

Comparison of Proximal Femur Nail and Dynamic Condylar Screw in Treating Proximal Femoral Fractures

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ABSTRACT

Background: Proximal femoral fracture is a substantial problem in people of several ages. Dynamic condylar screw (DCS) and proximal femoral nail (PFN) are currently the most commonly used implants for proximal femoral fractures fixation. But we have very few research-based comparative information regarding the effectiveness of both the methods in treating patients with proximal femoral fracture. Aim of the study: The aim of this study was to compare the management and outcomes of dynamic condylar screw (DCS) and proximal femoral nail (PFN) methods in treating proximal femoral fractures. **Methods:** This was a comparative observational study which was conducted in the Dept. of Orthopaedic & Traumatology, Rajshahii Medical College & Hospital, Rajshahi, Bangladesh during the period from January 2020 to December2020. In total 50 patients with proximal femoral fractures were enrolled as the study population. For better comparison only cases of subtrochanteric proximal femoral fracture were selected. Among total population 25 underwent dynamic condylar screw (DCS) method denoted as Group I participants whereas the rest 25 treated by proximal femoral nail (PFN) denoted as Group II participants. This study was approved by the ethical committee of the mentioned hospital. Proper written consents were taken from all the participants before starting data collection. A pre-designed questionnaire including the management procedure and outcomes of both the procedures was used in patent data collection. All data were processed, analyzed and disseminated by MS Office and SPSS version as per need. **Results:** In Group I, for 17, 7 and 1 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. On the other hand, in Group II, for 5, 16 and 4 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. As the final outcome analysis we observed, among Group I patients, the mean (\pm SD) Harris Hip scores were 70.5 \pm 4.2 after 6 weeks and 80.5 \pm 4.8 after 6 months period from surgery. This progress was significantly higher ($p < 0.0001$). Among Group II patients, the mean (\pm SD) Harris Hip scores were 68.8 \pm 3.5 after 6 weeks and 72.7 \pm 3.8 after 6 months period from surgery. This progress was also significantly higher ($p = 0.0004$). In analyzing the complications, 4 occurrences were found in Group I and 13 occurrences were found in Group II. **Conclusion:** Considering lower treatment duration, better increment of Harris Hip scores and lower incidence of complications we can consider dynamic condylar screw (DCS) method as the better option than proximal femoral nail (PFN) methods in treating proximal femoral fractures.

Keywords: Proximal femur nail, Dynamic condylar screw, Proximal femoral fracture, PFN, DCS.

INTRODUCTION

Proximal femoral fracture is a substantial problem in people of several ages. Dynamic condylar screw (DCS) and proximal femoral nail (PFN) are currently the most commonly used implants for proximal femoral fractures fixation. But we have very few research-based comparative information regarding the effectiveness of both the methods in treating patients with proximal femoral fracture. Subtrochanteric fractures are such fractures that occur in proximal femur just below the lesser trochanter and extending up to 5 cm below it. In human body the highest compressive stresses are present on posteromedial as well as medial cortices

of the subtrochanteric femur and on the counterpart high degree of tensile stress are put on the lateral cortex. Like Colles fracture subtrochanteric area is cortico-cancellous junction.^[1] On the other hand, hip fracture is consisting mainly of a fracture of the proximal femur. According to the anatomical area they categorized into 3 types out of which 90% of hip fractures are fracture femoral neck and intertrochanteric fractures. Incidence of both fractures are almost similar and remaining 5-10 % A are subtrochanteric fractures and they are distributed in all age groups.^[2] Two age groups of persons are more prone namely, older osteopenic patients in which the usual cause of trauma is a low-energy fall and younger patients, the commonly injury is due to high-energy trauma.^[3] In elderly patients, even minor slips or falls on lateral side is usually the common mode of injury. Metastatic disease which are frequently associated with this age group is also vulnerable to pathologic fractures and either direct or from axial loading (e.g., a fall from height), whichever the mode, the

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high-energy trauma is always the mechanism of injury in young age group which usually produces a comminuted fracture.^[4] There are many ways to classify the subtrochanteric femur fracture firstly on the basis of integrity of piriformis fossa in Russell Taylor classification,^[5] secondly on basis of fracture location in Fielding classification and thirdly on basis of amount of comminution in Muller's A.O. classification. Non-operative treatment procedure of subtrochanteric femur fracture in adults has no role and lost its role completely in last 2 to 3 decades. Now recent orthopedic practice recommends the surgical reduction and internal fixation for most of the subtrochanteric femur fracture.^[6] Intra medullary, extra-medullary devices are two main types of implants for treatment of subtrochanteric femur fracture. Reconstruction nail, gamma nail, Russell Taylor nail, proximal femoral nail etc. are some of intramedullary devices used in subtrochanteric fracture, whereas extra medullary devices include A.O. 95 angled condylar blade plates, A.O. 95° dynamic condylar screws, dynamic hip screws, proximal femoral plates.^[7] This operative method has the advantage of reconstructing the anatomy and contact loading characteristic of the hip which further helps in early rehabilitation, early mobilization and earlier weight bearing.^[8] For most fractures, the surgical method most likely guarantees anatomical joint reconstruction and fracture union. The aim of this study was to compare the management and outcomes of dynamic condylar screw (DCS) and proximal femoral nail (PFN) methods in treating proximal femoral fractures.

Objectives

General Objective:

- To compare the management and outcomes of DCS and PFN methods in treating proximal femoral fractures.

Specific Objective:

- To collect information regarding the demographic status of participants.
- To collect information regarding the clinical status of participants.
- To collect information regarding the blood loss and operative times in both the methods.
- To collect information regarding the complications and outcomes of both procedures.

MATERIALS AND METHODS

This was a comparative observational study which was conducted in the Dept. of Orthopaedic & Traumatology, Rajshahii Medical College & Hospital, Rajshahi, Bangladesh during the period from January 2020 to December 2020. In total 50 patients with proximal femoral fractures were

enrolled as the study population. For better comparison only cases of subtrochanteric proximal femoral fracture were selected. Among total population 25 underwent dynamic condylar screw (DCS) method denoted as Group I participants whereas the rest 25 treated by proximal femoral nail (PFN) denoted as Group II participants. This study was approved by the ethical committee of the mentioned hospital. Proper written consents were taken from all the participants before starting data collection. A pre-designed questionnaire including the management procedure and outcomes of both the procedures was used in patient data collection. Only those patients satisfying the inclusion and exclusion criteria were included in the study. All the patients were clarified about the surgical procedure, the purpose of the study and informed consent was taken. According to the inclusion criteria of the study skeletally mature patients with subtrochanteric femur fracture, patients with open and closed fractures and fractures extending to intertrochanteric femur line were included. On the other hand, according to the exclusion criteria of the study, patients below 20 years of age in whom epiphyseal closure has not occurred, patients with open subtrochanteric femur fracture, associated fractures around hip joint and neurovascular compromised patients were excluded. Russell and Taylor classification was used to classify the presented subtrochanteric fracture.^[9] The general condition of the patients is assessed at the time of admission and associated comorbidities are noted. Thomas splint was applied till the surgery. Both the anteroposterior and lateral radiographs were taken and studied. The functional outcome was evaluated using Harris Hip Score¹⁰ during follow up. Harris Hip Score was used to evaluate the patients clinically during their follow up period. Based on Harris Hip score (HHS) the results were graded as Excellent: > 90 points, Good: 80 – 89 points, Fair: 70 – 79 points and Poor: < 70 points. Random sampling technique was used in this study. Both types of surgical methods were performed on fracture table in supine position. Patient is in appropriate anesthesia, reduction maneuver was performed by longitudinal traction and external rotation of limb and checked under c arm, incision of 5 cm taken above greater trochanter of femur, skin is cut, subcutaneous tissue cut, tensor fascial at a cut, gluteus maximums was cut. Tip of greater trochanter of proximal femur was identified and entry made with an awl, through entry portal guide wire was passed from proximal fragment to distal fragment of fracture, proximal rimming done, appropriate size proximal femoral nail is inserted, reduction conformed under c arm, position of both guide wire in femoral head checked in both anteroposterior and lateral view under fluoroscopic guidance. After conformation on central position of both guide wires in both views proximal 2 screws,

one of 8mm and one of 6mm are inserted and distal locking done, wound was closed. After conforming central placement of guide wire in both anteroposterior and lateral view triple rimming of neck and head of femur was done, appropriate size Richard screw was inserted within 1cm of subchondral bone, 95 DCS was passed, distally 4 to 5 screws inserted in femur cortex through plate, middle screws are inserted, top nut to Richard screw is applied reduction conformed under c-arm wound was closed. Intra venous antibiotics were given routinely to all patients. Antibiotic was given intra-operatively and are continued for 5 days and after that patient was shifted to oral antibiotics till suture removal. After 48 hours drain was removed.

Patients of both groups were mobilized non weight bearing on second day of surgery and gradually progressed to partial and then full weight bearing which was dependent on quality of fixation of bone. All data were processed, analyzed and disseminated by MS Office and SPSS version as per need.

RESULTS

In this study among total participants, 62% were male and 38% were female. In group I (DCS Group), 64% participants were male and 36% were female whereas in Group II (PFN Group), 60% participants were male and 40% were female.

Table 1: Age and gender distribution of participants (n=50)

Age (Year)	Group I (n=25)		Group II (n=25)		Total (n=50)			
	Gender (n)		Gender (n)		Male (n)	Female (n)	Both total	
	Male	Female	Male	Female			n	%
21-40	8	5	10	8	18	13	31	62
41-60	5	3	4	1	9	4	13	26
≥60	3	1	1	1	4	2	6	12
Total	16	9	15	10	31	19	50	100
%	64	36	60	40	62	38	100	

Table 2: Side involvement among participants (n=50)

Side	Group I		Group II		Total (n=50)	
	n	%	n	%	n	%
Right	14	56	13	52	27	54
Left	11	44	12	48	23	46
Total	25	100	25	100	50	100

Table 3: Types of fractures among participants (n=50)

Side	Group I		Group II		Total	
	n	%	n	%	n	%
Type 1 A	7	28	9	36	16	32
Type 1 B	8	32	8	32	16	32
Type 2 A	4	16	6	24	10	20
Type 2 B	6	24	2	8	8	16
Total	25	100	25	100	50	100

Table 4: Amount of blood loss among participants (n=50)

Blood loss	Group I	Group II	P value
80-119 ml	4	2	0.976
120-159 ml	13	4	
160-199 ml	6	9	
200-239 ml	1	6	
>240 ml	1	4	

Table 5: Operative time distribution of participants (n=50)

Operative Time	Gr. I	Gr. II	P value
60-90 Min.	17	5	0.957
91-120 Min.	7	16	
121-150 Min.	1	4	

Table 6: Mean Harris Hip score distribution between the groups (n=50)

Groups	6 Weeks	6 Months	P value
Group I	70.5±4.2	80.5±4.8	<0.0001
Group II	68.8±3.5	72.7±3.8	0.0004

In Group I 13, 8 and 4 participants were from 21-40, 41-60 and ≥60 years' age groups respectively

whereas in Group II, the participant's numbers were 18, 5 and 2 respectively. So, among total participants, majority (62%) number of patients were from 21-40 years' age group. In this study, in analyzing the side involvement among participants, we observed, in both the groups majority number of participants, fractures were found in the right side. In Group I it was in 56% whereas in Group II it was in 52%. In this study, the distribution of types of fractures were near about similar in both the groups. In this study, among Group I participants, we found 80-119 ml, 120-159 ml, 160-199 ml, 200-239 ml and >240 ml blood losses were occurred in 4, 13, 6, 1 and another 1 patients respectively. On the other hand, among Group II participants, we found 80-119 ml, 120-159 ml, 160-199 ml, 200-239 ml and >240 ml blood losses were occurred in 2, 4, 9, 6 and 4 patients respectively. In Group I, for 17, 7 and 1 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. On the other hand, in Group II for 5, 16 and 4 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. In this study, as the final outcome analysis we observed, among Group I patients, the mean (±SD) Harris Hip scores were 70.5±4.2 after 6 weeks and 80.5±4.8 after 6 months period from surgery. This progress was significantly higher (Extremely) where the p value was less than 0.0001. On the other hand, among Group II patients the mean (±SD) Harris Hip scores were 68.8±3.5 after 6 weeks and 72.7±3.8 after 6 months period from surgery. This progress was significantly higher where the p value was 0.0004. In analyzing the complications among the participants 4 occurrences were found in Group I and 13 occurrences were

found in Group II. The complications were infection, pulmonary complications, pressure sores and implant failure.



Figure 1: Union time in week between the groups (n=50) (P=0.017)

Table 7: Complications among the participants (n=50)

Complications	Gr. I	Gr. II	Total	
	(n=25)	(n=25)	n	%
Infection	1	3	4	8
Pulmonary complication	1	3	4	8
Pressure sores	1	2	3	6
Implant failure	1	1	2	4

DISCUSSION

The aim of this study was to compare the management and outcomes of dynamic condylar screw (DCS) and proximal femoral nail (PFN) methods in treating proximal femoral fractures. Proximal femur fractures are demanding to treat in Orthopaedics set up. Failures are commonly associated with management of Subtrochanteric proximal femur fracture. Failure of management of Sub trochanteric femur fracture are mainly due to: troublesome fracture biomechanics, multiple deforming forces leading to high stress concentration area around sub trochanteric femur fracture, increased complication rates after surgical management.^[11] In addition to that, the amount of trauma suffered at the time of injury in young or middle age adults also influences the outcome of this fracture treatment. It was found that closed manipulation of these fractures is associated with difficulties in regaining and maintaining the reduction. These challenges are overcome by surgical means. So, the surgical line of management is preferred for the management of these fractures.^[12] Subtrochanteric region of the femur is subjected to very high stresses because of its anatomical considerations. So, to design the ideal implant is an uphill task. Besides these, the muscle attachments around the subtrochanteric area and their counteracting forces add to the challenges in attaining anatomical reduction and adequate fixation.^[13] In spite of having many implant options

in management of subtrochanteric femur fractures, there is an increased trend along the use of intramedullary devices. Use of intramedullary devices are more challenging than what was expected of a closed nailing technique due to the technical fallacies associated with these devices and troublesome biomechanics of subtrochanteric fracture.^[14] Comprehensive knowledge of subtrochanteric region anatomy and experience with the implant are crucial for favorable outcome in these complex fractures. Early weight bearing is facilitated by proximal femoral nail which uses the principle of internal splinting and endurance of bearing large axial load.^[15] Small surgical incision is needed that reduces the blood loss and leads to minimal tissue damage. But some complications have been found with the use of proximal femoral nail which includes implant cut out, proximal screws' lateral migration and femoral medialization. In a study conducted by Wang et al.^[16] long PFN was implanted in 25 patients of subtrochanteric femur fracture, had follow up of 20 months. Excellent to good outcome was found in more than 90% of cases. They found that PFN is associated with less tissue trauma, less blood loss, faster procedure and early union. In our study, among Group I participants, we found 80-119 ml, 120-159 ml, 160-199 ml, 200-239 ml and >240 ml blood losses were occurred in 4, 13, 6, 1 and another 1 patients respectively. On the other hand, among Group II participants, we found 80-119 ml, 120-159 ml, 160-199 ml, 200-239 ml and >240 ml blood losses were occurred in 2, 4, 9, 6 and 4 patients respectively. In a study conducted by Abraham et al.^[17] PFN used in 26 patients with comminuted unstable subtrochanteric femur fracture and followed at least for 1 year, reported ease of implantation, less operative time and blood loss. Mean Harris Hip score was 82 after 1 year of follow up period and no implant failure was found. One case of varus malunion was encountered in same study. In the present study, the results in Group I were better than the results in Group II with includes blood loss, postoperative blood transfusion, mean operative time which was comparable with study conducted by Mishra et al.^[18] in which 50 patients was included in their study, of which 25 cases were treated by PFN and 25 cases by 95° DCS. In our study in Group I, for 17, 7 and 1 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. On the other hand, in Group II for 5, 16 and 4 patients, the operative times were 60-90, 91-120 and 121-150 minutes respectively. In this study, as the final outcome analysis we observed, among Group I patients, the mean (\pm SD) Harris Hip scores were 70.5 \pm 4.2 after 6 weeks and 80.5 \pm 4.8 after 6 months period from surgery. This progress was significantly higher (Extremely) where the p value was less than 0.0001. On the other hand, among

Group II patients the mean (\pm SD) Harris Hip scores were 68.8 ± 3.5 after 6 weeks and 72.7 ± 3.8 after 6 months period from surgery. Mean operative time was less in Group A (90 min) than Group B, with p value 0.019 which is similar to study by Mishra et al.^[18] where it was 95 min in PFN group with p value 0.023. The mean blood loss in Group A (148 ml) was comparably lower than Group B (177 ml) with p value 0.02, correspondence with study by Mishra et al.^[18] where it was 300 ml in PFN group with p value 0.004. The mean post-operative blood transfusion units in Group B was higher than Group A with p value 0.107, was similar with results found by Mishra et al.^[18]

CONCLUSION

Considering lower treatment duration, better increment of Harris Hip scores and lower incidence of complications we can consider dynamic condylar screw (DCS) method as the better option than proximal femoral nail (PFN) methods in treating proximal femoral fractures. This was a single centered study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country. For getting more reliable information we would like to recommend for conducting more studies in several places with larger sized samples.

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