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Comparative study between effectiveness of proximal femoral nail and dynamic condylar screw in fixation of subtrochanteric femur fracture

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ABSTRACT

Background: Subtrochanteric femur accounts for 10–30% of peri-trochanteric fractures. They need early fixation to avoid complications of prolonged immobilization. Proximal femoral nail (PFN) and dynamic condylar screw (DCS) fixation are most commonly used for subtrochanteric fracture fixation. **Aims and Objectives:** The purpose of the study was to evaluate the outcomes of PFN and DCS fixation of the subtrochanteric fracture. **Materials and Methods:** This descriptive follow-up study was conducted in Bankura Sammilani Medical College, Department of Orthopedics from May 2020 to October 2021. A simple random sampling technique with an estimated sample size of 40 patients in PFN group and 40 patients in DCS group was taken. **Results:** Among the PFN cases, 24 (60%) cases were reduced by closed reduction, and 16 (40%) cases were reduced by open reduction. Among DCS cases, 30 (75%) were reduced by open reduction. The average operating time in PFN patients was 80 min and in DCS patients was 104 min. The average blood loss in PFN patients was 178 mL and for DCS patients 252 mL. The average union time of PFN cases was 15.56 weeks and DCS group was 18 weeks. Out of 40 cases of PFN, there were 24 excellent, 8 good, 6 fair, and 2 poor functional outcome by Harris hip Score, and DCS fixation had 6 excellent, 16 good, 12 fair, and 6 poor functional outcome. **Conclusion:** There are no major differences in union rate and complication rate between the PFN and DCS. Although PFN has advantages over DCS in terms of decreased blood loss, decreased operative time, faster union, and a greater chance to closed reduction. Overall, it gives better functional result than DCS.

Key words: Subtrochanteric femur fracture; Proximal femoral nail; Dynamic compression screw

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INTRODUCTION

Subtrochanteric femur fractures are generally defined as fractures occurring within 5 cm of the distal extent of the lesser trochanter and represent an unstable injury and have evolved as one of the most difficult fractures to manage and heal. Subtrochanteric fractures constitute about 10–30%[1] of peri-trochanteric fractures. These generally occur in a bimodal distribution[2] that is high-energy trauma in young patients and ground level fall in the elderly. Subtrochanteric fractures need early surgical intervention to avoid complications related to long immobilizations such as deep vein thrombosis, thrombophlebitis, urinary and lung infections, and decubitus ulcers. Due to the anatomical peculiarity of the subtrochanteric region,[3] these fractures are associated with higher rate of non-union and malunion.

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Different modalities of management exist for these fractures, among them major two groups are the cephalomedullary nail and lateral plate screw systems. There were many implants such as angular blade plate, dynamic condylar screws (DCS), and cephalomedullary nails that were used for the fixation of subtrochanteric femur fractures. However, proximal femoral nail (PFN) and DCS fixation are most often among the many. Both these implants have their own advantages and disadvantages.

Aims and objectives

The purpose of the study was to compare the functional and radiological outcomes of PFN and DCS for subtrochanteric fracture fixation in terms of rate of fracture union, rate of complications and functional outcome in terms of Harris hip score.

MATERIALS AND METHODS

This descriptive follow-up study comparing patients operated by PFN and DCS fixation of subtrochanteric femur fractures was conducted in Bankura Sammilani Medical College and Hospital, Bankura at the Department of Orthopedics from May 2020 to October 2021. The study was started after the Institutional Ethics Committee clearance pertaining to certificate number BSMC/ACA-380 dated February 04, 2020. The participants for the study were selected fulfilling inclusion/exclusion criteria with prior informed consent.

Inclusion criteria

Skeletally mature patients with subtrochanteric fractures and injuries within 3 weeks were included in the study.

Exclusion criteria

The exclusion criteria were pathological fractures, contraindicated systemic diseases, skeletally immature patients, and open fractures.

The estimated sample size was 40 in each group selected by a simple random sampling technique. Both groups of patients were treated with standard emergency care and put on for operation after proper investigation. Primarily closed reduction attempted on a fracture table in supine position under fluoroscopic guidance. Where closed reduction was not possible, open reduction was done. For PFN, standard greater trochanteric entry port were created, guide wire insertion, reaming, and fixation with long PFN nail done. For DCS, fixation lateral approach to proximal femur was used and fixed with head screw and 6–10 holes 95° barrel plate. Intraoperative blood loss was measured by visual assessment of number of swabs of 10 cm × 10 cm multiplied by 60 ml.

Static and quadriceps strengthening exercises and physiotherapy started on 2nd day. Partial weight-bearing walking with walker was started on 3rd post-operative day for PFN cases. For DCS cases, weight-bearing was delayed up to 8 weeks depending on the evidence of callus formation. Clinical follow-up, supported with radiological finding, was done at immediate and 6 weeks, 3 months, 6 months, and 12 months after discharge. Functional outcome was evaluated with Harris hip score at the end of 6 months.

Objective 1 of the study was the determination of the proportion of patients having radiological improvement determining the rate of fracture union. Objective 2 included the proportion of patients developing various types of complications. Objective 3 included the determination of functional outcome as per Harris hip score.

For statistical analysis, data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0). Data had been summarized as the mean and standard deviation for numerical variables and count and percentages for categorical variables. Paired t-tests, Chi-squared test (χ^2 test), and Fischer's exact test were used as appropriate. If the calculated $P \leq 0.05$, then it was considered statistically significant.

RESULTS

Most of the patients enrolled in this study were in the age group of 41–60 years, with most aged patients being of 74 years of age. The average age of patients fixed with PFN was 54 years, whereas the average age for patients fixed with DCS was 58 years. The age distribution of cases in various age groups is shown in Table 1.

Both groups of patients fixed either by PFN or DCS had 32 (80%) male patients and 8 (20%) female patients. Among a total of 80 cases, 32 (40%) cases were due to accidental fall and 48 (60%) cases were due to road traffic accident. Regarding the involvement of the right or left femur in the injury, we observed that 44 (55%) cases were left-sided and 36 (45%) were right-sided. On the classification of fracture pattern as per Russell-Taylor classification, 52 (65%) cases were Russell-Taylor IB, whereas 12 (15%) cases were type 2B and 16 (20%) were classified under Type 1A. Table 2 summarizes these findings.

Among the PFN cases, 24 (60%) cases were reduced by closed reduction, and 16 (40%) cases needed open reduction. Among DCS patients, 30 (75%) needed open reduction, and 10 (25%) were reduced by closed method. Comparing PFN to DCS, PFN had better chances of

Table 1: Age distribution

Age group	Frequency	Percentage
21–40	14	17.5
41–60	45	56.25
61–80	21	26.25
Total	80	100

Table 2: Case distributions for gender, mode of injury, side of injury, and Russell-Taylor classification

Case distributions	Number (percentage)	Total
Gender		
Male	64 (80)	80
Female	16 (20)	
Mode of injury		
Accidental fall	32 (40)	80
Road traffic accident	48 (60)	
Side of injury		
Left	44 (55)	80
Right	36 (45)	
Russell-Taylor classification		
1A	16 (20)	80
1B	52 (65)	
2B	12 (15)	

Table 3: Mean, standard deviation and P-value of age, union time, operating time, and blood loss

Groups	Mean	SD	P-value
Age			
PFN	54.20 years	16.390	0.329
DCS	57.60 years	14.524	
Union time			
PFN	15.56 weeks	2.404	0.0001
DCS	18.00 weeks	3.024	
Operating time			
PFN	80 min	13.944	0.0001
DCS	104 min	13.499	
Blood loss			
PFN	178.00 mL	13.375	0.0001
DCS	252.50 mL	32.167	

PFN: Proximal femoral nail, DCS: Dynamic condylar screw

Table 4: Union rate

Union rate	PFN (%)	DCS (%)	Total (%)
Non-union	2 (5)	6 (15)	8 (10)
Union	38 (95)	34 (85)	72 (90)
Total	40	40	80

PFN: Proximal femoral nail, DCS: Dynamic condylar screw

closed reduction. The average operating time in PFN patients was found to be 80 min whereas for DCS patients, it was found to be 104 min. P value for the operating time in our study comparing PFN and DCS is 0.0001; this indicates that there is a significant statistical difference comparing the operating time between PFN and DCS (Table 3). The average blood loss in PFN patients was found to be 178 mL and DCS patients were found to be 252 mL, P-value comparing PFN and DCS for blood loss was 0.0001. This was also a significant difference between PFN and DCS (Table 3). The mean duration to fracture union for PFN fixation (Figure 1) was found to be 15.56 weeks and those managed with DCS (Figure 2) were found to be 18 weeks. P-value calculated was 0.0001. This showed a statistically significant difference between PFN and DCS regarding the time for the union of fracture (Table 3).

Out of 80 cases total eight cases went for non-union, among eight cases, six were treated by DCS, and two cases were treated by PFN (Table 4). Six cases of non-union in primary DCS cases, revision surgery was done with PFN. Two cases that ware managed by PFN and went into non-union and implant failure, needed re-fixation with augmentation by bone grafting. P-value calculated for the union rate between PFN and DCS was 0.136. Hence, there was no significant difference between PFN and DCS in the union rate.

Eight cases in our study had implant failure. Two patients with PFN fixation had implant failure (Figure 3). Whereas for DCS, two patients had screw and plate loosening, two patients had screw cut out (Figure 4), and two patients had plate breakage.

Functional outcome of PFN and DCS fixation was assessed with Harris hip score. A score of 90-100 was classified as excellent; 80–90 as good; 70–80 as fair; and <70 as poor. The cases fixed with PFN had 24 (60%) excellent, 8 (20%) good, 6 (15%) fair, and 2 (5%) poor outcomes, whereas cases fixed with DCS had 6 (15%) excellent, 16 (40%) good, 12 (30%) fair, and 8 (10%) poor results (Table 5). The calculated P value was found to be 0.0005, which is statistically significant.

This study showed on comparing the operating time, blood loss, and union time in PFN and DCS groups, there was significant better outcome in favor of PFN and chances of closed reduction were also better for PFN group. Overall, the functional outcome as per Harris hip score was significantly better for PFN Group.

DISCUSSION

In subtrochanteric fractures, deforming forces are difficult to curtail and these fractures take a longer time to unite, making it a challenge for treating orthopedicians. It still remains a controversial topic as to which is the better implant. PFN and DCS fixation are the most often used systems for the fixation of subtrochanteric femur fractures.

Figure 1: Proximal femoral nailing. (a) Pre-operative X-ray. (b) Post-operative X-ray after union

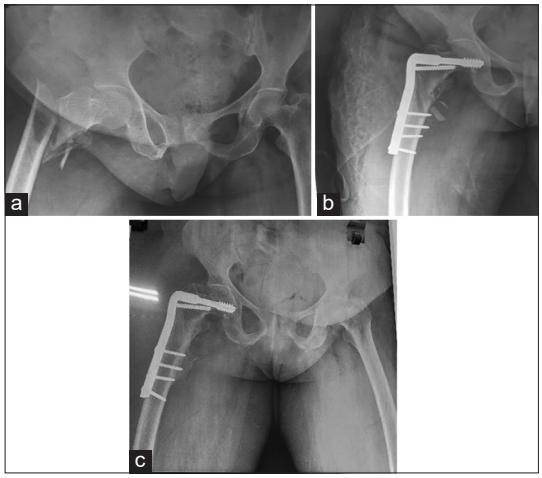

Figure 2: Dynamic condylar screw fixation. (a) Pre-operative X-ray. (b) Immediate post-operative X-ray. (c) Post-operative X-ray after union

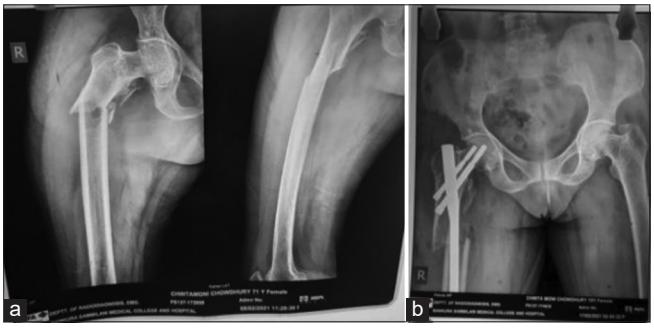

Figure 3: Proximal femoral nail (PFN) implant failure. (a) Pre-operative X-ray. (b) PFN implant failure

In our study of 80 patients, the mean age was 56 years most common age group being 41–60 years, which was similar to studies conducted by Fuse et al.,[4] Kachewar et al.,[5] Nayak et al.,[6] and Bhasme et al.[7] However, studies conducted by Islam et al.,[8] and Mishra et al.,[9] showed most common age group for subtrochanteric femur fracture being 21–40. In our study, 80% of the patients were male with only 20% females. Kachewar et al.,[5] Nayak et al.,[6] Bhasme et al.,[7] Islam et al.,[8] and Mishra et al.,[9] all have showed significant higher incidence among men. The higher male incidence may be

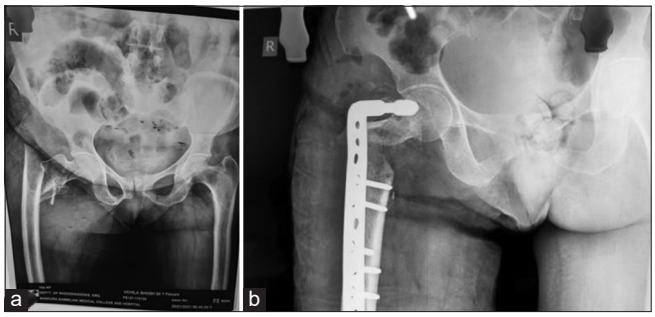

Figure 4: Dynamic condylar screw ((DCS) implant failure). (a) Pre -Ooperative X-ray. (b) DCS implant failure (screw cut out)

Table 5: Harris hip score distribution

Harris hip score	PFN (%)	DCS (%)	Total (%)
Excellent	24 (60)	6 (15)	30 (37.5)
Good	8 (20)	16 (40)	24 (30)
Fair	6 (15)	12 (30)	18 (22.5)
Poor	2 (5)	6 (15)	8 (10)
Total	40	40	80

PFN: Proximal femoral nail, DCS: Dynamic condylar screw

due to increased outdoor activity. This study showed 60% of patients sustained fractures following RTA and 40% of patients following accidental fall. Bhasme et al.,[7] and Mishra et al.,[9] also showed the most common mode of injury to be road traffic accident.

In our study, 75% of our DCS fixation needed an open reduction to achieve good reduction, whereas 60% of PFN fixation achieved a closed reduction. Similarly, a study by Bhasme et al.,[7] also had a higher chance of closed reduction in PFN. Out of their 22 PFN fixation cases, closed reduction done in 12 and 10 needed open reduction, but all DCS cases needed open reduction.

The average blood loss in DCS group was 252.5 mL. The average blood loss in PFN group was 178 mL, there was a significant lower amount of blood loss in PFN groups compared to DCS group. Fuse et al.,[4] Kachewar et al.,[5] Nayak et al.,[6] and Bhasme et al.,[7] also had similar findings. Similarly, Mishra et al.,[9] had 425 mL average blood loss in DCS group and 300 mL average blood loss for PFN group. Whereas Islam et al.,[8] showed that their DCS group has less blood loss (120–159 mL) than the PFN group (200–239 mL).

The average operating time for PFN group was 80 min, which was significantly lower than 104 min of the DCS group. Table 6 summarises mean operating time in different studies. Only Islam et al.,[8] showed higher operating time in PFN than DCS group.

We had a 95% union rate for cases treated with PFN. Union rates for DCS group were 85%. Statistically, there is

Table 6: Comparison of operating time with different studies

Studies	PFN	DCS
This study	80 min	104 min
Fuse et al.[4]	60–90 min	91–120 min
Kachewar et al.[5]	66.25 min	92.30 min
Nayak et al.[6]	66.35 min	92.37 min
Bhasme et al.[7]	93.64 min	101.15 min
Islam et al.[8]	91–120 min	60–90 min

PFN: Proximal femoral nail, DCS: Dynamic condylar screw

no significant difference between PFN and DCS in terms of union rate. Kachewar et al.,[5] also had about 20% non-union rate for DCS, but they did not have any non-union in PFN cases.

In our study, the mean time to union for PFN was 15.56 weeks. For DCS group, the mean time to union was 18 weeks, with P<0.001. That signfies PFN to be better than DCS with significantly shorter mean time to fracture union. Fuse et al.,[4] had a mean union time of PFN of 24.6 weeks and 26.4 weeks for DCS. Kachewar et al.,[5] and Nayak et al.,[6] both had 16 weeks of mean union time for PFN and 19 weeks for DCS. Mishra et al.,[9] had 20.4 weeks mean union time among those treated with DCS and 17.04 weeks in those treated by PFN. However, Islam et al.,[8] showed the mean time to fracture union, 24.5 weeks for DCS which was lower than 26.25 weeks for PFN.

In our study, we observed that 80% of cases in PFN group had good to excellent Harris hip score, whereas, for DCS group, 55% of cases had good to excellent Harris hip score. Fuse et al.,[4] Kachewar et al.,[5] and Mishra et al.,[9] also suggested better functional result in patient operated with PFN than DCS. Similarly, Bhasme et al.,[7] showed 9 excellent, 9 good, 2 fair, and 2 poor functional outcome in 22 cases of PFN and 2 excellent, 5 good, 5 fair, and 1 poor outcome in 13 cases of DCS group. Whereas Nayak et al.,[6] had total of 16 patients in excellent category, 13 good, and 6 fair category considering both PFN and DCS. They found a significant association between the mode of treatment and functional outcome and suggested that PFN showed better functional outcome than DCS. However, Islam et al.,[8] showed Harris hip scores of 80.5±4.8 in DCS patients and 72.7±3.8 in PFN group conferring functional outcome in patient treated with DCS to be better than PFN.

Limitations of the study

This is a single-center study with a limited number of cases and short duration of follow-up, a multicentered study with a larger sample size and longer follow-up would have given a more holistic understanding.

CONCLUSION

Both PFN and DCS are effective in the management of subtrochanteric femur fractures. There are no major differences in terms of union rate and complication rate between the PFN and DCS. However, PFN has advantages over DCS in terms of decreased blood loss, shorter duration of surgery and faster time to union, and better chances of closed reduction during fracture fixation. This faster rate of fracture union might be explained due to increased chances of closed reduction in PFN over DCS, causing less devascularization of fracture fragments and fewer disturbances of fracture hematomas. Overall, PFN had a better functional result than DCS in this study.

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REFERENCES

1. Burnei C, Popescu G, Barbu D and Capraru F. Intramedullary osteosynthesis versus plate osteosynthesis in subtrochanteric fractures. J Med Life. 2011;4(4):324-329.
2. Celebi L, Can M, Muratli HH, Yagmurlu MF, Yuksel HY and Bicimoğlu A. Indirect reduction and biological internal fixation of comminuted subtrochanteric fractures of the femur. Injury. 2006;37(8):740-750.
https://doi.org/10.1016/j.injury.2005.12.022
3. Hu SJ, Zhang SM and Yu GR. Treatment of femoral subtrochanteric fractures with proximal lateral femur locking plates. Acta Ortop Bras. 2012;20(6):329-333.
https://doi.org/10.1590/S1413-78522012000600003
4. Fuse AB, Joshi S, Bhardwaj S, Apte A and Maniar A. Comparison between functional outcome of 95° dynamic condylar screw versus proximal femoral nail in treatment of subtrochanteric femur fracture. MVP J Med Sci. 2019;6(2):145-151.
https://doi.org/10.18311/mvpjms/2019/v6i2/22891
5. Kachewar VB, Pundkar GN, Bute BD and Wankhade UG. Comparative study of the clinical and radiological outcome of subtrochanteric fracture femur fixed by dynamic condylar screw (DCS) and long proximal femur nail (PFN). Indian J Orthop Surg. 2020;6(4):311-315.
https://doi.org/10.18231/j.ijos.2020.057
6. Nayak S, Patra G, Panda SK, Dhar RN and Mohapatra PK. Comparing clinical and radiological outcome of long proximal femur nail (PFN) and subtrochanteric fracture femur fixed by dynamic condylar screw (DCS). Int J Pharm Clin Res. 2022;14(4):201-207.
https://doi.org/10.18231/j.ijos.2020.057

7. Bhasme VK, Ramanand M and Raj AC. Surgical management of subtrochanteric femoral fractures by PFN and DCS-a comparative study. Indian J Appl Res. 2022;12(3):34-36.
https://doi.org/10.36106/ijar/2904168
8. Islam MM, Tarik MM and Arozullah M. Comparison of proximal femur nail and dynamic condylar screw in treating proximal femoral fractures. Ann Int Med Dent Res. 2021;7(3):237-245.
9. Mishra SK, Deepak CE, Goari K and Shukla S. Study internal fixation of subtrochanteric fracture of femur with dynamic hip screw, dynamic condylar screw and proximal femoral nail-a retro-prospective study. Int J Res Med Sci. 2018;6(3):1011-1016.
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Authors Contribution:
PS- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation, and submission of article; **SM and IS**- Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **SR-** Design of study, statistical analysis and interpretation; **RB**- Review manuscript; **DS**- Review manuscript

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