

Retrospective Study of Distal Femur Fractures Surgically Treated with Dynamic Condylar Screw

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Abstract

Despite the advances in techniques and improvements in surgical implants, treatment of distal femoral fractures remains a challenge. Anatomical reduction of articular surface, stable internal fixation with minimal soft tissue stripping, restoration of limb alignment, early mobilization and ambulation are the pre requisite for good results. Though locking plates appear very promising in these fractures, long term studies are needed. Dynamic condylar screw (DCS) with 95° barrel plate is well established method of treating these fractures. Twenty adult patients who had supracondylar and intercondylar fractures of distal 15 cm of femur treated with DCS were studied, all the twenty fractures united with the average time to healing was 15.6 weeks in, ranging from 12 weeks to 18 weeks. In 5 cases some residual deformity, 3 cases deep infection, five patients had quadriceps lag of less than 10°, three of them had ipsilateral lower limb associated fractures. Average knee flexion was 114°; range of flexion was from 100° to 125°. Six patients in this series had mild pain in the knee. Overall functional results were excellent in 8 (40%) patients, good in 6 (30%) patients, moderate in 3 (15%) patients and poor in 3 (15%) patients. In none of the cases we had loss of fixation or implant failure. DCS augmented with interfragmentary lag screws gives good results in intra articular distal end fractures of femur. Judicious use of bone grafting can reduce the risk of non union in severely comminuted metaphyseal fractures.

Keywords: Distal Femur Fractures; Dynamic Condylar Screw (DCS).

Introduction

Knee joint is more vulnerable for injuries in vehicular accidents. Travelling at high speeds in the position of flexed lower limbs with knee as leading edge will be the first to take the impact during collision.

Alternatively pedestrian injury, called as bumper fractures are around knee, since bumper of most of the vehicles are roughly at knee height. In elderly patients, fractures of distal end of femur may occur after a minor slip and fall on a flexed knee because of osteoporotic bones.

These fractures are complex injuries and have historically been difficult to treat. These fractures often are unstable and tend to occur in either elderly or in patients with poly trauma. Because of the proximity of these fractures to knee joint, regaining full knee motion and function may be difficult [1].

Distal femoral fractures are much less common than hip fractures and account for about 7% of all femoral fractures. Of hip are excluded, 31% of femoral fractures involve the distal portion [2].

With the improvements in surgical techniques and implants, there has been an unmistakable trend toward surgical management of these fractures. It is

now accepted by most orthopaedic surgeons that displaced distal femoral fractures are best treated with reduction and surgical stabilization [3].

There are various treatment options available for the management of these injuries. Despite the advances in techniques and improvements in surgical implants, treatment of distal femoral fractures remains a challenge. Anatomical reduction of articular surface, stable internal fixation with minimal soft tissue stripping, restoration of limb alignment, early mobilization and ambulation have been shown to be effective way of managing most distal femoral fractures [4]. Thin cortices, comminution, cancellous bone and a wide medullary canal make secure internal fixation difficult fragments, secure bone purchase with conventional screws may be compromised. Locking screws do not rely on bone/plate compression to resist patient load, but function similarly to multiple small angled blade plates. In osteopenic bone or comminuted fractures, the ability to lock screws into a fixed-angle construct is imperative. These are expensive implants and long term studies are needed to prove definitively acceptable outcomes. Although distal femur locking plate is designed to fit the anatomy of the distal femur, its fit in our local Asian population where shorter and smaller femurs are the Several studies reported favourable results using the dynamic condylar screw (DCS) [7,8,9]. This provides interfragmentary compression across the femoral condyles, better purchase of compression screw in osteoporotic bones and needs only 2 plane alignments.

In low supracondylar fractures the condylar screw may not provide rotational control of the distal fragment. In articular comminution, the fragments purchase may not be as adequate as in the locking plate & screws.

The present study was conducted to evaluate the results of surgical treatment of adult patients with distal femoral fractures in terms of fracture union, post operative reduction of the fracture, functional results and complications like infection, malunion, non union etc. concern and need further studies [5,6]. Norm is a matter of Disadvantages are the big incision and bulky size of the implant.

The surgical procedures using various implants including angle blade plate, Zickel device, Ender's nail, Rush pins and Intramedullary Supracondylar interlocking nails have advocated. The locking plate and screws used in recent studies are accepted as better fixation methods for for distal femur fractures. By using locking screws in a bone plate, a fixed-angle construct is created. In osteopenic bone or fractures with multiple.

Materials & Methods

This is a retrospective study conducted in our hospital between September 2015 and August 2017. Twenty adult patients who had supracondylar and intercondylar fractures of distal 15 cm of femur were selected for the study, all were fresh fractures, presenting within two days after injury. X-ray of lower half of thigh including knee joint antero-posterior and lateral views were taken and Muller's classification [10] was used. There were 3 cases of type A1, 6 cases of type A2, 2 cases of type A3, 2 cases of type C1, 5 cases of type C2 and 2 cases of type C3.

Patients with open wounds were graded according to Gustilo & Anderson [11] classification. There were 4 compound fractures, of which one was Gustilo's type I and 3 were Gustilo's type II. Wound was thoroughly cleaned with copious amount of normal saline and taken for debridement and primary fixation. The mode of injury was road traffic accident in all 20 patients. Associated injuries were present in 5 patients, were managed according to standard treatment protocol followed in our institution. Once the general condition of the patient was stabilized, definitive treatment was planned. The interval between injury and definitive treatment ranged from 1 day to 6 days.

The patient was placed supine on a radiolucent operating Table. Image intensifier was used. All the patients were operated under spinal anaesthesia. Sand bag was placed under the ipsilateral hip another rolled towel was placed under the knee. The injured limb was prepared and draped. Lateral approach to the distal femur was used; the articular fragments reduction was done and fixed with temporary K wires. Then condylar fragment reduced to the proximal fragment and fixed with DCS with 95° barrel plate and screws. Minimum of 8 cortices purchase was obtained in the proximal fragment. Often we had used one to two 6.5 mm cancellous screws to enhance the condylar fragments fixation. Very small articular fragments were fixed using 4 mm cancellous screws. In 6 cases of severe metaphysical comminution primary bone graft from ipsilateral iliac crest was used.

Most of the patients were discharged after 10 days of operation after suture removal. They were advised active range of movement exercise, non weight bearing ambulation with walker and quadriceps strengthening excersises. The patients were followed every four weekly with clinical and radiological examination. The duration of non weight bearing

ranged from 6 to 8 weeks. This was followed by partial weight bearing till the signs of radiological union were seen after which weight bearing was allowed. The average time to full weight bearing was 16 weeks.

The functional results were evaluated according to the Schatzker and Lambert criteria [12], which is as follows:

Excellent

Full extension, flexion loss less than 10°, no varus, valgus or rotatory deformity, no pain. Perfect joint congruity.

Good

Not more than one of the following: loss of length not more than 1.2cm, less than 10° varus or valgus, flexion loss not more than 20°, minimal pain.

Moderate

Any 2 of the criteria in good category.

Poor

Any of the following: flexion to 90° or less, varus or valgus deformity exceeding 15°, joint incongruity, disabling pain no matter how perfect the X-Ray.

Results

This series consists of 20 cases of distal femoral fractures with 11 supracondylar and 9 intercondylar fractures of the femur treated surgically by internal fixation with a dynamic condylar screw system.

The average age was 38.7 years with a range of 23 years to 65 years. Left femur was involved in 07 (35%) patients and right was involved in 13 (65%) patients. All the twenty patients were males.

The time between injury and surgery was 1 to 6 days, an average being 1.4 days. All the cases were operated under spinal anaesthesia. Average duration of surgery was 110 min ranging from 60 min to 210 min. Duration was more in cases of comminuted fractures. Bone grafting was done in 6 cases which were comminuted fractures, the graft taken from from ipsilateral iliac crest.

All the patients were ambulant using crutches or walker, except 4 patients due to associated injuries. Two patients who had fracture both bones same leg



Fig. 1: Type C 1 fracture of distal femur radiograph (a & b), Post operative radiograph showing satisfactory fracture reduction and fixation (c & d).



Fig. 2: Type C1 fracture of distal femur radiograph (a & b), good healing of the fracture after 16 weeks (c & d)

with patella, one patient with fracture both bones same leg and one of which had ipsilateral patella with both bones leg & fracture neck of femur.

The follow up was available in all patients and ranged from 10 months to 24 months.

On radiological evaluation the post operative reduction of the fracture found satisfactory in 15 cases (Figure 1). In two cases 10° valgus deformity and in three cases 15° valgus deformity occurred due to error in the angle of insertion of guide pin which is said to be the one of the important part of the surgery. There were 3 cases of deep infection. Of these 3 cases 2 were Gustilo's type II compound fractures. Of these two, one healed with regular dressings and the other healed after removal of implant after one year. The other one case of deep infection was Gustilo type 1 which healed with debridement, regular dressings and antibiotics. Shortening of 1 cm to 2 cm occurred in 5 patients post operatively. In all cases shortening was due to comminution. Three patients, who had wound infection, were discharged 20 to 25 days after surgery. The average duration of hospital stay in all patients was 16.2 days. Time to radiological healing, defined as the time taken for the formation of circumferential bridging callus across the fracture. The average time to healing was 15.6 weeks in, ranging from 12 weeks to 18 weeks (Figure 2).

Five patients had quadriceps lag of less than 10° , three of them had ipsilateral lower limb associated fractures. Average knee flexion was 114° , range of flexion was from 100° to 125° . Six patients in this series had mild pain in the knee. Overall functional results were excellent in 8 (40%) patients (Figure 3 & 4), good in 6 (30%) patients, moderate in 3 (15%) patients and poor in 3 (15%) patients. In none of the cases we had loss of fixation or implant failure.



Fig. 3: The patient whose radiograph shown in Fig 2, no extensor lag or flexion deformity of the knee



Fig. 4: Good flexion of the knee of about 125°

Discussion

Distal femoral fractures are one of the challenging fractures to the orthopaedic surgeons. The aim of treatment of these fractures is anatomical reduction of the articular surface, adequate stabilization of the fracture, early mobilization of the knee to prevent stiffness, and early ambulation of the patient. During the surgery the soft tissues need to be handled meticulously, with as minimal surgical damage to soft tissues as possible to prevent stiffness, infection, knee instability, quadriceps weakness etc.

The 95° angled blade plate, condylar buttress plate, DCS with 95° barrel plate and locking plate and screws are the commonly used implants for the fixation of these fractures. Harder Y et al [13] did invitro investigation to measure the stability of Y-osteotomy stabilized either with the Condylar plate or Dynamic Condylar Screw in 8 pairs of human Cadaveric femora. It was found that amplitude of interfragmental movement of all bones fixed with Condylar Plate was more than those fixed with Dynamic Condylar Screw. It was concluded that DCS should be regarded as implant of choice both technically and mechanically even in osteoporotic bones.

Sanders R et al [7] concluded that less comminuted fractures have better results than with more comminuted fractures. They emphasised the advantages of DCS over 95° blade plate, in terms of ease of insertion, the ability to obtain good fixation even in osteoporotic bone, and the capability of revising non unions with a simple plate exchange. Shewring DJ et al [8] analysed the results of treatment with the dynamic condylar screw in 21 cases of supracondylar and intercondylar fractures of the femur. There were 2 nonunions and average range of knee flexion was 112° (80° to 130°). It was found the device was easy to use and the good fixation allowed

early patient mobilization. It was concluded that the AO dynamic condylar screw was an effective and technically undemanding method of treating supracondylar - intercondylar fractures of the femur. Zehntner MK et al [14] concluded that alignment of the distal femoral fragment in coronal plane was far more difficult than restoration of the sagittal plane and rotation during fixation of distal femoral fractures, but a satisfactory functional result appears to be compatible with angulations of less than or equal to 5° in any plane.

Khan MA et al [9] in their study done to assess the outcome of DCS in Supracondylar fractures of femur in adults, while comparing the results with other international studies which were of Muller type A fractures they concluded that DCS was one of the best device to treat these fractures.

Twenty cases of distal femoral fractures with 11 supracondylar and 9 intercondylar fractures of the femur were treated by open reduction and internal fixation using the dynamic condylar screw system. They were followed up for an average of 10.8 months. The purpose of the study was to evaluate the end result of treatment in terms of fracture union, post operative reduction of the fracture, functional results and complications like infection, malunion, non union etc. in these patients.

The average age of all cases in this series was 38.7 years. Fracture was more common in age groups between 31 to 40 years. All patients were males. Komert L et al [15] and Shewring DJ et al [8] reported female preponderance in their series. Giles JB et al. Healy WL et al. , Pritchett JW et al. and Siliski JM et al reported male preponderance.

Five of our patients (25%) had associated injuries, denoting that the injury was due to high energy trauma. Many other authors have reported associated injuries to the popliteal artery and ligaments of the knee joint. However, in this series there were no vascular and ligamentous injuries. In this series there is slight preponderance for right sided fractures. Left femur was involved in 07 (35%) patients and right was involved in 13 (65%) patients.

In this series there were 3 cases (15%) of deep infection. Out of these 3 cases, 2 had presented with Gustilo's type II compound fracture and 1 Gustilo type I. The studies by Shewring DJ et al [8] and by Giles B J et al [16] had no post-operative infection. The study by Siliski JM et al [19] noticed deep infection with compound fractures and all of those 3 patients had poor results, which is similar to our study. Shortening had occurred in 5 patients ranging from 1 to 2 cms. Valgus deformity of 10° to 15° occurred in patients. Giles JB et al [16] noted more

than 10° angulation in 3 patients in their series. No case went for non-union in our study, may be due to our anticipatory primary bone grafting in severe comminution in metaphysis or proximal to it.

None of our cases had loss of fixation or implant failure. None of our patients had any preoperative or post operative neurovascular injury. There was no case of secondary osteoarthritis of knee in our series at last follow up, which definitely needs a longer study follow up period to comment. The flexion of knee in our patients ranged from 100° to 125°, average flexion was 114°. Five patients had extension lag of less than 10°. Patients with Type A fractures had good range of movements compared to type C fractures. Knee flexion average in our study is comparable to that in the previously published studies compared to simple fractures took more time for union. The average time to union in our study is comparable to other studies reported using 95° Blade plate reported as excellent in 61.3%, good in 23.7%, moderate in 9.7%, poor in 5.3% of their cases. The results of our series (Excellent 40%, Good 30%, Moderate 15%, Poor 15%) are comparable these studies. In our study both the type C3 patients had poor results. In 4 compound fractures one had moderate result and 3 had poor results.

The limitations of the study are that it is a retrospective study, relatively small number of patients, non comparative nature of the study, the bias associated with the patient selection by the surgeon and in selecting the proper implants and the fact that multiple surgeons were involved in the treatment of the patients.

Conclusion

The DHS is a good implant to use for fractures of the distal femur. However, accurate positioning and fixation are required to produce satisfactory results. We recommend use of this implant in Type A and C fractures. DCS augmented with interfragmentary lag screws gives good results in intra articular distal end fractures of femur. Judicious use of bone grafting can reduce the risk of non union in severely comminuted metaphyseal fractures.

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