 4 patients (15.4%) experienced non-union, 3 patients (11.5%) developed avascular necrosis of the femoral head, and 1 patient (3.8%) had screw migration. In group B, 4 patients (15.4%) experienced failure of fibular graft uptake, resulting in non-union, and 1 patient (3.8%) developed avascular necrosis. The occurrence of complications in both groups was not statistically significant, with a p-value of 0.50.

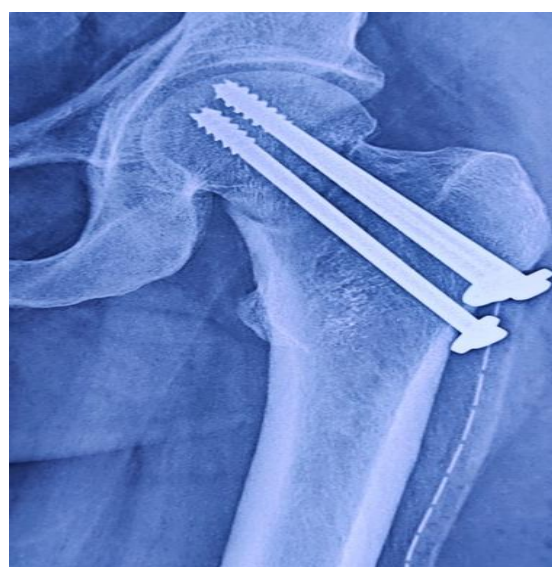
The mean operative time for the two procedures was  $82.65 \pm 13.80$  minutes in group A and  $85.96 \pm 8.61$  minutes in group B, with no statistically significant difference. The mean fracture union time was slightly shorter in group B at  $9.92 \pm 5$  weeks compared to  $11.08 \pm 7.11$  weeks in group A, though this difference was not statistically significant.

**Table 2: Mean Operative time of surgery among groups**

		MEAN	STANDARD DEVIATION	P Value
OPERATIVE TIME IN MINUTES	GROUP A	82.65	13.795	0.30
	GROUP B	85.96	8.605	
UNION IN WEEKS	GROUP A	11.08	7.116	0.50
	GROUP B	9.92	5.003	



(a)



(b)

**Figure 1(a)(b): Cannulated cancellous screw fixation in Group A patients.**





**Figure 2: Post Operative Xray taken at 4weeks after Cannulated cancerous screw fixation in Group A patients.**

The mean preoperative Harris score was  $31.27 \pm 4.68$  in group A and  $31.54 \pm 5.60$  in group B. Postoperatively, the mean Harris score was  $71.58 \pm 20.68$  in group A and  $80.27 \pm 19.19$  in group B, with no statistically significant difference between the groups.

**Table 3: Mean Harris scores of the study groups**

SCORE		MEAN	STANDARD DEVIATION	P Value
PRE -OP HARRIS SCORE	GROUP A	31.27	4.678	0.851
	GROUP B	31.54	5.595	
POST -OP HARRIS SCORE	GROUP A	71.58	20.677	0.122
	GROUP B	80.27	19.197	

In this study, the mean postoperative Harris hip score was higher in group B, though the difference was not statistically significant. Functional outcomes favored group B, with excellent results observed in 11 patients (42.3%) compared to only 4 patients (15.4%) in group A. A poor functional outcome was noted in 8 patients (30.8%) in group A, while only 4 patients (15.4%) in group B had similar results. This difference was statistically significant.

**Table 4: Functional outcome among the Study treatment groups**

FUNCTIONAL OUTCOME		GROUP A	GROUP B	TOTAL	P VALUE
	EXCELENT (score 90-100)	4(15.4%)	11(42.3%)	15(28.8%)	0.03
	GOOD (score 80-89)	8(30.8%)	10(38.5%)	18(34.6%)	
	FAIR (score 70-79)	6(23.1%)	1(3.8%)	7(13.5%)	
	POOR (score <70)	8(30.8%)	4(15.4%)	12(23.1%)	
	TOTAL	26	26	52	

## DISCUSSION

In this study, CCS combined with fibula graft in type III and IV femoral neck fracture had a high Harris function score, better bone healing and lower complications of femoral head necrosis with good the hip joint function outcomes compared to patients treated with the CCS alone.

A cancellous screw with a single fibular graft has been reported with excellent results in patients below the age of 50 years.<sup>8,9</sup> Free fibular grafting has been widely studied as a method to introduce both structural support and a graft framework due to osteoconductive and osteoinductive<sup>10</sup> properties, in a femoral neck fracture.<sup>11-15</sup>

Our study aligns with the findings of Zahid et al.,<sup>16</sup> who reported on a series of 37 patients treated with fixation using cannulated screws and fibular strut grafts for fresh femoral neck fractures with posterior comminution as majority 20 out of 33 showed good to excellent Harris hip score. Similarly in Mehraj M et al.,<sup>17</sup> study, done among 32 patients of femoral neck fractures treated by Fibular Strut Graft Along with Cannulated Screws, Harris hip score outcome was good to excellent in 23, fair in 7, and poor in 2.

However in Kumar S et al.,<sup>7</sup> study group B(multiple cancellous screws with fibular graft) showed many complications like five (11.90%) patients of non union, in which two patients also had avascular necrosis of femoral head. One patient had broken fibular graft which finally showed sign of union compared to Group A (multiple cancellous screws)

Our study is comparable with Goyal et al.,<sup>18</sup> Who showed union in 15 patients with 24 months follow up with fibular grafting and MHS.

In the present study, femoral neck fractures treated with a combination of fibular grafting and cannulated cancellous screw fixation were observed to have a higher likelihood of union and reduced functional disability. The mean fracture union time in group B at  $9.92 \pm 5$  weeks compared to  $11.08 \pm 7.11$  weeks in group A, though this difference was not statistically significant.

This observation aligns with the findings of Clark et al.<sup>19</sup>, who suggested that the approach of fibular grafting combined with cannulated cancellous screw fixation may offer superior outcomes compared to cases treated solely with cannulated cancellous screw fixation.

However study done by Wisesa IKIT et al.<sup>20</sup> showed that the mean union time in femoral neck fracture using multiple cancellous screws with and without fibular graft is same which was  $16 \pm 8$  weeks. Li et al.,<sup>21</sup> in China done a Comparative study of Pauwels type III femoral neck fractures managed by short dynamic hip screw(DHS) with fibula bone graft or cannulated screws in young adults stated that DHS combined with fibula bone graft can shorten the healing time of fracture, reduce the rate of bone non-union and femoral head necrosis.

## CONCLUSION

The findings suggest that the combined treatment of Femoral neck fractures with Canulated cancellous screw along with fibular grafting yielded better functional outcomes, as demonstrated by higher postoperative Harris Hip scores. Although fracture union rates were also higher in Group B, this difference was not statistically significant. Additionally, Group B experienced fewer complications compared to Group A. In conclusion, adding fibular grafting to CCS appears to improve functional outcomes and reduce complications in femur neck fracture treatment, though further studies may be needed to confirm the findings due to the lack of significant difference in fracture union rates.

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