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Follow up study of surgically treated intra-articular fractures of distal femur

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Abstract

Background: Fractures of distal femur have been historically difficult to treat because of their unstable or intra-articular nature and their degree of comminution. The proximity of these fractures to the knee joint makes regaining full knee function and motion relatively more difficult. The incidence of malunion, nonunion and infection is also high in these fractures.

This has lead many surgeons to abandon conservative measures in favour of open reduction and internal fixation devices. These devices are useful in achieving restoration of bony continuity, maintenance of good reduction, restoration of articular congruity and restoration of early joint movements.

Materials and Methods: Present study consisted of periodic follow up of patient with certain standard questions about the degree of pain on weight bearing, range of motion (ROM) of the treated leg, walking ability and resumption of daily activities using Neer Scoring System. Postoperative radiographs evaluated for axial alignment and osteoarthritis and radiological union. The results of surgically treated intra-articular fractures of distal femur were evaluated according to Neer *et al* scoring.

Results: Out of 25 cases, 15 (60%) showed excellent results. younger the average time of union was 13.36 ± 2.69 weeks. Selection of implants was based on the decision of the surgeon during the surgery depending on fracture configuration. There cannot be a fixed rule laid down on this matter. Maximum stability with minimum implants was our aim in choosing the implants. In all cases of excellent results, postoperative mobilization was started within 10 days of surgery. The mean Neer Score was 85.

Conclusion: Earlier the surgery, better the results. Comminution of the fracture adversely affects the results. Intra articular comminution is not a contraindication for internal fixation. Active mobilization is the keystone in determining long-term functional outcome. Undisplaced fractures had good results comparing displaced fractures. Displaced fractures with intra-articular extension had bad prognosis, irrespective of the method of treatment adopted.

Keywords: distal femur, intra-articular fracture, distal femur locking plate, neer scoring

Introduction

Distal femoral fractures account for 3-6% of adult femoral fractures and 0.4% of all fractures and are associated with considerable morbidity and mortality rates. Men sustain fractures due to high energy trauma (70.5%) whilst women sustained injuries mainly from low-energy mechanisms (82.7%)^[1]. Distal femoral fractures have typically a bimodal occurrence in young people due to a high-energy trauma (RSA) and in older people related to a low-energy trauma (Osteoporosis). The methods have modified from time to time but till date no method is perfect.

Materials and Methods

The present study is based on follow-up of 25 cases of intra-articular fractures of distal femur treated surgically admitted at our hospital. Fractures in the distal femur have posed considerable therapeutic challenges throughout the history of fracture treatment. Most of these surgical failures were due to inadequate fixation of the fracture fragments. (Mize *et al.* ^[2]). Present study evaluates the patient on certain criterion as per Neer scoring System ^[1].

Pain: 0-20 marks are given as per patients description of symptoms.

0-4 marks for constant pain/pain at night

6-marks for restriction of function

12 –marks for fatigue on walking

16 marks for intermittent pain

20 –marks for no pain

Function: full 20 marks if patient is able to assume full function as before surgery, 16 for mild restriction, 12 for restricted staircase climbing, 8 for severe restriction and 0-4 for being able to walk with crutches or brace.

Motion: Full 20 marks are allotted for 135° ROM, 16 for 100°, 12 for 80°, 8 for 60°, 4 for 40° and 0 for 0-20°.

Work: if patient is able to resume his work as before injury full 10 marks are given, if with slight handicap 8 marks, 6 marks for altered work, 4 for light work only and 0 for not being able to work.

Anatomical: Gross anatomy and on Roentgenogram

Gross Anatomy: 15 marks for thickening only, 12 for 5° angulation, 9 marks for 10° angulation /2 cm shortening, 6 marks for 15° angulation/ 3 cm shortening, 3 marks for union with greater deformity and 0 for non-union or chronic infection.

Roentgenogram: Full 15 marks for near normal x-ray appearance, 12 for 5° angulation/0.5cm shortening, 9 for 10° angulation/ 1 cm shortening, 6 for 15° angulation/ 2 cm shortening, 3 for union with greater deformity and 0 for non union or chronic infection.

Neer score:

Excellent:	>85	Unsatisfactory	55-70
Satisfactory	70-85	Failure	< 55

Surgical technique

Position: Patient is placed in supine position on image intensifier compatible table with pillow under the knee with knee in slight flexion.

Approach: Lateral extensile approach is employed routinely for most intra articular distal femoral fracture. In case of compound fractures incision was modified to include the pre-existing wound to facilitate debridement, Swash-buckler approach or its modifications were used to address the intra-articular involvement of the lateral femoral condyle.

Reduction: We first reduce the fracture anatomically and provisionally stabilize with K-wires.

Then appropriate plate is selected for fracture fixation. A minimum of 5 screws including lag screw and locking head screws in the distal fragment and 4 screws (8 cortices) in proximal fragment are placed. Joint capsule arthrotomy is closed with absorbable suture. Then fascia of vastus lateralis, iliotibial band and subcutaneous tissue is closed with absorbable suture. Skin is closed with non-absorbable suture and stitches removed on 12th post-op day.

Post-operative protocol

Drain removed at 48 hrs and wound inspection done. Intravenous antibiotics were continued for 24 hours in closed fractures and 72 hours in case of open fractures. In cases where ever possible, knee bending was started on post-operative day 3. Full weight-bearing ambulation without any aids was started at approximately 3 months in most of cases with radiographic evidence of fracture union. Patients were discharged at post-operative day 12 with stitch removal being done at the time of discharge, making it convenient for the patient to take bath and maintain good body hygiene. The first follow-up was at 6 weeks and subsequent follow-ups were done at 3 months, 6 months and at 1 year. When a femoral fracture involves the knee or quadriceps mechanism or both, some loss of motion of the knee is expected in most patients,

whether they are treated non-operatively or by internal fixation. Intra-articular fractures lead to intra-articular stiffness, decreased range of motion and poor result and open fractures results in extra-articular stiffness. Passive mobilization from day 3, manual or with the help of electronic CPM (Continuous passive motion machine) was the rule as per patients pain tolerance.

This was followed by active movements and quadriceps exercises so as to avoid muscle wasting and joint stiffness.

Results

On analyzing the results according to the type of internal fixation used DFLCP (Distal femoral locking condylar plate) and DCS and CBP (condylar buttress plate) had good results (Table I). 70% patients with DFLCP and 66.6% in 95° condylar blade plate had excellent results. One case treated with IMN gave excellent result.

In present study, time taken for radiological union was less than 10 weeks for 8 patients (Figure 1, 2), 11-14 weeks for 10 patients, 15-16 weeks for 5 patients and more than 16 weeks for 2 patients. The average time of union being 13.36 ± 2.69 weeks. None of the fractures treated by external fixation devices had excellent results. The prognostic factors for supracondylar fracture included age, intra-articular involvement, methods of treatment, timing of joint motion, etc (Neer *et al*)^[1].

All these cases were treated surgically with appropriate treatment method, depending upon type of fracture, at the earliest possible. The youngest patient in the study had an age of 22 years and oldest had age of 85 years. Average age was 46.4 years. These also common in old age where the bones are more osteoporotic and trivial trauma can lead to such fractures. All the simple fractures were fixed with appropriate fixation device depending on fracture pattern at the earliest and all compound fractures were stabilized with external fixator and operated later on after soft tissue healing had occurred and infection was under control.

Out of five fractures treated by external fixation device, one had unsatisfactory result and two had failure. Poor results were mainly because of open fractures. In the present study we had 8 patients with Type B fractures and 17 with Type C. At one month of follow-up Neer score for Type B fractures was 77.50 ± 7.98 and for Type C 63.53 ± 7.70 with p-value of 0.004 which is statistically significant. At 3 months values were 81.25 ± 8.35 , 71.76 ± 7.48 and $p=0.009$ respectively which were significant. At six months respective values were 87.0 ± 6.05 , 78.59 ± 7.48 and $p=0.010$ which was again significant. At one year of follow-up score were 90.0 ± 4.78 SD, 82.59 ± 6.62 and $p=0.009$ respectively with significant p-value. Thus the study proved that partial articular (Type B) fractures had better results as compared to the complete articular (Type C) fractures as can be seen from significant p-values in each of the time frame. In present study time taken for radiological union was less than 10 weeks for 8 patients, 11-14 weeks for 10 patients, 15-16 weeks for 5 patients and more than 16 weeks for 2 patients. Nonunion in the distal third of femur is and should be relatively rare for the bone is primarily cancellous and has an excellent vascular supply with good local osteogenic properties. The incidence of this complication seems to vary according to the method with which the fracture was treated. there were only 2 cases of delayed union (8%). They were treated by bone grafting. Non union in non-operative group may be due to distraction of the fracture fragments in skeletal traction. Traction must be applied carefully and good

quadriceps muscle tone must be maintained to prevent distraction. The length of follow up evaluation is insufficient to allow calculation of the incidence of late degenerative joint disease. Bone grafting was done in 13 fractures, out of which 6 were of type-C fractures. Out of 6, primary bone grafting was done in 4 fractures. The remaining 2 bone grafting was done for delayed union. Thus, displaced and comminuted type-C fractures required open reduction and rigid internal fixation with bone grafting. Two patients had wound infection, one superficial and other deep, which was treated with appropriate antibiotics (Table II).

At one year 60% of the patients did not have any pain, 30% had mild pain on weight bearing, 10% had moderate pain. Mean range of motion was 111° (10-145). 75% of the patients were able to walk for 30 min or more and remaining 25% for 30 min or less. Overall 84% of the patients had good to excellent results (figure 3). The mean Neer Score was 85.

Discussion

Intra-articular fractures distal femur are difficult to handle [3, 4]. Most of these surgical failures were due to inadequate fixation of the fracture fragments [2]. The prognostic factors for supracondylar fracture included age, intra-articular involvement, methods of treatment, timing of joint motion,

etc¹. Analysis of results were dependant on age, sex, characteristics of fracture, time interval between trauma and surgery, duration of hospital stay and periodic follow up of patient with certain standard questions about the degree of pain on weight bearing, range of motion (ROM) of the treated limb, walking ability and resumption of daily activities using Neer Scoring System [5-9].

Independent risk factors are open fracture, deep infection, diabetes, smoking, increased body mass index, and shorter plate length [9-13]. Postoperative radiographs evaluated for axial alignment, radiological union and osteoarthritis and comparison with similar studies. By analysing the gait 4 of the 25 patients had short-limbed gait, maximum shortening being 3.5 cm, which was treated with shoe modification. Shortening less than 2 cm were not given any form of treatment.

In our study, in the early followup period, quadriceps wasting and resultant weakness was present in 20 of 25 patients. This was mainly due to lack of doing quadriceps exercises by the patients because of pain. But in the later follow-up 15 of them regained good power. Those with open fractures failed to regain power. The results were comparable to earlier studies (Table III).

Table I: Results at quarterly intervals as per Neer’s scoring system.

	Mean neer score ± SD			
	1 month	3 months	6 months	1 year
Pain (20)	10.88 ±3.17	12.16 ±3.16	14.08 ±2.86	14.72 ±2.76
Function (20)	11.36 ±2.98	12.80 ±3.27	13.76 ±3.48	14.72 ±2.51
Work capacity (15)	5.20 ±1.53	7.52 ±1.05	7.92 ±0.70	10.00 ±0.0
Joint motion (15)	10.56 ±3.81	12.32 ±3.25	15.52 ±2.66	15.52 ±2.66
Gross anatomy (15)	15.00 ±0.00	15.00 ±0.00	15.00 ±0.00	15.00 ±0.00
Radiological appearance (15)	15.00 ±0.00	15.00 ±0.00	15.00 ±0.00	15.00 ±0.00
Neer’s score Total 100	68.00 ±10.12	74.80 ±8.83	81.28 ±8.00	84.96 ±6.96

Assessment of patient with neer’s scoring system Functional (70 points) and Anatomical (30 points)

Excellent- more than 85 points Fair- 55 to 69 points
 Good- 70 to 85 pointsq Poor- less than 55 points

Table II: Complications encountered in the management of distal end femur fracture

Complications	No. of cases	Percentage
Infection		
-Superficial	1	4.0
-Deep	1	4.0
Loss of length (>2cm)	4	16.0
Knee stiffness	2	8.0

Table III: Comparison of present study with previous studies

Study				
	Excellent	Good	Fair	Poor
EJ Yeap (SCHATZKER)	04	04	02	01
Siliski (NEER’s)	26	16	06	04
Manohar (NEER’s)	06	10	05	04
Shiblee S. Siddiqui (NEER’s)	28	12	06	04
Present Study (Neer)	15	5	3	2



Fig 1: Immediate post-operative image of distal end femur fracture fixation.



Fig 2: Radiological union at the end of one year



Fig 3: Range of motion at the end of six months

Locking plate fixation of distal femoral fractures is a challenging technique: A retrospective review. Clin Cases Miner Bone Metab. 2015; 12(1):55-58.

Conclusion

Closed undisplaced fractures in young adults with early fixation leads to good results, open fractures with two stage surgeries end up with stiff joints [14, 15]. Primary or secondary bone grafting is often necessary with severely comminuted fractures where the bone loss is more. Rigid internal fixation and early post-operative rehabilitation are the key factors for a better functional outcome. Complications like neurovascular injury, non-union, traumatic arthritis significant malunion etc. are rare after open reduction and internal fixation.

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