e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(10); 1326-1333

Original Research Article

A Comparative Study of Proximal Femoral Nail (PFN) versus Dynamic Condylar Screw (DCS) in Management of Unstable Femoral Trochanteric Fractures

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Received: 08-08-2023 / Revised: 17-09-2023 / Accepted: 22-10-2023

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Conflict of interest: Nil

Abstract

Background: Trochanteric fractures are the most common fractures of the proximal femur that occur due to ground-level falls, especially in the elderly population. Studies have predicted that in 2050, approximately 4.5–6.2 million fractures will occur all over the globe, and more than 50% will occur in the Asian region.

Objectives: compare PFN versus DCS in treating trochanteric femoral fractures with respect to intraoperative and postoperative assessment, and complications.

Materials & Methods: The present randomised prospective study included 60 patients with unstable trochanteric fractures attaining opd/emergency in the orthopaedic department. All the study participants were briefed about the study, and written informed consent was obtained, after approval from the institutional ethical committee.

Results: The mean age of group A was 58.91±12.05 year and group B was 56.50±14.06 years, respectively. In group A (DCS), male patients were more (54.17%) than female patients, and in group B (PFN), female patients were more (72.22%) than male patients. Trivial falls were the most common mode of injury in both groups, with group A (DCS) at 62.5% and group B (PFN) at 69.45%.

Conclusion: In the present study, the proximal femoral nail showed less operative time, a higher union rate, a shorter duration for fracture union, a better functional outcome, and fewer complications than the dynamic condylar screw.

Keywords: Unstable trochanteric fractures, dynamic condylar screw, proximal femoral nail, Harris hip score.

Introduction

Trochanteric fractures are the most common fractures of the proximal femur that occur due to ground-level falls, especially in the elderly population. These fractures extend from the extra-capsular basilar to the lesser trochanter region, and the incidence of trochanteric femur fractures was observed in a higher number in patients who had a history of osteoporosis. Studies have predicted that in 2050, approximately 4.5–6.2 million fractures will occur all over the globe, and more than 50% will occur in the Asian region [1, 2]. Unstable fracture patterns have also been observed in the subtrochanteric area; the femur shaft dislocates medially; and there are also types of oblique fractures. Trochanteric fractures are mostly operated on; however, certain contraindications are also found in their operative methods. These usually happen due to severe comorbidities in the perioperative and even intraoperative periods. Furthermore, unstable trochanteric fracture poses a serious management challenge for surgeons due to the high postoperative associated risks and sometimes even mortality [3]. Extramedullary fixation, such as the dynamic hip screw, the dynamic condylar screw, DHS, DCS, and CHS, and intramedullary fixation, including IMHS, PFNA, PFN, and the intramedullary hip screw, are the available treatment options, and both of them have their own benefits and drawbacks. Though the extramedullary sliding screw was once considered the gold standard for these types of fractures, intramedullary devices have surpassed the previous ones due to their effectiveness. Therefore, studies have suggested that extramedullary fixation should be opted for with caution due to poor functional outcomes and a higher risk of associated complications [4,5]. Several studies have found that intramedullary devices are more effective than

extramedullary devices for the fixation of unstable trochanteric femoral fractures and that extramedullary fixation should be used with caution due to greater complication rates and poor functional outcomes. Other studies, on the other hand, found no significant difference in outcomes when intramedullary and extramedullary fixations were used [6–8].

Aims and Objectives

The present study compare the proximal femoral nail (PFN) versus dynamic condylar screw (DCS) in treating unstable trochanteric femoral fractures with respect to preoperative demographic characteristics, intraoperative and postoperative assessment, and complications.

Materials and Methods

Study Design

The present randomised prospective study included 60 patients with unstable trochanteric fractures attaining opd/emergency in the orthopaedic department. The study was conducted in the orthopaedic department at Anugrah Narayan Magadh Medical College and Hospital, Gaya, Patna, Bihar, India, after approval from the institutional ethical committee. All the study participants were briefed about the study, and written informed consent was obtained. This study was done between January 2022 and December 2022. Demographic details such as age and gender were noted in all the cases.

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 60 (the minimum required number of cases) patients in present study.

Inclusion Criteria

Skeletally mature (age ≥18 years) patients of both genders with fresh (≤3 weeks old) trochanteric fractures with unstable fracture geometry as per the AO classification (AO 31A2 and AO 31A3) were included in the study.

Exclusion Criteria

Stable fracture pattern (AO 31A1), pathological fractures (other than osteoporosis), patients on chemo-radiotherapy, compound fractures, and poly-trauma patients were not included. Patient randomization and group allocation

The present study included 60 patients with unstable trochanteric fractures, out of whom 24 were fixed with a dynamic condylar screw (group A) and 36 were fixed with a proximal femoral nail (group B). All study participants were thoroughly examined both clinically and radiologically as per the predetermined study protocol. We don't lose any cases during follow-up, and all cases are available for final follow-up assessment and evaluation.

Open reduction was done in Group A (DCS) through a lateral approach. Closed reduction was done by axial traction and internal rotation of the fractured hip in Group B (PFN). All patients received injectable antibiotics 30 minutes before the surgical incision. The type of anaesthesia was given as per the decision of the anaesthetist.

Postoperative Protocol and Outcome Evaluation

Injectable antibiotics were continued for 2–3 days. Static quadriceps drill exercises along with non-weight-bearing walks were started on the second post-operative day. Sutures were removed after 10 to 12 days. Weight bearing was started depending on fracture stability and fixation adequacy, and it was delayed in patients with inadequate fixation. The patients were followed up every 6 weeks until the union of the fracture, then every 3 months with check X-rays to assess fracture union and complications. The Harris hip score was used to evaluate the functional outcome [16]. The Harris hip scoring system takes into account discomfort, function, deformity, and hip range of motion. A patient's maximum possible score is 100. Radiological assessment was done for union, varus collapse (change in neck shaft angle of >5 degrees), non-union, screw cut-out, femoral head perforation into the hip joint, symptomatic back out of the screws, and other complications.

Statistical Analysis

The categorical variables were presented in the form of numbers and percentages. The comparison of the variables, which were quantitative and not normally distributed in nature, was analysed using the Mann-Whitney test (for two groups), and an independent t test was used for the comparison of normally distributed data between two groups. The comparison of the variables, which were qualitative in nature, was analysed using Fisher's exact test, as at least one cell had an expected value of less than 5. The data was entered into a Microsoft Excel 16 spread sheet, and the final analysis was performed using IBM's Statistical Package for Social Sciences (SPSS) version 21.0 software. A p value of less than 0.05 was considered statistically significant.

Results

The present prospective study included 60 patients with unstable intertrochanteric fractures, out of whom 24 were fixed with a dynamic condylar screw (group A) and 36 were fixed with a proximal femoral nail (group B). Out of 60 studied cases, there were 37 (61.67%) females and 23(38.33%) males with an F;M ratio of 1:0.62. Compare these two groups for radiological and functional outcomes. The mean age of group A was 58.91±12.05 year and group B was 56.50±14.06

years, respectively and P value was 0.83. In group A (DCS), male patients were more (54.17%) than female patients, and in group B (PFN), female patients were more (72.22%) than male patients. Trivial falls were the most common mode of injury in both groups, with group A (DCS) at 62.5% and group B (PFN) at 69.45%.

The distribution of age, sex, mechanism of injury, fracture pattern, and time from injury to operation was not significantly different between the two groups according to pre-operative data (Table 1, Figure 1).

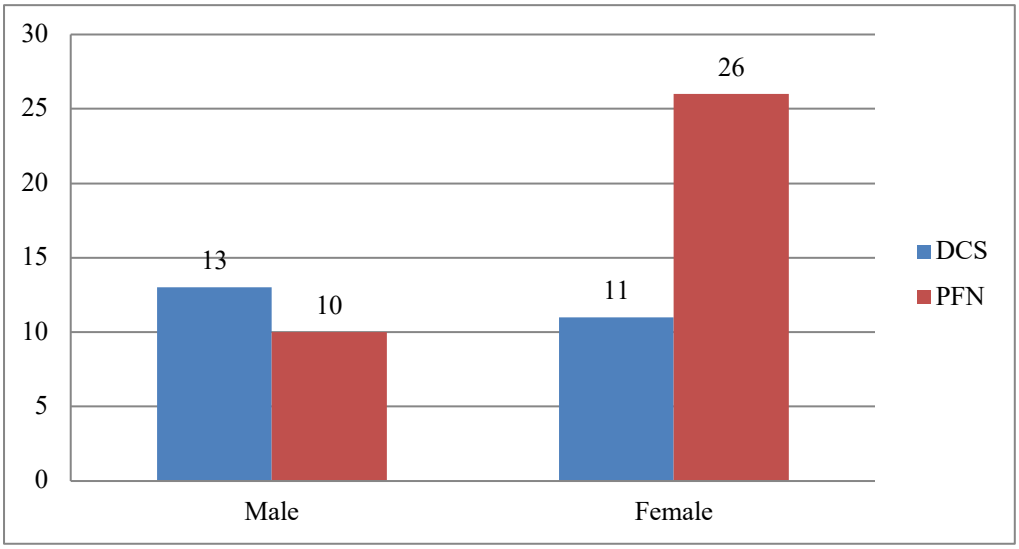

Figure 1: Gender wise distribution of patients in DCS and PFN

Table 1: Preoperative demographic characteristics between group A (dynamic condylar screw) and group B (proximal femoral nail) patients

Parameters	Dynamic condylar screw (Group A), n=24	Proximal femoral nail (Group B), n=36	P value
Mean age (years)	58.91±12.05	56.50±14.06	0.47
Sex			
Male	13(54.17%)	10 (27.77%)	
Female	11 (45.83)	26 (72.22%)	
Mode of injury			
Fall from height	3(12.5%)	07(19.44%)	0.61
Road traffic accident	6 (25%)	04(11.11%)	
Trivial fall	15(62.5%)	25(69.45%)	
Evans classification			
Type 1c	02 (8.33%)	04(11.11%)	0.92
Type 1d	15(62.50%)	13(36.11%)	
Type 2	07(29.17%)	21(58.33%)	
Duration from injury to operation (days)			
<5	8(33.33%)	25(69.44%)	0.38
5-10	10 (41.67%)	05(13.89%)	
>10	6 (25%)	06(16.67%)	

Table 2: Intraoperative and postoperative assessment between group A (dynamic condylar screw) and group B (proximal femoral nail) patients

Parameters	Dynamic condylar screw (Group A), n=24	Proximal femoral nail (Group B), n=36	P value
Mean time taken from the injury to operation (days)	9.05±5.98	6.23±2.90	0.14
Mean duration of operation (minutes)	94.72±13.89	82.53±10.82	0.001
Mean duration of hospital stay (days)	8.72±1.98	8.31±3.41	0.08
Mean union time (weeks)	18.05±1.25	17.18±3.16	0.06

The mean time taken from the injury to the operation in group A (DCS) was 9.05±5.98 days and in group B (PFN) was 6.23±2.90 days, respectively. The mean duration of operation time in group A (DCS) was 94.72±13.89 minutes, ranging from 75 to 135 minutes, and in group B (PFN), it was 82.53±10.82 minutes, which was found to be statistically significant (*P*-value =0.001). The mean duration of hospital stay in group A (DCS) was 8.72±1.98 days, and in group B (PFN), it was 8.31±3.41 days. The mean union time was 18.05±1.25 weeks in group A (DCS) and 17.18±3.16 weeks in group B (PFN) (Table 2).

Table 3: Complications in Group A (dynamic condylar screw) and Group B (proximal femoral nail) Patients

Parameters	Dynamic condylar screw (Group A), n=24	Proximal femoral nail (Group B), n=36	P value
Union	7 (29.17%)	33 (91.67%)	0.14
Non-union	18 (75%)	03 (8.33%)	0.07
Implant failure	10 (41.67%)	03 (8.33%)	0.16
Varus collapse	11(45.83%)	10 (27.78%)	0.28
Lag screw break	04 (16.67%)	03 (8.33%)	0.001
Symptomatic screw back out	03 (12.5%)	06 (16.67%)	0.08
Anterior thigh pain	14 (58.33%)	05 (13.87%)	0.06

Follow-up, fracture union, and complications in all patients in both groups (Table 3). Fracture union was seen in 7 (29.17%) patients in group A (DCS) and 33 (91.67%) patients in group B (PFN). Non-union with or without implant failure was seen in 18 (75%) patients in group A (DCS) and 3 (8.33%) patients in group B (PFN). In the DCS group, implant failure was observed as a breakage of the barrel plate in 10 (41.67%) patients and in 3 (8.33%) patients in group B. lag screw cut out through the femoral head in four (16.67%) patients in group A and three (8.33%) patients in group B. In the PFN group, varus collapse with backing out of hip screws was noted in 11 patients (45.83%) and 3 (8.33%) in group B. Varus collapses were seen in 11 (45.83%) patients in group A (DCS) and 10 (27.78%) patients in group B (PFN). A symptomatic screw back was seen in three (12.5%) patients in group A (DCS) and six (16.67%) patients in group B (PFN). Fourteen (58.33%) patients were having anterior thigh pain in group A (DCS) and five (13.87%) patients in group B (PFN).

Table 4: Harris Hip Score as an indicator of functional outcome in group A (dynamic condylar screw) and group B (proximal femoral nail) patients at final follow-up

Harris hip score	Dynamic condylar screw (Group A), n=24	Proximal femoral nail (Group B), n=36	P value
90-100 (Excellent)	3 (12.5%)	19 (52.78%)	<0.05
80-89 (Good)	4 (16.67%)	10 (27.78%)	
70-79 (Fair)	0 (0%)	04 (11.11%)	
<70 (poor)	17 (70.83%)	03 (8.33%)	

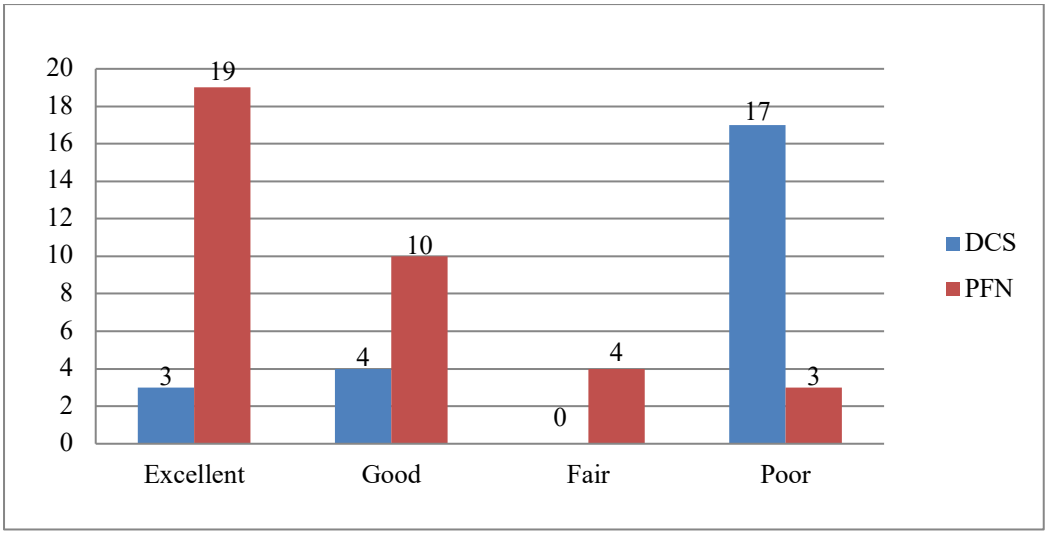

Figure 2: Functional outcome of patients in DCS and PFN at final follow-up

Figure 3: Pre-operative radiograph showing Unstable femoral sub trochanteric fracture left hip in 55 years old male

Figure 4: Post-operative radiograph showing acceptable reduction and alignment after Open reduction internal fixation with long PFN- 6 Weeks follow up

Figure 5: Post-operative radiograph showing acceptable reduction and alignment after Open reduction internal fixation of unstable femoral trochanteric fracture left hip with long PFN - 12 weeks follow up

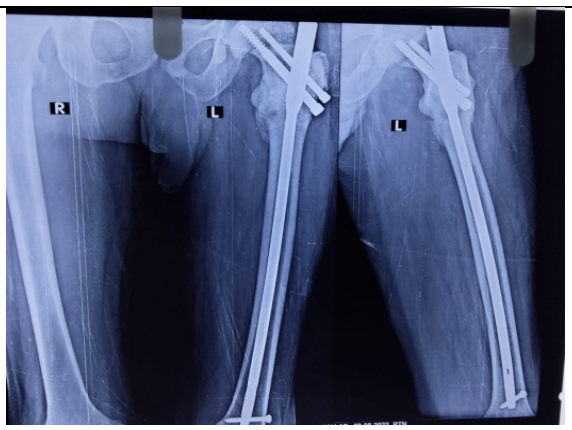

Figure 6: Post-operative radiograph showing acceptable reduction and alignment after Open reduction internal fixation of unstable femoral trochanteric fracture left hip with long PFN – 9 months follow up

Figure 7: A & B. Pre-operative radiograph showing unstable femoral sub trochanteric fracture right hip in a 55 year old male. C & D: Post-operative radiograph showing acceptable reduction and alignment after fixation with dynamic condylar screw. E, F: Plain radiograph at 2 months & 9 months follow up showing union

Discussion

The purpose of the present study was to compare patients' functional and radiological outcomes fixed with a dynamic condylar screw and proximal femoral nail and determine the implant of choice for managing unstable trochanteric fractures. We were able to construct a more homogeneous group by precisely defining the inclusion criteria. Functional outcome Functional outcome was assessed according to the Harris Hip Scoring System (Table 4). In the present study, group A (DCS) showed 3 (12.5%) patients with an excellent (90-100) score, 4 (16.67%) patients with a good (80-89) score, and 17 (70.83%) patients with a poor (<70) score, while group B (PFN) showed 19 (52.78%) patients with an excellent (90-100) score, 10 (27.78%) patients with a good (80-89) score, 4 (11.11%) patients with a fair (70-79) score, and 3 (8.33%) patients with a poor (<70) score. Combining the excellent and good scores, this comprises 7 out of 24 (29.17%) patients in the DCS group and 29 out of 36 (80.55%) patients in the PFN group. In the study done for DCS by Ninad [22] (100%) patients and Hameedullah [19] (86.39%) patients, they were in the excellent and good score groups, which is much higher than in our study. The studies done for PFN by Tribhuvan [21] (92%), C. Joney [23] (91.66%), and Vishal [25] (80%) showed excellent and good scores almost comparable to those for PFN in present study.

Radiological Outcome

Fracture union was seen in 7 (29.17%) patients in group A (DCS) and 33 (91.67%) patients in group B (PFN). In the previous comparative study done by Christophe [10], union was seen in 16 out of 17 (94.12%) patients in the DCS group, which was much higher than we observed in our study, and in the PFN group, 17 out of 18 (94.44%) patients showed union, which was almost comparable to that of PFN in our study. In the study done for DCS by Ninad [12], 18 out of 18 (100%) patients achieved union, and the Ha Meedullah [9] study showed 144 out of 147 (97.96%) patients achieved union, which was much higher than our DCS group. In the study done for PFN by Tribhuvan [11] and C. Joney [13], 100% union was shown, while Vishal [15] showed union in 38 out of 40 (95%) patients and Siddiqui [14] showed union in 40 out of 42 (95.24%) patients, almost comparable to that of the PFN group in our study.

The mean union time was 18.05±1.25 weeks in group A (DCS) and 17.18±3.16 weeks in group B (PFN). Previous studies done for DCS by Ninad [12] showed a mean union time of 14.6 weeks, ranging from 9.2 to 20 weeks, and Hameedullah [9] showed a mean union time of 6.3±1.4 weeks, which showed early union as compared to that in our study. In the study done for PFN by C. Joney [13], the mean union time was 11.12 weeks, ranging from 8 to 22 weeks, which showed early union, while Siddiqui [14], with a mean union time of 24 weeks, showed longer union time as compared to that for the PFN group in our study.

Complications

Fracture union was seen in 7 (29.17%) patients in group A (DCS) and 33 (91.67%) patients in group B (PFN). When compared to the proximal femoral

nail, the overall incidence of complications was greater in the dynamic condylar screw group. In present study, non-union was seen in 18 (75%) patients in group A (DCS) and 3 (8.33%) patients in group B (PFN). In the previous comparative study done by Christo-phe [20], non-union was seen in 1 out of 17 (5.88%) patients in the DCS group, which was much less than we observed in our study, and 1 out of 18 (5.56%) patients in the PFN group showed non-union, which was almost comparable to that of the PFN group in our study. In the study done for DCS by Ninad [12], none of the patients showed non-union, and the Hameedullah [9] study showed 3 out of 147 (2.04%) patients with non-union, which was very less than that in our study for the DCS group. In the study done for PFN by Tribhuvan [11] and C. Joney [13], none of the patients showed non-union, while Vishal [15] showed 2 out of 40 (5%) and Siddiqui [14] showed 2 out of 42 (4.74%) patients with non-union, almost comparable to that for the PFN group in the present study.

In the DCS group, implant failure was observed as a breakage of the barrel plate in 10 (41.67%) patients and in 3 (8.33%) patients in group B. Christophe [10], while comparing DCS and PFN, showed DCS failure in 6 (35.29%) patients, which was comparable to the DCS failure in our study. Furthermore, no failure was reported in the PFN group in that study [10]. Ninad [12] and Hameedullah [9] reported none of the patients with DCS failure. In the study done for PFN by Vishal [15], implant failure was seen in 1 (2.5%) patient, and in the study done by Siddiqui [14].

lag screw cut out through the femoral head in 4 (16.67%) patients in group A and 3 (8.33%) patients in group B.

In the PFN group, varus collapse with backing out of hip screws was noted in 11 patients (45.83%) and 3 (8.33%) in group B. Varus collapse was seen in 11 (45.83%) patients in group A (DCS) and 10 (27.78%) patients in group B (PFN). In previous studies done for PFN by C. Joney [13] (25%) and Vishal [15] (25%), varus collapse was seen, which was almost comparable to that in our study, and the study done by Siddiqui [14] (9.52%) showed a relatively low percentage of varus collapse.

A symptomatic screw back was seen in three (12.5%) patients in group A (DCS) and six (16.67%) patients in group B (PFN). Fourteen (58.33%) patients were having anterior thigh pain in group A (DCS) and five (13.87%) patients in group B (PFN). [16]

Strengths and Future Recommendations

Our study compares the functional and radiological outcomes of unstable trochanteric fractures fixed with a dynamic condylar screw and proximal femoral nail. The strengths of the study are its prospective nature, inclusion of unstable fracture patterns, and definite treatment protocol. Follow-up is required for defining the criteria for implant selection in the management of unstable trochanteric fractures.

Limitations of the study: Limited sample sizes and a short follow-up are the limitations of the current study.

Furthermore, more RCT is required to be done in the future to establish the superiority of PFN over DCS in managing unstable trochanteric fractures.

Conclusion

In the present study, the proximal femoral nail showed less operative time, a higher union rate, a shorter duration for fracture union, a better functional outcome, and fewer complications than the dynamic condylar screw. The proximal femoral nail is a statistically significantly better implant as compared to the dynamic condylar screw in terms of less operative time, a higher union rate, and a better functional outcome. The present study showed that PFN is a better implant for managing unstable trochanteric fractures. Even if PFN is also associated with implant failure and other complications, with proper execution of techniques and following the principles of PFN fixation, the complications can be reduced to an acceptable rate.

Acknowledgement: The authors would like to acknowledge all the faculty and residents of the Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India, for their valuable support, time to time suggestion in undertaking present study. Special thanks to Dr. Vinod Kumar Singh, Professor and Head of Department, Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India.

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