



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2017; 3(1): 351-355
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www.orthopaper.com
Received: 22-11-2016
Accepted: 23-12-2016

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Outcome evaluation of dynamic condylar screw fixation for subtrochanteric femur fracture

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DOI: <http://dx.doi.org/10.22271/ortho.2017.v3.i1f.52>

Abstract

Objective: To study the results of dynamic condylar screw DCS (Dynamic condylar screw) fixation for subtrochanteric femoral fractures.

Materials and Methods: This study included 34 males and 6 female patients with age ranging 21 to 80 years (mean 48.85 year) who presented with closed subtrochanteric femur fractures. All the patients underwent fracture reduction on a standard orthopedic traction table under C-arm guidance and this was followed by fixation with dynamic condylar screw. Functional outcomes were assessed using the modified Harris hip score.

Results: The average time to weight bearing was 15 weeks. (Range 12-18 weeks). The mean time to union was 16.3 weeks. The complication included superficial infection, implant failure and limb length discrepancy. According to the modified Harris hip score, functional results were excellent in 50% of patients and good in 30% of patients, whereas two patients showed poor result. The mean Harris hip score was 84.

Conclusions: Our results of DCS fixation for Subtrochanteric femoral fractures indicated that it is a satisfactory method of fixation which gives favorable outcome. Minimal stripping of the soft tissues and gentle fragmentary manipulation intra operatively is of paramount importance for good fracture healing and functional outcome.

Keywords: Dynamic condylar screw, modified harris hip score, subtrochanteric femur fracture

1. Introduction

Subtrochanteric fractures of the femur present considerable challenge in management. Despite improvement in patients care and operative technique, it account for significant amount of health care expenditure and hence possess an important economic and social impact. Looking forward to high profile life of the twenty first century, there is an over increasing transport, along with an increasing number various accidents and also an overall increase in the fracture incidences in humans. Subtrochanteric fractures, a variant of peritrochanteric fractures/proximal femoral fractures have been reported to 10-30% of proximal femoral fractures. They have bipolar age distribution with different mechanism of injury in each group.

In elderly the etiology of the subtrochanteric fractures is the combination of increased bone fragility of the subtrochanteric area of the femur associated with decreased muscle tone of the muscles in the area secondary to the aging process. The increasing bone fragility results from osteoporosis secondary to lack of adequate ambulation, antigravity activities, decreased hormone levels, decreased intake of calcium and vitamin D. The combination of increased fragility of the bone and a traumatic event may result in either a direct impact or generation of a force transmitted through the leg to the subtrochanteric area when such forces are greater than the strength of the bone in the subtrochanteric area, a fracture occurs. Constant in their occurrence and providing difficult in management, they frequently involve consequences serious and disastrous to the patients and many a time to the surgeon also. These fractures pose difficulty in management because of following reasons:

1. High stress concentration in the subtrochanteric area.
2. Varying degree of comminution, making maintenance of reduction and fixation difficult.
3. Slow healing time because of predominance of cortical bone.

- 4 Long period of immobilization, increasing morbidity effecting patient, socially, economically and psychologically.
- 5 Increased duration and magnitude of surgery, increased blood loss and higher incidence of post-operative complications.
- 6 Uncertainty in surgical technique because of complexity of fracture configuration poses a challenge to the surgeon himself.

Operative treatment remains mainstay of management of this fracture. The rationale of operative treatment of subtrochanteric fracture should be to obtain adequate reduction, achieve stability and to provide adequate fracture fixation. The final aim of treatment remains early union in anatomical position with early, active, pain free mobilization and the patient returning to his routine activities at the earliest. With operative treatment there is constantly changing trend of choosing ideal implant. No single implant is universally recommended for the internal fixation of these fractures. From last century, subtrochanteric fractures are being treated with wide range of different implants; intramedullary implants like proximal femoral nail, Russell Taylor nail, zickel nail, Ender's nail, gamma nail and extra medullary implant like plate and hip screw.

Intramedullary implants although require less surgical exposure, enable early weight bearing, achieve better proximal fixation are less capable to bear biomechanical stresses exerted during healing phase of such fractures (as the lever arm is moved medially). They are not very suitable for subtrochanteric fractures with an intertrochanteric extension, where condylar screw or condylar blade fixation achieved better results. Dynamic hip or sliding hip screws are technically straight forward, but anchoring the proximal fragment cannot be supplemented with screws and on weight bearing the lateral drift of the proximal fragment leads to construct failure and nonunion. Here the dynamic condylar screw which exerts vertical forces on weight bearing is a better option as it provides strong fixation in the cancellous bone of the neck and head with considerable rotational stability. In our study we have reviewed our results retrospectively using DCS fixation for subtrochanteric femoral fractures and tried to evaluate its efficacy first hand in our setup.

2. Materials and Methods

We evaluated the functional outcome of subtrochanteric fractures treated with dynamic condylar screw in 40 patients from March 2014 to February 2016 at tertiary care hospital.

Each patient with injury around Hip Joint was reviewed in emergency department and examined thoroughly including general, local and systemic examination to rule out any Head, Abdominal, Chest, Pelvic injuries and associated injuries if any. X-ray pelvis with both Hips with affected hip AP was taken to assess the fracture pattern. In necessary cases CT scan with 3-D reconstruction hip was done.

Fractures were evaluated by X-rays and classified according to AO classification to assess the stability of fracture. All patients were admitted and temporary immobilization was given in form of proximal tibial skeletal traction by Steinmann-pin under local anesthesia and limb was suspended on a Bohler's splint in 45 degree of abduction at hip, with weight equal to 10 lbs. Necessary investigations for surgical fitness were conducted.

Pre-operatively plate length, caput-collum-diaphyseal angle (CCD angle) and desired length of the screws were measured from radiographs of the opposite limb. After giving spinal or

epidural anesthesia, supine position was given to the patient on a traction table. All patients were given a dose of preoperative intravenous antibiotic.

We used posterolateral approach to the subtrochanteric region. A guide pin was placed on the anterior surface of the femoral neck to determine the anteversion. Another guide pin was inserted across the femoral neck, with due consideration paid to the degree of anteversion and the fixed angle of the implant, such that the tip of the guide pin was seated 2 cm short of the articular surface in the lower half of the femoral head. An appropriate length condylar screw was then applied over the guide.

The condylar screw was engaged in the subchondral bone of the lower quadrant of the femoral head. A suitable side plate was applied after attempting anatomic reduction. At least four screws were applied distal to the main fracture. Minor fragments were lagged in an attempt to restore medial bone support. Bone grafting was carried out in cases of severe posteromedial comminution in Type A and B fractures where it was not possible to hold the posteromedial area with screws in spite of the anatomical alignment. The focus was on obtaining the length, mechanical and rotational alignments. Correct alignment and rotation were checked intraoperatively using C-arm guidance. The length, axial alignment and rotation, were checked again using clinical assessment. The incision was closed over a negative suction drain.

Postoperatively, intra-venous antibiotics were given to all patients for 6 days followed by oral antibiotics till suture removal (usually on 12th or 14th post-operative day). Patient was taught static quadriceps exercises, knee bending exercises and high sitting exercises as tolerable in the postoperative period. According to stability of fixation, postoperative non weight bearing or partial weight bearing crutch walking was started.

First follow-up was after 4 weeks and thereafter patient was reviewed at every 4 weeks. Patient was examined clinically (operated site, range of motion, deformity, shortening etc) and radiographically (status of union, position of implant etc) as per the predefined Performa. The results were rated on the basis of Modified Harris Hip Score as - excellent, good, fair and poor results.

3. Results

In Our study, patient's age varied from 21 to 80 years but majority of patients (65%) were from 41-70 yrs. In our study 34 (85%) patients were male [M: F = 5.6:1]. In our study 50% patients were laborer by occupation. In our study left side was affected more (60%) than right side (40%). In our study Road traffic accident (50%) was major mode of injury followed by fall while walking (35%). Type B-2 fracture (30%) was commonest type of fracture in our study. Associated injury was present in total 25% of the patients majority of which was due to vehicular accident. Hypertension was found to be most common associated medical disease in our study (20%). All patients had closed fracture in our study.

Majority (80%) patients were operated under spinal anesthesia; only 8 patients in whom more operative time was anticipated, epidural anesthesia were used. Majority (75%) of our patients got admitted within 24 hours of injury. Majority of patients were operated between 5-10 days after injury at our setup. 3 patients were operated after >10 days. One patient had superficial wound infection in the early postoperative period which was controlled with antibiotics without any need of debridement. Two patients had implant related complications due to premature weight bearing.

In majority patients (65%) longer plates (more than 7 holes) was required. 70 mm condylar screw was most commonly used. Majority (60%) of patients had a hospital stay of 1-2 weeks. Majority (35%) of patients had union time of around 16-20 weeks, while 30% of patients had early union time (12-16 weeks). Majority (60%) of patients had slight pain at final follow up while 1 patient had moderate pain at final follow up due to pre-existing osteoarthritis of hip. Majority (55%) of patients were able to walk without support at final follow up while 25% of our patient required cane for long distance walking. Majority (70%) of patients were able to climb stairs without using a railing at final follow up. Majority (80%) of patients were able to wear foot wear with ease on their own at final follow up. Majority (95%) of patients were able to enter public transport at final follow up.

Majority (85-90%) of patients had good hip range of motion without any significant deformity. 75% of our patients were able to sit cross-legged. 1 patient with preexisting osteoarthritis of hip had fixed flexion deformity of 20° with global restriction of hip movements (was advised implant extraction and secondary procedure in form of Total Hip Replacement). One patient had 3.5 cm limb length discrepancy, because he started premature weight bearing post-operatively and had bending of plate with coxa-vara (<100°-109°) deformity and one patient (5%) who started premature weight bearing and had re-trauma leading to plate backout and screw breakage (both of them underwent revision Dynamic condylar Screw fixation). 10-15% patients had difficulty in squatting due to restricted hip range of motion.

In majority of patients (80%) normal neck shaft angle was maintained (120-135°) while 15% of patients had neck shaft angle of 110°-119°. Majority of patients (80%) had excellent (50%) to good (30%) results at final follow up while 15% of patients had fair results. 2 patients (5%) in our study had poor results. The mean modified Harris hip score was 84.

4. Discussion

Subtrochanteric fractures of the femur demand a special consideration in orthopaedic traumatology, given the high rate of complications associated with their management biomechanically. There is a high stress concentration in subtrochanteric region and high degree of comminution makes reduction and fixation of such fractures a difficulty, which in turn is responsible for high incidence of complications in treatment of these fractures.

Nonoperative treatment for such fractures is only indicated in the paediatric age group where the potential of union is excellent if managed on conservative note, or for those adult patients who are unfit for anaesthesia for a variety of reasons. Healing in such fractures is highly dependent on the degree of vascular insults to the bone.

Primary goal of subtrochanteric fracture treatment is to achieve rigid fixation and adequate union with optimal functional outcome. Operative success of fixation of these fractures depends on intra-operative care of factors like meticulous patient positioning on the traction table, and the precise manoeuvres in reduction. Avoiding over distraction in the fracture site is another important factor to ensure good fracture healing⁴. In absence of these measures, there is an increased risk of delayed union, infection, non-union, re-fracture, and implant failure⁵.

Several implants have evolved over time to manage this difficult fracture. When the intramedullary devices cannot be used for technical reasons, the dynamic condylar screw provides a reasonable alternative. Because of the familiarity of

most surgeons with the sliding hip screw techniques in the treatment of trochanteric fractures, the adaptation of condylar screw is enhanced. The position of the condylar screw makes it possible to stabilize the proximal fragment and hence the fracture with extra screws. Vertical fractures too can be effectively treated with DCS fixation⁶.

The recent advent of 95 degree angled side plate with a locking mechanism for the screw like locking compression plate (LCP) has further increased the effectiveness of DCS especially in the older osteoporotic patients⁷. Technically it is important to remember that a valgus reduction (=85°) is preferred to a varus reduction as the incidence of osteoarthritis is less⁸. Moreover the tip of the greater trochanter should point to the centre of rotation of the femoral head, remembering that the greater trochanter is eccentric in its relation to the femoral neck. Nungu *et al*¹¹. Felt that the DCS is able to tolerate bending loads well. They however recommended the reconstruction of a good medial support. Our study was based on the recommendations of Nungu *et al*¹¹, Radford *et al*¹², and Schatzker¹³.

The down side of procedure remains that DCS insertion in proximal femur has a slow learning curve. It is also important to avoid unnecessary soft tissue dissection and stripping which can be catastrophic in regards to a satisfactory fracture union and culminates in various complications⁹. Post-operative weight bearing must be strictly monitored as early implant loading in the face of inadequate new bone or callus formation is seriously dreaded with strong bending forces leading to implant failure.

In our study age varied from 24-75 years with an average age of 48.85 years. Older age group sustained low velocity injury whereas younger age group sustained high velocity injury. In the series of 31 patients undertaken by Elzohairy MM¹⁰ age distribution was 37-75 years with an average age of 53.5 years. We had more excellent results in the middle age group and good results in old age group was due to associated medical disease and general weakness which affected their final outcome.

We had 17 males and 3 females in our study. Men are working outdoor, involved in working at heights, driving and heavy labour makes them more susceptible to high velocity trauma. In the series by Elzohairy MM¹⁰, there were 21 males and 10 female patients. We got excellent results in both the sexes. We got fair and poor results in only male patients. In our study majority of patients had left 12(60%) side affected while only 8(40%) had right side affected, while in Elzohairy MM¹⁰ study 18 (58%) had right side affected while 13 (42%) had left side affected. In our study Road traffic accident (50%) was major mode of injury followed by fall while walking (35%). In the series conducted by Elzohairy MM¹⁰ all patients had history of high velocity trauma.

In our study, one patient (5%) with osteoarthritis of hip was advised implant extraction and Total Hip Replacement. One patient (5%) with plate bending due to premature weight bearing was advised for revision surgery. One patient (5%) who started premature weight bearing and had re-trauma leading to plate backout and screw breaking underwent revision plating.

While in the series conducted by Elzohairy MM¹⁰, One patient (3.2%) with cut through of the lag screw, was converted to cemented total hip arthroplasty, one patient(3.2%) with loss of fixation needed revision with proximal femoral nailing and one (3.2%) patient with bending of plate with coxa-vara and persistent limp refused further surgery and was satisfied with results.

Table 1

Complications	Elzohairy MM ^[10]	Our Study
Cut through	1(3.2%)	0
Plate bending	1(3.2%)	1(2.5%)
Cortical Screw breaking	0	1(2.5%)
Loss of fixation	1(3.2%)	0
Cortical Screw backout	0	1(2.5%)
Superficial infection	2(6.4%)	1(2.5%)

5. Complications

Most (80%) of our patients started partial weight bearing within 12 weeks and full weight bearing without support by 20 weeks except for 8 patients (20%) in which full weight bearing was further delayed by 4 weeks.

Table 2

Final Results	Elzohairy MM ^[10] Harris Hip Score	Our study Modified Harris Hip Score
Excellent	45.16%	50%
Good	32.25%	30%
Fair	12.90%	15%
Poor	9.67%	5%

6. Results

6.1 Conclusion

In conclusion, Dynamic Condylar Screw is a good option for unstable subtrochanteric femoral fractures giving good to excellent results at follow up with proper surgical technique and patient selection.

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