

Original Research Article

Locking condylar plate: best device to treat supracondylar fractures of the femur

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ABSTRACT

Background: Supracondylar fractures of the femur in adults account for only 7% of all femoral fractures. However, these fractures present with numerous complications. The purpose of this study was to assess the outcome of locking condylar plate in supracondylar fractures of femur in adults.

Methods: This study was based on 25 patients of supracondylar fracture of the femur treated with locking condylar plate at Srinivas Institute of Medical Sciences and Research Centre, Mukka, Suratkal, Mangalore. The patients were followed up for 1 year.

Results: In present study, 84% fractures were sustained due to road traffic accidents. In 23 (92%) patients, full weight bearing was achieved at 20 weeks while only 2 (8%) patients required more than 20 weeks. 80% of cases required less than 16 weeks for union while 20% required more than 16 weeks. Average injury to surgery time was 3.62 days in the present series. Superficial stitch infection occurred in two cases. Deep infection occurred in a grade 2 compound fracture in a male who was treated initially with debridement and antibiotics.

Conclusions: Good results are seen by distal femur locking condylar plate alone. It is the main implant of choice for distal femur fractures of all varieties. Best outcome is expected if fracture fixation is done following all the basic principles of fracture fixation. Advantage of the mechanical properties of a locking plate is definitely useful.

Keywords: Supracondylar fracture of femur, Fixation, Locking plate, Range of motion

INTRODUCTION

Incidence of distal femoral fractures is 7%. Anatomical reduction of the articular surface, restoration of limb alignment, and early mobilization are effective in management of most fractures. Though there are advances in techniques and the improvement in surgical implants, treatment of distal femoral fractures is still a difficult one.¹

Fractures of the distal part of the femur are difficult to treat. They present considerable difficulty in

management. Severe soft tissue damage, comminution, extension of fracture into knee joint and injury to the extensor mechanism are the problems which prevent satisfactory results in many cases even if they are treated surgically or not.²

Understanding the deforming forces involved is critical for successful operative management. Shortening with varus and extension deformities are problems seen due to the unopposed pull of the hip adductors and gastrocnemius muscles respectively.²

Distal femoral fracture occurs at 1/10th incidence of proximal femoral fracture. It accounts for 6% of all femur fractures. There is a bimodal distribution of fracture based on age and gender. Most high energy distal femoral fractures occur in males between 15 and 50 years of age. Low energy fractures occur in osteoporotic women above 50 years of age. The most common high energy mechanism of injury is traffic accident (53%). Most common low energy mechanism is fall at home (33%).³

Evaluation by X-ray of distal femoral fractures should include plain radiographs of entire length of the femur to avoid missing ipsilateral femoral neck or shaft fractures. Good quality X-ray of knee will ensure screening for intra articular extension of fracture lines. CT scan may be required if intra articular and comminuted fractures are suspected.³

Supracondylar fractures of the femur occur in two different age groups due to different types of injuries. In young patients these fractures occur due to mainly road traffic accidents, fire arm injuries and sport's injuries. While in elderly patients usually fall during walking, results in supracondylar fractures of the femur.⁴

The various methods used earlier for purpose of stabilizing distal femoral fractures were closed reduction and casting, skeletal traction alone, angled blade plate and the dynamic condylar screw.⁵

The distal femoral-locking condylar plate is precontoured. It provides better stability and functional outcome. It allows higher elastic deformation than the other systems putting between rigid fixation and intramedullary nailing. It also gives angular stability. So it is ideal for comminuted fractures and intra articular fractures.⁶

Definitive treatment of distal femoral fractures requires maintenance or restoration of distal femoral alignment. Aim is to preserve the function of the extremity. To get the best results, understanding characteristics of distal femoral fractures as well as the principles and challenges of management is important.⁷

Early knee motion is important in the management of distal femoral fracture. Knee stiffness and loss of range of motion may develop if proper mobilization is not done postoperatively.⁸

Locked implants are typically indicated in patients with osteoporosis, fractures with metaphyseal comminution. Because here, the medial cortex cannot be restored, or with a short articular segment.⁹

Locked condylar plate creates a fixed angle at each screw hole. Here, the individual screw head is secured to the plate by a locking mechanism. Thus, the flexibility of locking condylar plate with its fixed angle properties offers an effective alternative to implants like DCS,

condylar buttress plate and a supra- condylar or a distal femur retrograde nail.¹⁰

Aims and objectives

To study the functional and radiological outcome of distal femoral fractures in adult patients treated by open reduction and internal fixation with locking condylar plate.

METHODS

This retrospective study was conducted on 25 patients admitted in orthopedic unit of Srinivas Institute of Medical Sciences and Research Centre, Mukka, Suratkal, Mangaluru from 1st December 2018 to 31st December 2018. Files of patients having supracondylar fractures of the femur with or without intercondylar extension operated in 2018 were reviewed. AO classification was used to grade these fractures. The method used for fracture fixation was open reduction and for internal fixation was locking condylar plate. Duration of follow up was 6 months to 12 months.

Inclusion criteria

Patients with AO type A/C₁/C₂ supracondylar fracture, both sexes, age 21 years and above and fractures 9 cm from the distal articular surface of femur were included.

Exclusion criteria

Patients with lower diaphyseal fractures of femur, pathological fractures, AO type other than A/C₁/C₂ fractures, active infections anywhere in the body, medically unfit patients, fractures in children, supracondylar fractures treated by other systems and patients with intramedullary fixation, metastatic disease, impaired lower extremity motor or nerve function prior to injury, and supplemental methods for bone healing were excluded.

All these patients were evaluated for life threatening conditions as per ATLS protocol. Emergency treatment was provided in the accident and emergency department and after stabilization these patients were referred to the orthopedic department for definitive management. Trauma to surgery interval was 3-8 days with a mean of 4.2 days. After taking proper history and meticulous physical examination, patients were prepared for the surgery. Antero-posterior and lateral X-ray view were taken before the operation as pre-op preparation. The patients were operated under spinal/epidural/general anesthesia.

Supine position with a pillow under knee was used. Standard lateral approach was taken and vastus lateralis was elevated from lateral intermuscular septum. Locking condylar plate (LCP) system was fixed as per standard method.

Distal femur locking condylar plate was used for fracture fixation using locking, 4.5 mm cortical screws and partially threaded cancellous screws of diameter 4.5 mm, Herbert screws were used for smaller articular fragments and 6.5 mm for articular reduction of condyles. Technique of counter sinking for screw heads was used when proper seating of the plate had to be obtained. Length of the plate used was judged based on the extent of fracture of distal femur.

Primary bone grafting was done in closed cases where the demand for such a procedure was gauged by the operating surgeon. On an average, operating time varied from 2 to 3 hours in majority of the cases with certain comminuted fractures of type C3 even requiring 4 to 5 hours. The average blood loss was 300-400 ml in each case. No use of tourniquets was done in any of the case.

Post-operatively suction drain was removed after 48 hours and first wound inspection was done on 3rd post-operative day.

Intravenous antibiotics were given for 5 days followed by oral antibiotics and analgesics. Patients were given continuous passive motion twice daily from third day with the aim of achieving at least 90 degree of movement at time of discharge on tenth day. Patients were allowed only toe touch weight bearing for first six weeks with long knee brace. Patients were instructed to do knee bending; quadriceps and hamstring exercises at home. Partial weight bearing was started after reviewing X ray at six weeks. Full weight bearing was allowed at three months after reviewing union on X-ray which was delayed if radiologically fracture was showing signs of delayed union. Clinical union was considered satisfactory if progressively increasing stiffness and strength provided by the mineralization process made the fracture site stable and pain free. Union on X-ray was considered satisfactory when plain X-rays showed bone trabeculae or cortical bone crossing the fracture site. Full weight bearing was allowed when radiological signs of union were present. Check X-rays were taken in immediate postoperative period, thereafter every six weeks up to six months and then every three months interval up to one year. Final assessment of all the patients was done at one year. All the information regarding patient's age, sex, type of fracture, mechanism of injury, associated injuries, preoperative and postoperative complications, union time of fracture, partial weight bearing time of fracture, hospital stay were recorded on proforma specifically designed for this purpose.

All the study variables were analyzed for descriptive statistics that is frequency and percentages.

RESULTS

In present study the youngest patient was 22 years old male and oldest 65 years old male. Overall mean age was in male 40.38 years and in female 51. 25 years. The mean

age of female was nearly 11.13 years more than that of males. Most of the patients involved in high velocity accident were in the 21 to 40 years age group. The maximum numbers of cases were seen in 21 to 40 years (14.56%).

In present study, 84% males were involved 5.25 times more than females (16%). This may be due to male more exposed to high velocity trauma due to male domination in the society (Table 1).

Table 1: Age and sex distribution.

Variables	No. Of Patients	%
Age distribution (years)		
21-30	09	36
31-40	05	20
41-50	05	20
51-60	04	16
61-70	02	08
Total	25	100
Sex distribution		
Males	21	84
Females	04	16

In present study, 84% fractures were sustained due to road traffic accidents which resulted from high velocity trauma (Table 2).

Table 2: Mechanism of injury.

Mechanism of injury	No. of patients	%
Road traffic accident	21	84
Fall from height	04	16

In present study, 12 patients had associated injury resulting from trauma, medical illness was seen in three cases. Associated injuries included musculoskeletal or other systemic injuries. Head injury was present in two cases, fractures involving ipsilateral or contra lateral tibia- fibula were seen in 5 patients of which tibial shaft fractures were seen in 3 cases. One case head fracture of ipsilateral tibial condyle and one case had Supra malleolar fracture of tibia- fibula (Table 3).

Table 3: Associated injury.

Associated injury	No. of patients	%
Present	12	48
Absent	13	52

In present study, open reduction and internal fixation was considered only after the general and medical condition of the patient was stable. Average injury to surgery time was 3.62 days in the present series (Table 4).

In present study, healing of fracture occurred with formation of periosteal callus. This pattern was similar to

secondary healing. 80% of cases required less than 16 weeks for union while 20% required more than 16 weeks. Average period for union was 15.28 weeks (Table 5).

Table 4: Injury to surgery interval.

Injury to surgery interval (in days)	No. of patients	%
1-3	15	60
3-8	08	32
>8	02	08

Table 5: Period of radiological union.

Period of radiological union (in weeks)	No. of patients	%
10-12	3	12
13-14	8	32
15-16	9	36
17-18	2	08
19-20	2	08
>20	1	04

In present study, in 23 (92%) patients, full weight bearing was achieved at 20 weeks while only 2 (8%) patients required more than 20 weeks. Average time taken for full weight bearing was 16.68 weeks (Table 6).

Table 6: Time at which full weight bearing was achieved.

Time at which full weight bearing was achieved (in weeks)	No. of patients	%
12-14	07	28
15-17	11	44
18-20	05	20
21-23	01	04
24 or more	01	04

Table 7: Complications.

Complications	No. of patients	%
Superficial infection	2	8
Deep infection	1	4
Delayed union	1	4
Non-union	0	0
Implant migration	0	0
Implant failure	0	0
Bursitis	1	4
Fat embolism	0	0

In present study, superficial stitch infection occurred in two cases which were treated with removal of offending stitch. Drainage healing offered subsequently. Deep infection occurred in a grade 2 compound fracture in a male who was treated with initially with debridement and antibiotics according to culture and sensitivity (Table 7).

Two patients had nonunion and were grafted twice, three infections (1 superficial infection and 2 deep infections) were encountered, and one implant failure (Table 1). As a whole, 13 patients were grafted.

DISCUSSION

In present study the youngest patient was 22 years old male and oldest 65 years old male. Overall mean age was in male 40.38 years and in female were 51.25 years. 84% males were involved 5.25 times more than females (16%).

Similar to our study, Malik et al found that the average age in DCS group was 43.76 years. In DFLCP group, average age was 40.44 years with $p=0.45$. Number of males was 19 (76%) and of females was 6 (24%) in DCS group. There were 18 (72%) male patients and 7 (28%) female patients in DFLCP group with ($p=0.74$, chi square=0.10).¹¹

In present study, 84% fractures were sustained due to road traffic accidents which resulted from high velocity trauma.

Similar to our study, Malik et al found that in DCS group, 21 (84%) cases had mode of trauma as road traffic accident. In the DFLCP group, 19 (76%) cases had trauma predominantly due to road traffic accident with statistically insignificant difference ($p=0.47$, chi square=0.50).¹¹

In present study, 12 patients had associated injury resulting from trauma, medical illness was seen in three cases. Associated injuries included musculoskeletal or other systemic injuries. Contrary to our study, Gururaj et al found that 1 patient had intertrochanteric fracture femur on same side. 3 patients (21%) had colles fracture, 1 on the same side and 2 on the opposite side. 73% patients had only supracondylar fracture.¹²

In present study, open reduction and internal fixation was considered only after the general and medical condition of the patient was stable. Average injury to surgery time was 3.62 days in the present series.

Contrary to our study, Vallier et al found that time interval from the time of injury to the definitive treatment was from 3 days to 18 days, average being 7.8 days.¹³

In present study, healing of fracture occurred with formation of periosteal callus. This pattern was similar to secondary healing. 80% of cases required less than 16 weeks for union while 20% required more than 16 weeks. Average period for union was 15.28 weeks.

Similar to our study, Rekha et al found that at one year follow-up, union of fracture was seen in all patients. Union was faster in type A fractures than in type C intra

articular fractures. 67% of patients achieved excellent to good grading.¹⁴

In present study, in 23 (92%) patients, full weight bearing was achieved at 20 weeks while only 2 (8%) patients required more than 20 weeks.

Similar to our study, Girisha et al found that 16 patients (76%) had near normal radiographs. 2 (9%) had 10° angulations and another 3 (14%) patients had 5 mm displacement.¹⁵

In present study, superficial stitch infection occurred in two cases which were treated with removal of offending stitch. Drainage healing offered subsequently. Deep infection was seen in a grade 2 compound fracture in a male.

Similar to our study, Girisha et al found that superficial wound infection, wound gaping and pin site infection was seen in one patient each. Malunion with varus (n=2), plate breakage (n=1) and knee stiffness (n=1) were seen as late complications. The average hospital stay was 14 days.¹⁵

Similar to our study, Virk et al found that two patients had superficial infection which was then treated with culture sensitive parenteral antibiotics and antiseptic dressing. This resulted in satisfactory healing of the fracture. One case was found to have mal-union of the distal femur fracture.¹⁶

CONCLUSION

Good results are seen by distal femur locking condylar plate alone. It is the main implant of choice for distal femur fractures of all varieties. Best outcome is expected if fracture fixation is done following all the basic principles of fracture fixation. Advantage of the mechanical properties of a locking plate is definitely useful.

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