

## Subtrochanteric Fractures Treated With Dynamic Condylar Screw

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### Abstract

**Objectives:** To assess the functional outcome of dynamic condylar screws to treat subtrochanteric fractures in adult patients.

**Methods:** The prospective descriptive study was conducted at the department of orthopedic surgery, Dr. Ruth KM Pfau civil hospital Karachi, Pakistan, from March 2016 to October 2019. A total of 47 patients of 18 to 60 years of either gender with subtrochanteric fractures treated with dynamic condylar screw were included in the study. After consent and counseling, patients were operated on by a consultant orthopedic surgeon and fixed with a dynamic condylar screw. Postoperatively patients were regularly followed at 2nd, 6th, 12th, 16th, 20th weeks, and onwards monthly for at least one year. Functional outcomes such as infection, union, failure of fixation were observed in all patients. SPSS software version 23 was used to analyze data. Mean and SD was reported for numeric variables, whereas frequency and percentage were reported for categorical variables. A Chi-square test was used to assess the association between variables.

**Results:** The mean age was estimated as 37.53±12.31 years. Most of the patients were male (74.5%), and 25.5% were females. About 27 patients had a fracture on the right side (57.4%) and 20 on the left side (42.6%). Out of 47 cases, 3 were lost to follow-up, 33 patients showed excellent outcomes, 6 cases had a good outcome, 3 cases had fair outcomes, and 2 cases had poor functional outcomes. During the follow-up, 42 cases showed union, 3 lost to follow-up, 1 died, and 1 patient had implant break. About 2 patients had infections in post-operative duration because of fracture.

**Conclusion:** Subtrochanteric femur fractures are challenging to operate, especially in our society where extensive trauma becomes more frequent. Dynamic condylar screws showed overall acceptable results. It is simple, locally made, readily available, and cheap, with almost the same result as other implants around proximal femur fractures.

**Keywords:** Dynamic condylar screw, fracture, functional outcome, subtrochanteric fracture, union.

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### Introduction

The subtrochanteric femur is one of the most challenging regions to operate because of its diverse cortical bony region, limited vascularity, delayed healing, site for pathological fracture, and stressed area<sup>1</sup>. Subtrochanteric fractures are unstable, accounting for 7% to 34% of all hip fractures<sup>2</sup>.

Subtrochanteric fractures were seen in nearly the same percentage of males and females. Evidence showed that 7% of the patients with atypical subtrochanteric femur fractures were exposed to the bisphosphonate alendronate<sup>1,2</sup>. Over 25% of elderly people with subtrochanteric femur fractures die each year<sup>2</sup>.

The majority of hip fractures in adults over 60 years old occur due to low-energy trauma, such as minor falls during every day physical activity<sup>3</sup>. Furthermore, as people become older, fixation of these fractures is more prone to fail, become mal-united, or go into non-union owing to osteoporosis<sup>3,4</sup>. On the other hand, in younger people, high-energy trauma like falls, sports injuries, firearm injuries, and road traffic accidents causes such fractures<sup>5,6</sup>.

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Internal fixation failure has a poor prognosis and increases the duration of stay in the hospital and healthcare expenses<sup>5,6</sup>.

The treatment of subtrochanteric fractures presents a challenge to an orthopedic surgeon. The fracture is difficult to reduce using the non-operative treatment and operative treatment<sup>7</sup>. The non-operative treatment gives satisfactory outcomes in only 56% of the patients, whereas operative treatment provides satisfactory outcomes in up to 80% of the patients<sup>8</sup>. Before 1970, non-operative treatment was the treatment of choice for distal femoral fractures because of the availability of implants and new techniques. Problems associated with non-operative management include confinement of the patient to bed, malunion, knee stiffness, and non-union. On the contrary, conservative management facilitates care of the soft tissue allows relatively easy nursing care and early mobilization.

Two causes might induce slow union in the subtrochanteric femur region. To begin with, this region is primarily made up of cortical bone, which is comminuted and has limited vascularity. Second, the biomechanical stresses in this area increase the chances of implant failure before the union. Extramedullary devices (such as the 95 blade plate or the dynamic condylar screw) and intramedullary devices are used to treat subtrochanteric fractures (like reconstruction nail, proximal femoral nail, gamma nail, and Russel Taylor nail). Intramedullary implants provide less surgical exposure, produce less biomechanical stresses, allow for early weight-bearing, and improve proximal fixation. The A.O dynamic condylar screw, on the other hand, provides excellent fixation in the cancellous bone of the head and neck, as well as good rotational stability<sup>9</sup>.

The dynamic condylar screw is a low-cost implant readily available in the local market, and its sturdy and dynamic design makes it favorable for patients with subtrochanteric femur fractures<sup>10</sup>. In Pakistan, subtrochanteric fractures in adult patients are common, and no specific recommendations are made for this type of unstable and difficult fracture<sup>9</sup>. Therefore, the goal of this study was to determine the rate of union and complications associated with dynamic condylar screws

in subtrochanteric femur fractures.

### **Material and Methods**

The descriptive cross-sectional study was carried out in the department of orthopedic surgery, Dr. Ruth KM Pfau civil hospital Karachi, Pakistan, from March 2016 to October 2019. The sample size of 47 was calculated using the Open Epi online sample size calculator by taking statistics of union rate as 90% among patients with dynamic condylar screw<sup>11</sup>, the margin of error as 8.4%, and 95% confidence level. Patients of 18 to 60 years of either gender with subtrochanteric fractures treated with dynamic condylar screw were included in the study. Patients with old fractures, nonambulatory, not fit for surgery, and open fractures were excluded from the study. Non-probability consecutive sampling technique was applied.

The study was conducted after taking approval from the ethical review committee. Verbal informed consent was obtained from all the eligible participants. Patients were admitted through the emergency department. X-ray was performed in all the patients to diagnose and classify fracture. All patients were placed on a traction table after consent and counseling under general and spinal anesthesia for surgical intervention, with lateral incision skin, subcutaneous tissue, fascia lata dissected, vastus lateralis, and trochanteric ridge and abductors of hip identified. The fracture was discovered after the vastus lateralis was elevated from the femur. The anteversion guide wire was initially passed in the femur neck, followed by the jig of dynamic condylar screws at a 95-degree angle. The length of the screw was measured after the wire was confirmed in the best location on the anterior-posterior and lateral views with the C-arm. Reaming was done over the guiding wire. Following the tapping, the screw was inserted. The fracture was minimized using a side plate of adequate size that included at least four-plus screws below the fracture line. The 4.5 mm cortical screws were used to fix the plate. The incision was cleaned, a drain was placed, and the wound closed in layers. At two weeks, the stitches were removed.

All patients were operated on by consultant orthopedic surgeon. Patients were kept in the orthopedic ward for two days and then discharged with analgesics, oral

antibiotics, and calcium supplements. Patients were followed monthly for at least a year after surgery at 2<sup>nd</sup>, 6<sup>th</sup>, 12<sup>th</sup>, 16<sup>th</sup>, 20<sup>th</sup>, and 30<sup>th</sup> weeks in the out-patient department. At each visit, an x-ray was obtained, and the fracture was evaluated. Infection, union, and fixation failure were observed in all patients. On a pre-designed proforma, data on age, gender, mechanism of injury, side of fracture, kind of subtrochanteric fracture, and outcomes were noted by the researcher himself.

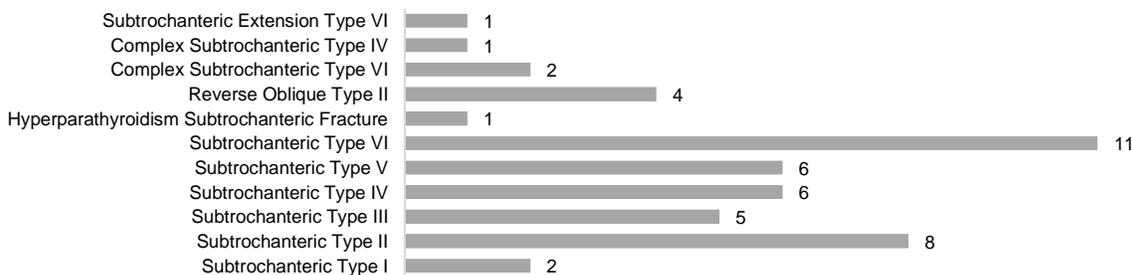
Data was entered and analyzed using a statistical package for social sciences (SPSS) version 23.0. Mean and SD was reported for a numeric variable like age. Frequency and percentage were reported for categorical data like gender, mode of injury, fracture site, type of subtrochanteric femur fracture, functional outcome, and complications. Chi-square/Fischer exact was used to assess the association between outcomes and age, gender and type of fracture. A p-value ≤ 0.05 was taken as statistically significant.

**Results**

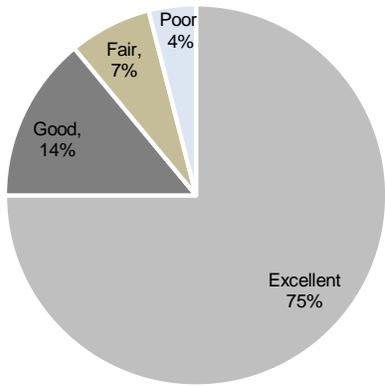
Total 47 patients with subtrochanteric fractures were included in the analysis. The mean age was estimated as 37.53 ± 12.31 years ranging from 18 to 60 years. Most of the patients were males (n=35, 74.5%) and 12 were females (25.5%). The majority of the injuries (n=41, 87.2%) were due to road traffic accidents (RTA) and six injuries were due to falls (12.7%). About 27 patients had a fracture on the right side (57.4%), and 20 had a fracture on the left side (42.6%), respectively.

About 23.4% had subtrochanteric fracture type 6 followed by Subtrochanteric fracture type 2 (17%), subtrochanteric fracture type 4, and 5 (12.8%), respectively (Figure 1). In all cases, dynamic condylar screw (DCS) fixation was performed. Out of 47 cases, 3 lost to follow (LFU), 33 patients showed excellent outcomes, 6 cases had a good outcome, 3 cases had fair outcomes, and 2 cases had poor functional outcomes (Figure 2). During the follow-up, 42 (100%) cases showed union, 3 LFU (7.1%), 1 died (2.4%), and 1 patient (2.4%) had implant break, respectively. About 2 patients had an infection in post-operative duration because of fracture.

In the age group less than and equal to 40 years, 26 cases showed union, 1 patient lost to follow-up, and 1 implant break, respectively. In the age group older than 40 years, 16 cases showed union, 2 patients lost to follow-up, and 1 patient died, respectively. There was no case of non-union in both age groups. Among males, 32 cases were of union, 1 patient lost to follow-up, 1 patient died, 1 lost to follow-up, and 1 implant break, respectively. Among females, 10 cases were of union, 2 patients lost to follow-up, 1 patient died, and 1 implant break, respectively. In patients with the right side of the fracture, 23 patients showed union, 2 lost to follow-up, 1 died, and 1 implant broke, respectively. In patients with the left side of the fracture, 19 patients showed union, 1 patient lost to follow-up, no patient died, and no implant break. There was no statistically significant difference observed between outcomes concerning age, gender, and fracture site (p>0.05) (Table 1).



**Figure 1:** Distribution of subtrochanteric fractures.



**Figure 2:** Functional outcomes of dynamic condylar screw.

**Table 1:** Stratification of outcomes concerning age groups, gender, and side of the fracture.

Variables	Outcomes				P-value	
	United	Lost to Follow-Up	Died	Implant Break		
Age						
Group	≤ 40 yr.	26	1	0	1	0.519
	> 40 yr.	16	2	1	0	
Gender						0.543
	Male	32	1	1	1	
	Female	10	2	0	0	
Site						0.999
	Right	23	2	1	1	
	Left	19	1	0	0	



**Figure 3:** (A) Comminuted subtrochanteric fracture. (B) After fixation with dynamic condylar screw.

**Discussion**

There has been no consensus on the optimal implant for treating subtrochanteric fractures up to this point, and several implants have been utilized with good functional and radiological results<sup>12</sup>. Due to tension, compression, and torsional pressures, as well as decreased vascularity in the subtrochanteric area, orthopedic surgeons have struggled with non-union and malunion<sup>13,14</sup>. In addition, blood loss in these fractures is larger than in intertrochanteric or neck femur fractures<sup>13,14</sup>.

Following subtrochanteric fractures, poor functional outcomes and implant failure are relatively common<sup>15,16</sup>. As a result, a dynamic condylar screw is more convenient to use than a condylar blade plate. It enables the fractured extremities' proper transitional and axial alignment without causing comminuted fracture fragments to lose their vascularity<sup>13,15,16</sup>. Hence, we have evaluated the outcomes of the dynamic condylar screw in patients with subtrochanteric fractures.

Most of the patients with subtrochanteric fractures had a satisfactory functional outcome of the dynamic condylar screw. We observed nearly 75 % of patients showed excellent functional outcomes, and 14% showed good results. A study conducted by Rohilla et al. treated 43 patients with comminuted subtrochanteric fracture patients using indirect reduction and mini-incision dynamic condylar screw fixation. They found favorable results in most of the patients, i.e., 12 patients had an excellent outcome, and 31 patients had a good functional outcome. Furthermore, no cases of avascular necrosis and deep infection of the femoral head<sup>17</sup>. A study at Sohag University showed that dynamic condylar screw plate is a beveled implant with 23 (96%) patient fracture united and one implant failure<sup>18</sup>. Vijay et al. conducted a comparative study of dynamic hip screw fixation and dynamic condylar screw for hip fracture. They found a statistically insignificant difference in functional outcome between both techniques<sup>19</sup>. Results of the meta-analysis by Kuzyk et al. revealed that intramedullary implants decrease the operative time and the failure rate of the implant compared to extramedullary implants<sup>13</sup>. Vashisht D et al. conducted a randomized trial in which they compared 95° angle blade plate fixation (n=15) and dynamic condylar screw fixation (n=15) for the treatment of subtrochanteric fractures. They observed that radiological union was achieved in 14 patients treated with dynamic condylar screw fixation between 12-16 weeks and 13 patients treated with 95° angle blade plate fixation between 14-18 weeks. Few patients needed bone grafting to avoid implant failure.

Furthermore, the proportion of satisfactory functional outcomes was significantly higher in dynamic condylar

screw fixation as compared to 95° angle blade plate fixation (93.33% vs. 66.66%)<sup>20</sup>. However, in the current study, we have not used bone graft in acute cases of subtrochanteric fracture. The overall prognostic factors of subtrochanteric fracture rely on the fracture type, location, and physical condition of the patient: the more co-morbidities and communication, the more morbidity of the patient<sup>13</sup>.

Kahle et al. treated 19 subtrochanteric fractures with dynamic condylar screw and cancellous bone graft with encouraging results<sup>21</sup>. In the study by Kim et al., 31 comminuted fractures reduced indirectly by preserving the biology of fracture, resulting in 28 unions and three implant failure<sup>22</sup>. Compared to this study, we also followed the principle of preserving the fracture biology by bridging the fracture that ultimately unites the fracture. Ashraf et al., published a review on subtrochanteric fracture mentioned high failure rate with dynamic condylar screw and varus collapse, especially in comminuted and medial wall bone deficient fractures<sup>23</sup>. Our study contradicts the previous study, as we have an excellent outcome in most cases. Another study conducted at LUMHS revealed 93.5% fractures united with a dynamic condylar screw. Implant failure was found in 6.3% of the patients, 5% developed an infection, and 6.3% developed varus deformity. However, they achieved good to excellent functional outcomes in 81% of the cases<sup>24</sup>.

Vaidya et al., in their study, found 28 young patients of age 20 to 40 years with subtrochanteric femoral fractures treated with dynamic condylar screw had 100% union within 4.9 months<sup>25</sup>. However, in the current study, age does not impact the union rate. In the current study, 31 sliding submuscular plating technique was used to preserve the fracture hematoma and maintain the fracture biology. We found all fractures fixed with dynamic condylar screw were united (100%). In 23 cases, we have not used this technique of MIPO or submuscular plating. The dynamic condylar screw is used in subtrochanteric pathological fractures with bone cement where needed. About 50% of implants failed, 8 plate breaks, and 2 screws cut out. So, the dynamic condylar screw should be used judiciously in pathological fractures. We also used cement in pathological fracture secondary to hyperparathyroidism, which also showed

excellent results.

A few limitations of our study were that it has a small sample and is based in a single center. We did not compare the functional outcome of other intramedullary and extramedullary implants. In the future, more comparative studies should be conducted, including a larger number of patients and hospitals, to increase the generalizability of findings.

### Conclusion

Subtrochanteric fractures are difficult to operate, especially in our society, where extensive trauma has become more frequent. Dynamic condylar screws showed overall acceptable results. It is simple, locally made, easily available, and cheap, with the almost same result as other implants around proximal femur fracture.

### Conflict of Interest

Authors have no conflict of interest and no grant/funding from any organization.

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