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Comparison between Functional Outcome of 95° Dynamic Condylar Screw versus Proximal Femoral Nail in Treatment of Subtrochanteric Femur Fracture

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Abstract

Objective: Study was done to compare results between the Proximal Femoral Nail (PFN) and 95° Dynamic Condylar Screw (DCS) in Subtrochanteric femur fracture. Hypothesis was made that outcome of PFN technique is comparable to 95° DCS. **Materials and Methods:** 60 patients were taken in study out of which PFN technique performed on 30 patients and on remaining 30 patients 95° DCS technique was used in a tertiary care Centre. Both technique were compared on basis of time of injury to surgery, operation time, blood loss, hospital stay, blood transfusion, implant related complication, healing time, Harris Hip score and union time **Results:** There was remarkable difference in Harris Hip score, fracture union, mean operative time, blood loss, wound healing. Complications such as pressure sore, pulmonary embolism etc. were found to be higher in 95° DCS group as compared to PFN group. **Conclusion:** PFN is found to better internal fixation device in treatment of subtrochanteric femur fracture.

Keywords: 95° Dynamic Condylar Screw (DCS), Proximal Femoral Nail (PFN), Subtrochanteric Femur Fracture

1. Introduction

Subtrochanteric fractures are the fractures which 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].

A 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 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

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classification[5], secondly on basis of fracture location in Fielding classification and thirdly on basis of amount of communication in Muller's A.O. classification

Non-operative treatment 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]. These operative methods 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]. Our aim in treating subtrochanteric fracture is to regain normal anatomy and to achieve perfect biomechanics of the joint. Whichever method we use in management of subtrochanteric fracture, either closed manipulation or open reduction and internal fixation the best possible results are obtained by anatomical joint restoration[9]. For most fractures, the surgical method most likely guarantees anatomical joint reconstruction and fracture union.

2. Aims and Objectives

a. To study the functional outcome of 95° dynamic condylar screws versus proximal femoral nail in treatment of subtrochanteric femur fracture.
b. To study the complications associated with treatment of subtrochanteric femur fracture.

3. Materials and Methods

3.1 Study Population and Sample Size

This study was conducted at tertiary care center from August 2016 to December 2018. The study was conducted on 30 patients in each group enlisting in the casualty or inpatient department of Orthopaedics at a medical college and tertiary health care centre. Only those patients satisfying the inclusion and exclusion criteria were included in the study. All the patients were explained about the surgical procedure, the purpose of the study and informed consent was taken.

Group A - Proximal Femoral Nail (30 cases)
Group B - 95° Dynamic Condylar Screw (30 cases)

3.2 Inclusion Criteria

1. Skeletally mature patients with Subtrochanteric Femur Fracture.
2. Closed fractures.
3. Fractures extending to Intertrochanteric Femur line.

3.3 Exclusion Criteria

1. Patients below 18 years of age in whom epiphyseal closure has not occurred.
2. Patients with open subtrochanteric femur fracture.
3. Associated fractures around hip joint i.e. only intertrochanteric femur fracture, acetabular fracture, intracapsular neck of femur fracture.
4. Neurovascular compromise.

3.4 Fracture Classification

Russell and Taylor classification[9] was used to classify the presented subtrochanteric fracture.

3.5 Preoperative Evaluation

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.

3.6 Radiographic Evaluation

Both anteroposterior and lateral radiographs were taken and studied.

3.7 Functional Analysis

The functional outcome was evaluated using Harris Hip Score[10] during follow up.

3.8 Randomization

Done by simple random technique.

3.9 Surgical Technique

3.9.1 Position

Both the types of surgical procedure were done on fracture table in supine position.

3.9.2 Procedure (Proximal Femoral Nail)

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 fascia lata 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.

3.9.3 Procedure (95° DCS)

Patient is in appropriate anesthesia, reduction maneuver was performed by longitudinal traction and external rotation of limb and checked under c arm, 10 cm incision longitudinal taken from greater trochanter distally ,skin is cut, subcutaneous tissue is cut, tensor fascia lata is cut, vastus lateralis is cut or reflected, fracture site was opened if satisfactory reduction was not achieved under c arm guidance guide wire was passed in 95 degree by an angle guide from tip of greater trochanter.

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.

3.9.4 Post-Operative Protocol

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.

4. Results

52 yrs and 53 yrs was the mean age for Group A & Group B respectively. According to Russell Taylor classification 1B (33%) was most common in group A and type 1A and 1C (37%) were more common in group B. Road traffic accidents were the commonest mode of trauma in either Group. Mean operative time was higher in Group B (106 min) than in Group A (90 min). P value 0.019. Group B (148 ml) had higher mean blood loss intra-operatively than Group A (177 ml). p value 0.02.Post-operative mean blood transfusion was higher in Group B (0.5 units) than Group A (0.26 units). Post-operative mean blood transfusion was higher in Group B (0.5 units) than Group A (0.26 units).

4.1 Age and Sex Distribution

In our study of total 60 participants, most of them were in age group of 20-40 years (33%) (20 cases) and 60-79 years (33%) (20 cases). Males are more in younger group and female outnumbered males in elderly group (Table 1).

Table 1. Age and sex distribution

Age	Group A		Group B	
	Sex		Sex	
	Male	Female	Male	Female
20-39	8	2	7	3
40-59	4	3	5	3
60-79	3	7	4	6
80-99	2	1	0	2
Total	**17**	**13**	**16**	**14**

4.2 Side

Out of 30 patients in group A, 15 patients had fracture on Right side and 15 on Left side.

Out of 30 patients in Group B, 16 patients had a fracture on Right side and 14 patients on Left side.

4.3 Singh's Index

In both groups grade 6 was more common having 9 patients each. In grade 5 had 6 patients in group A and 5 patients in group B. according to sing's index group A had 4 patients and group B had 8 patients of grade 4. Grade

3 had 5 patients in group A and 3 patients in group B. there were 5 patients in group A and 4 patients in group B was having Singh's index grade 2. Grade 1 contains single patients in either group.

4.4 Type of Fracture

In group A According to Russell Taylor classifications type IB was more common in 10 patients (33.3%) and type 1A in 8 patients, 5 patients if 2A type and 7 patients in 2B type.

In group B According to Russell Taylor Classifications, Type IA & IIA were more common consisting of 11 patients each (36%). 6 patients had Type IB and 2 patients had Type IIB fracture.

4.5 Blood Loss

Group B (177 ml) had higher mean blood loss intra-operatively than Group A (148 ml) p value 0.02 (Table 2).

Table 2. Blood loss

Blood Loss (ml)	Group A (No. of patients)	Group B (No. of patients)
80-119	5	2
120-159	15	6
160-199	8	12
200-239	1	6
>240	1	4

P value: 0.02(<0.05)
Shows that group A had significantly lesser blood loss than group B

4.6 Operative Time

Table 3. Operative **time**

Operative Time (in minutes)	Group A (No. of patients)	Group B (No. of patients)
60-90	19	7
91-120	10	20
121-150	1	3

P value is 0.019(<0.05).
The operative time in Group A was significantly lesser than Group B

4.7 Harris Hip Score

During every follow up, functional outcome of the patients was evaluated. During both follow-ups, group A had better Harris hip score than group B.

Group A, the mean Harris hip score at 6 weeks and 6 months are 70.5 and 80.5 respectively (Table 4).

Group B, the mean Harris hip score at 6 weeks and 6 months are 67 and 75.5 respectively (Table 4).

Table 4. Harris hip score

Follow up period	Mean harris hip score		P value
	Group A	Group B	
6 Weeks	70.5	67	0.03
6 Months	80.5	75.5	0.009

Harris Hip Score was used to evaluate the patients clinically during their follow up period. Based on their Harris Hip Score (HHS) the results were graded as Excellent: > 90 points

Good: 80 – 89 points

Fair: 70 – 79 points

Poor: < 70 points

4.8 Union Time

The mean union time of group A was 24.6 weeks and of group B was 26.4 weeks p value 0.004 (Figure 1).

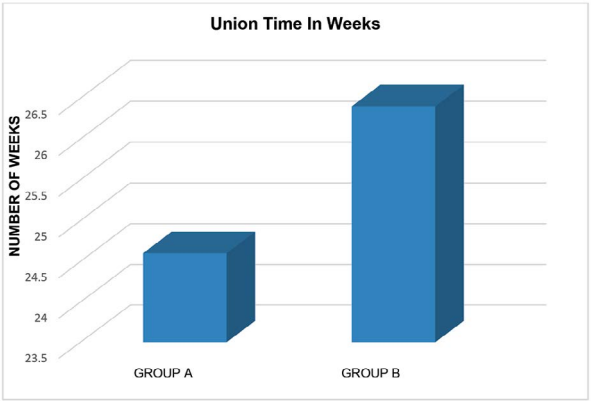

Figure 1. Union time.

4.9 Complications

Post-operative complication including pressure sore, pulmonary infections & failure of implants were common in Group B than Group A (Table 5, Figure 2, Diagram 1).

4.10 Illustrative Case: 95° DCS

70 years male had road traffic accident and had subtrochanteric femur fracture. After 6 months follow up, Patient had a Harris hip score of 85 (Diagram 1).

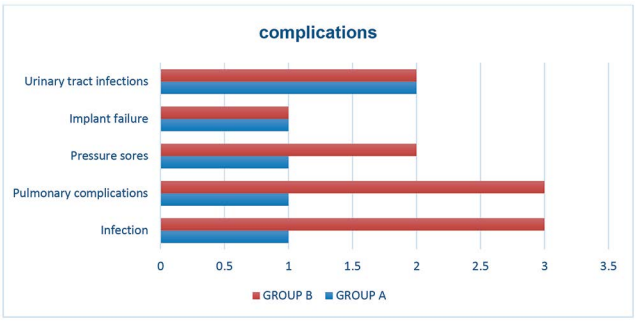

Figure 2. Post-operative complication.

Table 5. Post-operative complication

Complications	Group A	Group B	Total
Infection	1	3	4
Pulmonary complications	1	3	4
Pressure sores	1	2	3
Implant failure	1	1	2
Urinary tract infections	2	2	4

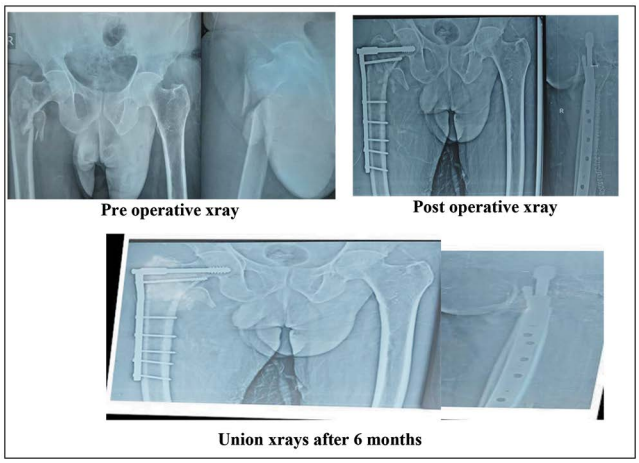

Diagram 1: **Illustrative Case: 95° DCS**

4.11 Illustrative Case: PFN

72 years male had road traffic accident with subtrochanteric femur fracture After 6 months follow up patient had Harris hip score 85 (Diagram 2).

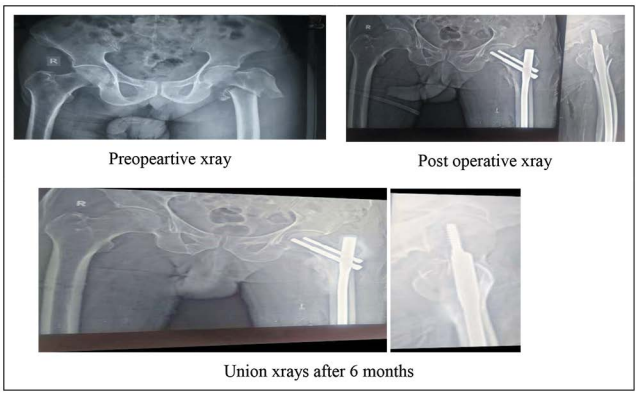

Diagram 2: Illusrative Case: PFN.

5. Discussion

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. Further more 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 elderly 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 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 A were better than the results in Group B 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.

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 all.*[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].

In Group A mobilization was started earlier than Group B with respect to bed side mobilization, partial and full weight bearing was accordance with many recent studies on PFN for subtrochanteric femur fracture.

Harris hip score measured at 6 weeks and 12 weeks were better in PFN group than 95° DCS with p value 0.063 and 0.018 respectively. Harris hip score was significantly less in Group B than Group A.

6. Conclusion

From our result, we have a opinion that proximal femoral nail may be a better implant for subtrochanteric femur fracture. PFN allows early mobilization that certainly reduces complications such as pressure sore, pulmonary infection etc. Small incision in PFN reduces the infection rate postoperatively. It seems to be cost effective as there is improved function and less post-operative hospital stay.

Despite the result are encouraging in short term, a bigger randomized prospective study comparing PFN and 95° DCS is required to arrive a definitive conclusion.

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