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Study of management of supracondylar femoral fracture using dynamic condylar screw

Lalith Mohan, Ramesh Benguluri*

Department of Orthopaedics, Deccan College of Medical Sciences, Hyderabad, Telangana, India

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***Correspondence:**
Dr. Ramesh Benguluri,
E-mail: doclalithmohan@yahoo.com

ABSTRACT

Background: Supracondylar femoral fracture poses a considerable therapeutic challenge. Operative treatment has become a standardized procedure. Stabilization has usually been achieved by an osteosynthesis with dynamic condylar screws or retrograde supracondylar nailing. In this article we are going to compare the results of surgical management of supracondylar nail and dynamic condylar screw. The aim is to study the effectiveness of dynamic condylar screw in surgical management of supracondylar fractures of femur.
Methods: Prospective study of patients who had sustained supracondylar fracture of femur. The patients included in this study were those with supracondylar fractures of the femur with or without articular involvement and disruption of the joint surface. Study was done for a period of two and half years.
Results: In our study of 21 cases, there were 8 patients (38%) who had associated fractures. Two patients were more than 50 yrs. 3 patients had compound injury which were grade-II of Gustilo Anderson classification. One of them developed post-operative infection and resulted in poor outcome. Other 2 patients had decrease range of movements resulted in fair outcome. Type C2 constituted highest number 8 (38%) followed by type A3 which was 28.5% i.e., 8 patients. Infection is observed in 9.5% of patients. 2 patients had implant failure and both were due to early weight bearing. In our study excellent and good results were found to be in 61.9%.
Conclusions: Role of dynamic compression screw in the surgical management of supracondylar fractures of the femur minimizes the risk of complications.

Keywords: Dynamic compression screw, Supracondylar fractures, Articular involvement

INTRODUCTION

Supracondylar fractures of the femur account for approximately 7% of all femur fractures.[1] They occur just proximal to the knee joint, in the terminal 9 cm of the femur between the metaphyseal-diaphyseal junction and the femoral condyles.[2] Supracondylar femoral fracture poses a considerable therapeutic challenge. Anatomic reduction, stabilization, early weight bearing and mobilization are the main aims of the fracture management. Operative treatment has become a standardized procedure.

Supra condylar fractures of the distal femur are on the increase due to increase in road traffic accidents. Most of the supracondylar fractures are to motor cycle accidents due to direct fall on the knee joint, especially in older individuals.[3] These fractures have historically been difficult to treat owing to its instability, associated internal derangement of knee and soft tissue injuries. Injury to the quadriceps mechanism leads to unsatisfactory results. If such fractures are not treated properly results are unsatisfactory. This study consists of supracondylar fractures treated by operative method using dynamic condylar screw.

Objective of the present study was to study the effectiveness of dynamic condylar screw in surgical management of supracondylar fractures of femur, follow up the patient operated upon and note the function recovery and restoration of range of movements of the knee joint, follow up patients and note the complications and analyze them.

METHODS

Prospective study in Deccan College of Medical Sciences, Hyderabad from the period of January 2014 to June 2017 in patients who had sustained supracondylar fracture of femur.

Inclusion criteria

Patients with supracondylar fractures of the femur with or without articular involvement and disruption of the joint surface.

Exclusion criteria

No pathological fracture or children and those below 20 years.

For the purpose of evaluating the results 21 cases with supracondylar fractures of femur treated with DCS where followed up. Only the patients who reported regularly for follow up where included in the study group. The average follow up period was 13.6 months varying from 4 months to two year.

The patients were examined clinically, especially for shock, heamarthrosis, and distal neurovascular deficit. The associated injuries if any were also recorded, skiagrams were taken to confirm the diagnosis and the type of fracture pattern. If the patients showed any signs of shock, they were adequately treated including blood transfusion.

After confirming the diagnosis most of the cases were treated initially with skeletal traction and the associated injuries were approximately dealt with If the fracture were compound the wounds were thoroughly cleaned and debrided and well-padded dressings were applied and the limbs were given pin traction in Bohler-Braun splint. Antibiotics and tetanus toxoid injection were given. If there were any associated fractures, they were treated accordingly. The patient was investigated and was taken up for surgery i.e., for Internal fixation with dynamic condylar screw.

Investigations

X-ray of the thigh with knee joints were taken. AP and lateral views if necessary oblique where taken, they were typed according Muller's classifications.

Blood grouping and typing, blood urea, blood sugar, CBP were done in all patients. In patients over 50 years ECG, chest X-ray, if necessary 2D echo and cardiologist opinion were taken. In cases of doubtful distal vascularity colour Doppler was indicated. In our series no cases were having vascular deficit.

The anaesthesia employed in all the patients was regional anaesthesia i.e., spinal or epidural anaesthesia. The recovery was smooth and uneventful in all the patients. Supine with the knee flexed over a roll 60 degrees to 90 degrees to relax the gastrocnemius muscle. Hip and knee are draped free. Use of a tourniquet may be indicated. Incision along a line joining the greater trochanter, the lateral condyle, and the tibial tuberosity.

Operative technique (dynamic condylar screw)

Place the patient supine, with due aseptic precautions through lateral approach. Incision given extending from the Gerdy tubercle upwards, parallel to shaft of femur. Longitudinal incision given into the fasciata and the iliotibial band. More, proximally fascia over the vastas lateralis is incised and the muscle is retracted anteriorly off the intermuscular septum. If the perforators are encountered they are ligated. Fracture site is exposed. Strip minimum amount of soft tissue necessary for application of the plate and reduction of the articular surface.

First, the condyles are reduced and held with 'K' wires, before fixation with cancellous screws. Plan the placement of screws so that they do not interfere, with subsequent insertion of DCS. Alignment wires superior and distal to the femoral condyles are applied, the first inferior 'K' wire is placed through the knee joint parallel to the surface of tibial condyle. Second 'K' wire is placed transversely posterior to the center of patella. Insert the third 'K' wire 2cm from the joint line parallel to the joint line. This should be parallel to the knee joint axis and it should not protrude medially. Measure the length of guide wire, set the DCS reamer at 10mm less than the measured length, if intraarticular fracture, otherwise measured length if supra condylar fracture. Tapping is not routinely done, if bone is osteopenic. The screw is placed and the plate is threaded over the condylar screw and attempt to reduce the shaft is done. Minimal soft tissue dissection is done for reducing the fracture directly. If the fractures are old and neglected routine bone grafting is carried out. The plate is secured to the femoral shaft using 4.5mm cortical screws. After securing haemostasis, wound is closed in layers keeping the suction drain in site. If tourniquet is used, it is removed. Large bulky dressing is applied.

Post-operative management

Patient was kept on parenteral antibiotics for 48 hours followed by oral antibiotics for 10 days. Primary dressing was done after 48 hours. Wound inspection and suction drain removed on the second post-operative day.

Quadriceps exercise is begun on 3rd post-operative day/ patient was discharged after 10 days after suture removal and advised to come to the out-patient department 4-6 weeks later. Patients were advised not to bear weight on affected limb and to attend physiotherapy department.

Follow up

Patients were examined for pain and swelling, tenderness, range of movement of the knee joint and radiographs were taken to see the signs of healing. Weight bearing is advised only after the fracture showed signs of union clinically and radiologically.

Role of bone grafting

Communication of the medial cortex was an absolute indication for bone grafting, current methods of fixation have eliminated the necessity of bone grafting in many complex supracondylar femoral fractures. Strong indications for the use of bone grafting are bone loss, residual bone defects and non-union. Relative indications include selected type A3, C2, C3 fracture patterns as well as many severe open fractures treated on a delayed basis to prevent non-union.

Statistical analysis

Data were entered into excel spreads heets and then managed with SPSS (IBM SPSS version 16.0) using descriptive methods: mean, standard deviation for numerical variables, percentages, frequencies for all categorical variables.

RESULTS

Total number of cases studied in this series was twenty one. The analysis of this study is as mentioned in Table 1.

The average age group of the study group was 55.56 yrs. The younger age group patients (less than 50 yrs) contributed a significant number (57%). This is probably due to greater mobility of the younger age group patients, mechanization of transport, increase in the incidence of high velocity road traffic accident, especially motorcycle accidents.

In our study we had a male preponderance, 17 of the 21 patients we had operated on were males. This is probably in India males are engaged in more strenuous activities compare to females who have a contained life. Hence males are more prone to trauma.

Table 1: Demographic distribution in study.

Age group	Number of patients	%
<50 years	12	57.14
>50 years	9	42.85
Males	17	80.95
Females	4	19.04

The injury which resulted in the fracture was severe one in 14 patients (66.6%) and trivial in 7 patients (33.3%) (Table 2 and 3). Most of the severe injuries results from high velocity road traffic accidents, especially motorcycle accidents or fall from height etc. These were most often seen in younger age group in from 14 out of 14 patients sustained injury due to severe violence. Fracture caused by trivial injury was seen most often in older age group patients in which 7 out of 9 were due to trivial trauma.

Table 2: Age group vs. nature of violence.

Nature of violence	<50 years	>50 years	No. of patients	%
Severe	12	2	14	66.6
Trivial	0	7	7	33.3

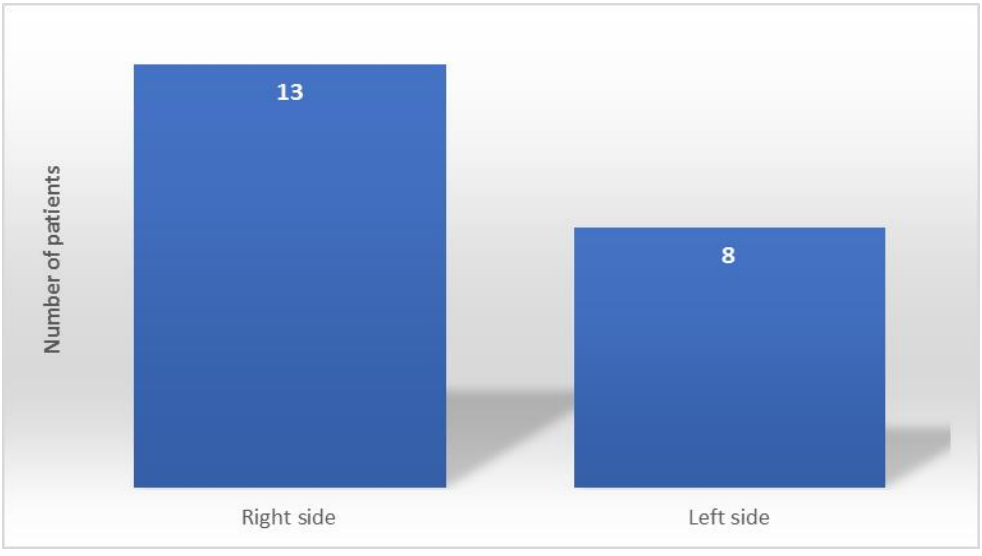

Figure 1: Side distribution.

Table 3: Associative and type of injuries.

Age	No. of patients	%
Associate injuries (years)		
<50	6	75
<50	2	25
Injury		
Closed	18	85.71
Compound	3	14.2

The incidence of fracture due to severe violence more in our study probably due to increased number of younger age group, who needed more force of impact to sustain a fracture, compared to older age group patients.

In our study right sided fractures were more common than left sided (Figure 1). Most of the patients sustained injury due to motorcycle accidents where impact was more on the right side.

In our series of 21 cases, there were 8 patients (38%) who had associated fractures. Two patients were more than 50 yrs. One of whom had a colles fracture and the other had ipsilateral fracture shaft femur in a road traffic accidents (Table 4). Six patients out of eight were less than 50 years of age. All of these patients sustained injury in high velocity trauma i.e., road traffic accidents. Three patients had ipsilateral fractures both bones of the leg, one had fracture both bones on the other leg, one patient had ipsilateral trochanteric fracture and one had head injury.

Table 4: Type of fracture pattern.

Type	A1	A2	A3	B1	B2	B3	C1	C2	C3
Number of patients	1	2	6	1	0	0	0	8	2
Percentage	4.7%	9.5%	28.57%	4.7%	0	0	0	38.09%	9.5%

Table 5: Complications in present study.

Complications	No. of patients	%
Infection	2	9.5
Non-union	0	0
Severe knee stiffness	1	4.76
Implant failure	2	9.5
Mal-union	0	0

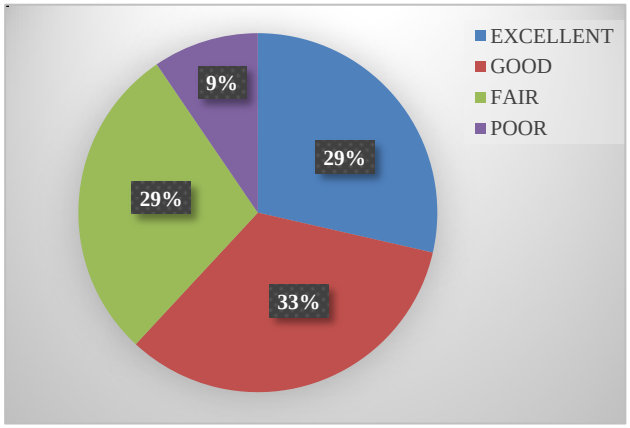

Figure 2: Result of outcome postoperatively.

One patient who was included in the study but later discarded had a vascular injury. Though pre-operative distal pulsation was present and there was minima swelling at the fracture site. But after opening the fracture site, there was profuse bleeding which has coming from the tear in the femoral artery. Vascular repair was done, fracture was fixed with intramedullary nailing.

In our series 3 patients had compound injury which was grade-II of Gustilo Anderson classification. One of them developed post-operative infection and resulted in poor outcome. Other 2 patients had decrease range of movements resulted in fair outcome. This could be attributed to associated quadriceps and other soft tissue injuries.

In our study type C2 constituted highest number 8 (38%) followed by type A3 which was 28.5% i.e., 8 patients.

Infection is observed in 9.5% of patients. 2 patients had implant failure and both were due to early weight bearing, one patient had broken screws and the other had broken plate. The plate and broken screws were removed retaining lag screw and replaced with a new plate and screws in one patient. In the other patient the plate was broken at 12 weeks, but the fracture was in good alignment and good callous was present. He was treated conservatively and the fracture united in further 8 weeks. The result was excellent in former case and fair in the latter case (Table 5 and Figure 2). In our study excellent and good results were found to be in 61.9%.

DISCUSSION

This dissertation consists of study of 21 patients with supracondylar femoral fractures with or without intra articular extension, treated by dynamic condylar screw. None of the patients were having bilateral fractures. There were 17 males and 4 females. 8 patients had associated fractures. There were three compound fractures and 19 of the fractures were communicated.

Supracondylar fractures of the femur with articular involvement are always regarded with concern because they are difficult to treat, cause a long absence from work and often results in permanent disability. These facts have encouraged surgeons to resort to operative treatment with internal fixation. Successful treatment of intra-articular fractures, especially in weight bearing joint,

requires restoration and maintenance of the congruence of the two articular surfaces. Traction can hardly guarantee restoration of such congruence. In principle, therefore all intra-articular distal femoral fractures should be treated surgically.

In Olerud series of 16 cases 10 were males and 6 were females.[4] While in our study 17 were males and 4 were females. This could be due to the fact that most of the mobile population is male and are at high risk to accidents.

The average age of the patient in Harrison study was 50 years.[5] In our study the average age was 40 years. In Siliski et al study of the 52 femoral fractures, three quarters of them were due to high energy trauma.[6] In our series 14 of the 21 patients had severe violence. The incidence is same as of their series. 39% of them were open injuries but in our study it was 14.28%. Infection occurred in 4 patients 7.7% in their series, but in our series two patients had deep infection (9.5%). One patient had superficial infection which was controlled by daily dressings and antibiotics.

Giles et al, Pritchett and more recently Sanders et al, Regazonni et al and Ruedi et al have reported the results of distal femoral fractures treated with dynamic condylar screw.[7-9] Non-union occurred in 5.7%, infection in 0-5.3%, and mal-union in 5.3 to 11%.In our study there were no mal-unions, and infection was present in two patients out of 21 i.e., 9.5%. There were no mal-unions. Bone graft was used in about a third of fracture in their series. In our series bone grafting was done in 8 patients. In Silikski et al series, overall good or excellent results were obtained in 81% of fracture and range of motion averaged 107 degrees.[6]

In our study excellent to good results were obtained in 61.9%. Poor results were in 9.5%. In Surulivel study, 80% excellent to good results achieved with supracondylar nailing.[10] This was comparable with the study done by Gellman et al who had 82.7% excellent and good results.[11] We had 20% fair and poor results, whereas they had 17.2% fair to poor results. Leung et al. reported better results with 94% excellent and good outcome and 6% fair to poor outcome.[12] In our study 61% excellent to good results were achieved with DCS fixation. This is comparable with the study of Mize et al.[13] who had 80% excellent to good results.[13] Jeon et al reported better results with 81% excellent and 19% good results. He had no fair or poor outcome.[14]

In this study, the predominance in the age and sex incidence showed that the active working class was involved in the supracondylar femoral fractures. Road traffic accidents especially motorcycle accidents were the predominant cause of the fractures. The high level of energy involved is manifested by the large number of comminuted fractures with both metaphyseal and diaphyseal involvement and the more incidences of associated fractures. The conditions in such fractures are often unfavourable for healing, this effect was present in few of our cases which resulted in delayed union and reduced range of movements. Large metaphyseal bone cavities/and bone loss were filled with autogenous cancellous bone grafts at the primary surgery.

The results in this series presented, here indicate the value of stable internal fixation and anatomical reconstruction of the distal end of the femur. This can be accomplished to a great extent by using DCS there by providing practically normal articular congruity and reducing the risk of post-traumatic secondary osteoarthritis due to incongruence of the articular surface. A post-operative infection may be disastrous, but if it is dealt with rapidity and adequately it should be controlled until bone healing has occurred.

CONCLUSION

Results in the present series are quite encouraging and satisfactory, we have come to the following conclusions regarding the role of dynamic compression screw in the surgical management of supracondylar fractures of the femur. Patients treated by this operative method had a very short hospital stay. Thereby occupancy of the hospital beds and cost were reduced. Incidence of non-union was drastically reduced if strict operative protocol was followed. None of the patients in our study had non-union. The technique is not very demanding, it is a simple procedure. The device facilities impaction at the fracture site and provides rigid internal fixation. Patient can be mobilized immediately post-operatively, thus avoiding problems of prolonged immobilization and knee stiffness. The fixation is rigid even in osteoporotic bone because of innovative truncated thread design of the lag screw. The dynamic condylar screw is technically easier to apply than a blade plate, because of plate and screw are separate pieces adjustment can be made in sagittal plane. The incidence of penetration due to absorption and collapse at fracture site is low even in an osteoporotic bone because of rounded tip design of lag screw and a provision for its telescopy. The intercondylar fracture reduction can be well maintained and compression can be applied at the fracture site with the lag screw, thus the joint congruity is well maintained. Patients treated with this device have recovered early with painless knee movements.

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