Research Article

Functional Outcomes of Subtrochanteric Femur Fracture Fixed with Dynamic Condylar Screw

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Abstract: Background: Orthopedic surgeons find it most difficult to manage subtrochanteric femur fractures because of its notorious location, where difficulties might arise. Various techniques, including intramedullary and extramedullary implant stabilization have been tried with varying level of success.

Objective: Our study aimed to assess the functional results of dynamic condylar screws in sub trochanteric femur fractures in order to aid the underprivileged masses in our area.

Materials and Methods: This prospective observational study was conducted in Akbar Medical Center Dabgari Garden Peshawar, Pakistan from September, 2018 to August, 2022. All patients of either gender having age above 20 years with proximal femoral fracture without concomitant fracture, with negative hepatitis profile and no diabetes were managed using a dynamic condylar screw. Functional outcome of the surgery was evaluated using Harris Hip Score.

Result: There were total 88 patients in the study with male to female ratio of 3:1 having mean age of 33.96±9.63. Postoperative functional outcome in terms of Harris hips score range from 64 to 94 with a mean of 83.87 ±7.27 SD. Excellent functional outcome were observed in 14.8% patients, good results in 64.8% patients, fair outcomes in 11.4% and poor outcome were observed in 9.1% patients.

Conclusion: DCS results are excellent and good functional outcome in majority of patients. Therefore, it can be used as a good alternative to other intra and extramedullary implants fixation.

Keywords: Dynamic condylar screw, Femur, Fractures, Harris hip scores, Subtrochanteric, Medullary devices.

INTRODUCTION

Sub trochanteric area of femur is the region lies 5 cm distal from the lesser trochanter [1]. Fractures that occur in the vicinity of isthmus (the narrowest part of the medullary cavity lies between upper third and lower two third of femoral shaft) and lesser trochanter are also considered sub trochanteric fractures [2]. Fractures in this region make 10 to 34% of total hip fractures and are caused by trivial trauma in older patient and in younger population high energy trauma is responsible [3,4]. These types of fractures are challenging because of some anatomic, biologic and biomechanical characteristics. This femoral area is predominantly cortical with poor vascularity, prolonging the healing time moreover strong muscles attachments on either side of the fracture causes shear at the fracture site making reduction very difficult [5,6]. Open reduction and internal fixation is suggested for treating sub trochanteric femur fractures [7,8]. The aim of operative procedure is to preserve length, stability, and alignment, which can only be done through surgery. Nevertheless, for those patients in whom surgical treatment puts their lives in danger because of associated life threatening comorbid issues non-operative treatment is always opted [6]. Various intramedullary (Russell Taylor and reconstruction nails, gamma Nail, proximal femoral nail) as well as extra-medullary devices (Dynamic hip screws, A.O 95 degree dynamic condylar screws, A.O 95 angled condylar blade plate) are also used to treat fractures of the sub trochanteric femur. Intramedullary devices require less surgical exposure, less blood loss, shorter operating time and short hospital stay compared to extra medullary devices. Radiological time of union and time of weight bearing is also prolonged in extra medullary devices [9]. High union and low complication rates make intramedullary nails appropriate for treating femoral shaft fractures; nevertheless, treating sub trochanteric femur fractures with an intramedullary nail is technically challenging and increases reoperation rates [10]. The proximal femoral segment that is often seen short, flexed, abducted and externally rotated making a precise nail entry point extremely challenging [11,12]. Direct cortical support is prevented by the large size of the metaphysis in relation to the medullary implant resulting in angular malreduction which is poorly tolerated biomechanically. Moreover, lack of proper cortical apposition the implant bears the entire bending load and therefore implant failure is inevitable, importantly for healing in this area accurate reduction allows the femur to share some of the load of the final construct [13-16].

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Various national and international studies have shown that dynamic condylar screws have good results if there is anatomic reduction and minimal soft tissue striping. One such study conducted in Karachi 2015 showed that good functional outcome was achieved in 82.2% cases [17].

Study done in Quetta Baluchistan in 2018 showed acceptable functional Outcome in 85% Excellent in 46%, good in 39%, fair in 8.16% and bad in 5.44% [18].

Similarly, studied done in India in 2016 concluded that 50% has excellent, 30% good results, 15% fair and 5% had bad outcome [19]. Overall acceptable functional outcome was above 80%.

The dynamic condylar screws are cheaper, easy to use and good alternative to intramedullary devices especially in third world countries. Our study aimed to assess the functional results of dynamic condylar screws in subtrochanteric femur fractures in order to aid the underprivileged masses in our area.

MATERIALS AND METHODS

This prospective observational study was conducted in Akbar Medical Center Dabgari Garden Peshawar Pakistan from September, 2018 to August, 2022 (IRB: 475/LHR/MTI). All patients of either gender having age above 20 years with proximal femoral fracture without concomitant fracture, with negative hepatitis profile and no diabetes were managed using a dynamic condylar screw. Functional outcome of the surgery was evaluated using Harris Hip Score [14]. A total number of 88 patients (n=88) sample size was calculated using WHO software for sample determination in health studied having confidence level 95%, anticipated population 82.2%, absolute precision required was 8%. Following certification by the hospital's management and ethical review board, all patients with subtrochanteric fracture of femur above 20 and below 60 years of age either gender having BMI 19 to 30 kg/m2 presenting with acute trauma of less than 7 days and ASA class I, II and III were included. Patients who presented with segmental and pathological fractures, poly trauma patients and patients with underlying medical comorbid conditions that affects fracture healing were excluded to avoid confounding factor and bias in the study. All participants in the study provided written informed consent. All patients with subtrochanteric femur fracture were operated on either emergency or elective list. Operative procedure was carried out in supine position over standard traction table with a conventional lateral skin incision. Following fracture reduction and determination of anteversion a guide wire was introduced using angle guide through neck of femur till subchondral region. After reaming and tapping a proper sized condylar screw was applied over the wire and engaged in subchondral bone at lower portion of femoral head. Proper anatomic reduction and interfragmentary lag screws wherever needed applied and fixed with multiple holes side plate. Following surgery patients were shifted to postoperative wards and kept under observation for 2 days on IV antibiotics and analgesics. Patients were mobilized on crutches as soon as possible and post op images were taken. On second post-operative day the patients were discharged with oral antibiotics, analgesics and calcium supplements and touch down mobilization with walker on operated leg for initial 6 weeks were allowed and full weight bearing afterward. Postoperatively assessment of all patients was done in follow up visits at 2 weeks, 4 weeks and then monthly for three months and at six months intervals for 2 years. On each follow up visit patients were evaluated; x-ray images were obtained and fracture assessment was done. At the end of 2 years follow up assessment of functional outcomes using Harris Hip Score (HHS) were done (Table **1**). The HHS [19] is to measure the functional deficit of hip so the higher the score, the better the outcome for the patient. Results can be recorded and calculated online. The maximum possible score is 100.

STATISTICAL ANALYSIS

A pre-structured design proforma was used for enrolments of patient's data. SPSS version 20.0 was used for statistical analysis of data. For quantitative variables, the mean and standard deviation were applied while frequencies and percentages were calculated for qualitative variables. The Chi square test and the student t-test were used to compare the qualitative and quantitative variables, respectively. Statistical significance level was kept as $p<0.05$. Presentation of result was kept in tabulated form where possible.

RESULT

There was total no of 88 patients with mean age of 33.96¬±9.63 in our study (Table **2**, Fig. **1**). These include male patients 66 (75%). Left sided limb was fractured in 51 patients (58%) (Table **3**). Most of the fractures were type 2A in 40 patients (45.5%) while least common were type 1A in 5 patients (5.7%) (Fig. **2**). Majority of the fractures in 67 patients (76.1%) were due to road traffic accident (RTA) (Table **2**). Body mass index of patients ranges from 22 to 29 with mean of 25.17. Fracture union achieved in 12 to 20 weeks' time with a mean of 15.5 weeks (Table **4**). Functional outcome in terms of Harris hips score range from 64 to 94 with a mean of 83.87 ±7.27 SD (Table **5**). Excellent functional outcome were observed in 13 patients (14.8%), good results in 57 (64.8%), fair result seen in 10 patients (11.4%) and poor outcome were observed in 8 patients (9.1%) (Figs. **3**, **4**).

Table 1. Haris Hip Score.

Question			**Score**
1.	**Please Describe any Pain in Your Hip**		
	A.	No pain	44
	B.	Slight pain or occasional pain	40
	C.	Mild, no effect on ordinary activity, pain after unusual activity, uses aspirin or similar medication	30

Continue

Continue

	D.	Moderate pain that requires pain medicine stronger than aspirin/similar medications. I'm active but have had to make modifications and/or give up some activities because of pain	20
	E.	Marked or severe pain that limits activity and requires pain medicine frequently	10
	F.	Totally disabled-wheelchair or bed ridden	0
2.	**Amount and Type of Support Used**		
	A.	None	11
	B.	Cane for long walks	7
	C.	Cane all the time	5
	D.	2 Canes	2
	E.	1 Crutch	3
	F.	2 Crutches or walker	0
	G.	Unable to walk	0
3.	**Limp. This Should be Judged at the End of a Long Walk using the Type of Support Chosen in Question 2.**		
	A.	None	11
	B.	Slight	8
	C.	Moderate	5
	D.	Severe	0
4.	**Distance that You can Walk. This should be Judged with the Aid of a Support if you use One**		
	A.	Unlimited	11
	B.	5–6 blocks	8
	C.	1–4 blocks	5
	D.	In the house only	2
	E.	Unable to walk	0
5.	**Climbing Stairs**		
	A.	Normally	4
	B.	Need a banister or cane or cratch	2
	C.	Must put both feet on each step/severe trouble climbing stairs	1
	D.	Unable to climb stairs	5
6.	**Shoes and Socks**		
	A.	Can put on socks and tie a shoe easily	4
	B.	Can put on socks and tie a shoe with difficulty	2
	C.	Cannot put on socks and shoes	0
7.	**Sitting**		
	A.	Comfortable in any chair	5
	B.	Comfortable only in high chair, or can sit comfortably for only 0.5 hour	3
	C.	Cannot sit for 0.5 hour because of pain	0

Table 2. Demographic Values Descriptive Characteristics of Patients (n=88).

Parameter		**Frequency/ Percentage**
Gender	Male	66 (75%)
	Female	22 (25%)
Male to Female Ratio		3:1
Age		33.96years±9.63SD
Body mass index		22 to 29±25.17
Fractured Limb	Right Side	37(42%)
	Left Side	51(58%)
Mechanism of Injury	Road Traffic Accident	67(76.1%)
	Fall on Ground	21(23.9%)

Table 3. Quartile Grading Scale for Harris Hip Score.

Improvement Level	**Score**
Excellent	90-100
Good	80-90
Fair	70-80
Poor	<70

Table 4. Outcome of Subtrochanteric Femur Fracture with DCS.

Characteristics	**Frequency/Percentages**
Union time	15.54 weeks ± 1.39 SD
Harris Hip score	83.87 ±7.27 SD

Table 5. Gender and Functional Outcomes of Subtrochanteric Femur Fractures Fixed with DCS on the Basis of Age Groups (n=88).

Age Group	**Functional Outcome Scores**				**Total**
	91-100	**81-90**	**71-80**	**<70**	
20-30years	7 (7.95%)	26 (29.54%)	5 (5.68%)	1 (1.13%)	39 (44.31%)
31-40years	5 (5.68%)	20 (22.72%)	2 (2.26%)	3 (3.39%)	30 (34%)
41-50years	0	6 (6.81%)	1 (1.13%)	1 (1.13%)	8 (9.09%)
51-60years	1 (1.13%)	5 (5.68%)	22 (25%)	3 (3.39%)	11 (12.5%)
Total	13 (14.76%)	57 (63.76%)	10 (11.35%)	8 (9.08%)	88 (100%)
Chi-Square=9.63; p=0.38 Linear by Linear Association=6.11p=0.013					

Gender	**Functional Outcome Scores**				**Total**
	91-100	**81-90**	**71-80**	**<70**	
Male	10 (11.36%)	43 (48.86%)	9 (10.22%)	4 (4.54%)	66 (75%)

Continue

Continue

Female	3 (3.4%)	14 (15.90%)	1 (1.13%)	4 (4.54%)	22 (25%)
Total	13 (14.76%)	57 (63.76)	10 (11.35%)	8 (9.08%)	88 (100%)
Chi-Square=3.89 p=0.38					

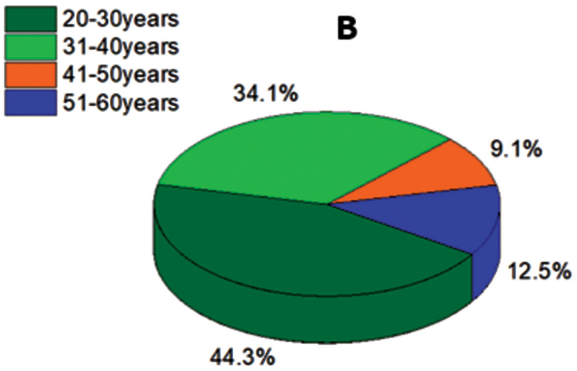

Fig. (1) Age of Patients.

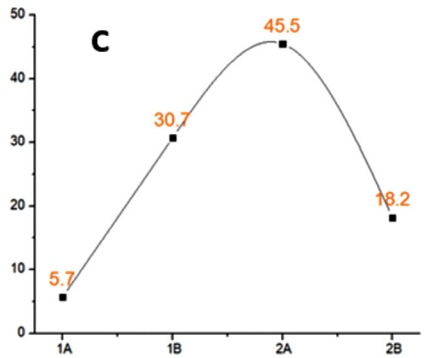

Fig. (2). Fracture Type OA(C).

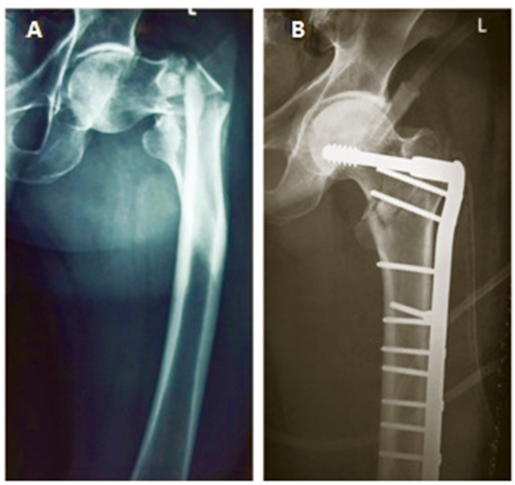

Fig. (3). Pre-op & Post-op x-rays of 49 Years Old Female Patient (A, B).

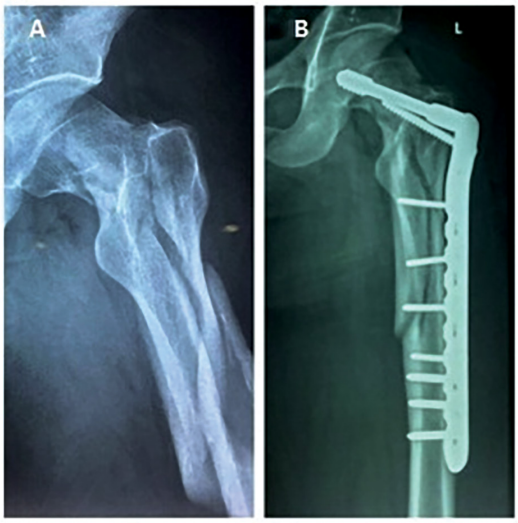

Fig. (4). Pre-op & Post-Op x-rays of 37 Years Male (A, B).

DISCUSSION

Sub-trochanteric femur fractures require special consideration due to the high complication rate as the postero-medial and medial cortices of this region experience the most compressive loads, whereas the lateral cortex experiences the highest tensile stresses [20]. Proper implant selection and anatomical reduction is crucial for better outcome. Dynamic condylar screw (DCS) is a good choice for sub-trochanteric fracture fixation because the chances of stress failure are very little, shorter operative time, decrease blood loss and high union rate [12].

In our study, we included patients with acute sub trochanteric femur fracture both male and females having age 20 to 60 years. Mean age of the patient included in study was 33.96years which is quite different from other studies where mean age of the patient is 58.23. The reason is that we have included patients that are less than 60 years whereas in other study all age groups were included. Male predominance in both studies is similar [21]. Male to female ratio in our study is 3:1 whereas this is 2:1 in a similar study done in Karachi. Reason is that females in this particular area are mostly restricted to homes whereas males are involved mostly in outside laborer activities at heights and driving making them susceptible to high energy trauma. Regarding mechanism of injury road traffic accident is the leading cause of sub trochanteric femur fracture in our study responsible for 76.1% cases followed by history of fall which is 23.9%, these numbers are quite high in comparison to studies done in other parts of countries that is Karachi where 53.16% sub trochanteric femur fractures are due to road traffic accident and 46.84% are due to history of fall. This difference may be attributed to increased incidence of road traffic accident because the roads are dangerous, bumpy and most of the tourists are not familiar with it. Left sided limb was fractured in majority of the patients that is 58% and right side in 42% which are quite similar to previous study where left sided limb was fractured in 59.49% cases and right in 40.51%. However, some studies have reported that right

limb is involved in most of the cases [22].

Regarding the functional outcome which is determined using Harris hip score we achieved excellent functional outcome in 13(14.8 %), good in 57(64.8%), fair in 10(11.4%), and poor results in 8(9.1%) which is similar to other studies where they achieved 82% acceptable outcome2. Out of these 8 patients with poor outcome two patients developed loss of knee flexion due to immobility of the limb in fear of re fracture of the limb. Three patients developed deep surgical site infection which was managed through surgical debridement and IV antibiotics while one patient need implant removal. Similar results are reported in study done in Iraq where they achieved excellent results in 30%, good in 40%, fair in 15% and poor in 10% cases [23]. Mean Harris hip score in our study was 83.8 which is comparable to study done in CMH Lahore where mean Harris hip score reported is 88 both of which fall in good functional outcome [24].

Study done by Shazly S. Musa on biological fixation of sub trochanteric femur fractures using DCS shows similar male to female ratio that is 2:1. Mean age of the patients enrolled in study was 33years. In terms of outcome excellent functional outcome reported in 75%, good in 17%, fair in 4% and poor in 4%. Fracture union was achieved in 4.6months. Similar complications like wound infection, loss of knee flexion anterior cut out of lag screw were reported. These results and complications are quite consistent with our study. The small difference in terms of functional outcome may be due to small sample size which is 24 [25]. Study conducted by shah SN, has similar outcomes compared to our study where he reported excellent functional outcome in 50%, good in 30%, fair in 15% and poor in 5% cases [19].

CONCLUSION

Subtrochanteric femur fractures are quite challenging and most of the time are unstable, dynamic condylar screw is cost effective, avoiding extensive soft tissue dissection and easy to insert. DCS results are excellent and good functional outcome in majority of patients. Therefore, it can be used as a good alternative to other intra and extra medullary implants fixation.

AUTHORS' CONTRIBUTION

- **Hidayatullah**: Proposed topic, Manuscript and Quality insurer.
- **Muhammad Inam**: Statistical analysis, Interpretation of result and Referencing.
- **Muhammad Tariq**: Data collection, Literature review.
- **Muhammad Jamil**: Basic study design, Methodology.

CONFLICT OF INTEREST

Declared none.

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