Functional Outcome of Distal End of Femur with Locking Compression Plate: A Prospective Study.

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ABSTRACT

Background: With modern technique of locking compression plate, still it is a great surgical challenge to orthopaedic surgeons, as most of these cases have compound injuries with high velocity trauma. **Methods:** Our prospective study reviewed 60 cases of distal femoral fractures treated with distal femoral locking compression plates between 2009 and 2014 at Gandhi hospital Secunderabad. There were 44 men and 16 women with a mean age of 40 years (range 20–70). Fractures were categorized according to MULLERS and GUSTILLO classification. **Results:** The mean follow-up period was 12 months (range 18–36). The mean time for radiological union was 12 weeks (range 10–18) at the latest follow up ROM> 100 is noted in 38 patients. With modern locking compression plate fixation techniques early mobilisation of the knee can be done even in osteoporotic pts. **Conclusion:** In compound injuries, primary debridement has a great role & primary bone graft always gives better results. Identifying the Hoffas fracture and its fixation is equally important. Follow up and physiotherapy plays a great role.

Keywords: Compression plate, Intra-articular fractures, GUSTILLO, ROM.

INTRODUCTION

Over the centuries from ancient ages to the present age of information technology, industrial and road traffic accidents with high velocity vehicles, Fractures of the distal end of the femur is unstable, compound, comminuted associated with multiple fractures. The incidence is higher in males between 20 to 45 years and females above the age of 60 yrs. These fracture management varied from conservative to the modern technique of using pre-contoured distal locking compression plate. The outcome in the management ends up with stiffness of the knee, shortening, rotational deformities and internal derangement of the knee with knee instability.

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MATERIALS AND METHODS

This study was to evaluate functional outcome, fracture healing and complications of the distal femur.

The study is a prospective study reviewed 60 cases of distal femoral fractures treated with distal femoral lock in Compression plates between 2009 and 2014 at Gandhi hospital Secunderabad.

There were 44 men and 16 women with a mean age of 40 years (range 20–70). Fractures were categorized according to MULLERS and GUSTILLO classification. Inclusion Criteria were as follows: (i) type A, B and C distal femoral fractures and (ii) patients older than 18 years.(iii) Ipsilateral patella fractures.(iv) Compound fractures. Pathological fractures, bilateral distal femur &, floating knees were excluded from the study. 10 patients belong to type A, 18 belongs to type B and 32 belongs to type C Mullers. The ratio of compound to simple found to be 3:1 in our series. 10 patients with open fractures were treated, within 2 weeks after temporary application of external fixator.

Preoperative AP and lateral radiographs of an affected knee with femur were obtained. CT was obtained in suspected intra-articular fractures. All surgeries were carried out at our tertiary trauma centre after Emergency management, compound cases were taken up for primary debridement at the earliest possible time and fixation was done within 2 to 3 weeks. Anterolateral parapatellar approach or lateral approach was used. Intra-articular fracture reduction was obtained and temporarily fixed with multiple K wires. Length of plate was determined intra-operatively after fracture reduction in the minimum length of the plate, which is three times the fracture comminution segment. For proximal fixation, 3 or 4 bicortical screws were used. Minimum of 4 locking screws were used for distal fixation. In 4 cases Hoffas fracture fixation was done with cancellous screws and patellectomy was done in 6 cases. The position of the plate was confirmed under image in both AP and lateral views and no screw passed through the inter-condylar notch. Suction drains were used in all patients and was removed after 24 to 48 hrs. Primary bone grafting was performed in 20 cases. Static quadriceps exercises with active hip and knee mobilization were started from the 1st postoperative day. Postoperative radiographs were taken. Follow-up radiographs were taken after 6 weeks, 12 weeks, 6 months, 9 months, and 12 months after surgery. Initially non-weight bearing mobilization was started. Gradual weight bearing was started based on the evidence of bridging

callus on follow-up radiographs. The average time until weight bearing was 3 months. Radiological union was defined as the presence of cross trabeculation on both AP and lateral radiographs. Non-union was defined as failure of fracture union at 9-month follow up. Clinical and functional outcomes were assessed using the KNEE society score.

RESULTS

Table 1: ???

Union		Complications			
Clinical (mean)	Radiological (mean)	Non-union	Infection	Stiffness	Shortening
12 weeks 58 cases	15 weeks	2	3	8	8

At latest follow up, 50 patients had a good / excellent outcome. 45 patients returned to their Pre-injury functional level.

The Pritchett rating system for supracondylar femoral fractures

Result Criteria

Excellent: Full extension; flexion >110°; no deformity or joint Incongruity

Good: Full extension; flexion >90°; <5° of varus or valgus;

Loss of length <1.5 cm, minimal pain

Fair Flexion of 75°–90°; varus, valgus, or angular

Deformity of 5°–10°; mild or moderate pain

Poor Flexion <75°; valgus, varus, or angular deformity >10°; articulate incongruity; frequent pain requiring analgesics

At the latest follow up ROM> 120◦ is noted in 30 patients,

90–120 in 20 patients, and 70–90 in 10 patients.

Table 2: Complications.

Complications	Number	Number requiring reoperation
(i) Infection	0	0
(ii) Nonunion	2	2
(iii) Varus/valgus deformity	0	0
(iv) Severe restriction of ROM	1	1
Total	3 (6.81%)	3 (6.81%)

Table 3: Complications.

Type of fracture	Number	Knee society score (mean)	
		Knee score	Functional score
C1	10	96.5	92.9
C2	12	93.8	86.2
C3	22	86.1	79.3

Clinical outcome (range of motion) according to Kristensen[11]

Range of motion: <60° 60–94° 95–104° >104° Unknown or not applicable:

Number of patients 614 308. 2

Percentage (%) 1023.35.8 4.5

DISCUSSION

Locking plates have become the most commonly used methods to stabilize fractures of the distal femur. Improved distal fixation for locked plates compared to blade plate and retrograde nailing has been demonstrated in osteoporotic bone. Although locking plates have provided a valuable additional option for treatment of distal femoral fractures, the use of locked plates has expanded and the numbers of fractures fixed with these plates have increased, complications related to slow healing, including non-union, delayed union, and implant failure are not infrequent and are ongoing problems in managing these fractures.

Earlier studies have shown reduced non-union rates for locked plating of distal femoral fractures compared to non-locking plates, but more recent studies found non-union rates up to 20%. In the current study, 4% of the fractures showed signs of delayed or non-union. Comparing traditional

plating, intramedullary nails, and locking plates, no observed differences were found between implants regarding the rate of non-union, infection, fixation failure, or revision surgery.

The current recommendation for adequate bridge plate fixation is three or four empty holes at the level of the fracture. The recommended screw ratio is 0.4 to 0.5 for bridging fixation with three to four screws on either side of the fracture gap Ricci recommended at least five screws proximally but required an adequate plate length to maintain screw density below 60%.

In our study, these recommendations were followed. More than 80% had three to five proximal screws and only 50% of the proximal holes were filled. This may be the reason why we did not see differences in these parameters for non-union or hardware failure. Distal femoral alignment is one of the treatment priorities. Maintaining this alignment is critical to the function and durability of the limb. Coronal plane alignment has been shown to be the most difficult factor to control and the most crucial to the overall outcome. Malalignment in the axial and sagittal planes also affects knee kinematics and range of motion.[14] When comminution is present, supracondylar femoral fractures are especially prone to varus collapse that is why we have done primary bone grafting in many cases of our series. Patients with greater loss of fixation tend to have a worse outcome. We found more than 75% open fractures in our study population. Previous studies stated that open fractures are common in the setting of distal femur fractures (19%–54%).[17]

Open fractures were related to high-energy injury mechanisms and a greater prevalence of infection. Therefore, the outcome of distal femoral fractures, similar to other major injuries, not only depends on bony reconstruction but also on soft tissue management. Henderson states, 'The diversity of injury patterns and bone quality and the complex mechanical and biological interplay in each individual case make it difficult to rarely assess separately and study potentially important variables'.[17] Outcome has been previously defined by reduction quality, range of motion, and pain.[9,11,12] We found 92.8% good flexion according to utilizing the more strict criteria of Pritchett[12], only 45.9% excellent or good results were achieved. Multiple factors are related to patient outcome. No comparison between the Pritchett functional outcome and subjective outcome scores were performed. In addition, the majority of fractures were treated with similar plate length.

The main goals of the above-mentioned techniques to maintain the important anatomy and to promote early fracture healing. More extensive approaches are needed for fixation of complex intra-articular fractures (C2/C3). In these fractures, we have employed lateral parapatellar arthrotomy for direct reduction of the joint surface. This articular block was fixed to the femoral shaft. In our series of 60 patients, there were 3 cases of infection. We noted 2 cases of non-union in compound comminuted fracture gustillo grade IIIB. 2 cases required implant removal, infection could be controlled.

CONCLUSION

Mobilisation of the knee can be done even in osteoporotic patients with modern locking compression plate fixation techniques. Primary debridement has a great role in achieving better results in compound injuries. Primary bone graft always gives better results. Early diagnosis of Hoffas fracture and it fixation is important. Follow up and physiotherapy do have a great role.

REFERENCES

1. Giles JB, DeLee JC, Heckman JD, and Keever JE. Supracondylar-intercondylar fractures of the femur treated with a supracondylar plate and lag screw. J Bone Joint Surg 1982;64(6):864–870.
2. Neer CS 2nd., Grantham SA and Shelton ML. Supracondylar fracture of the adult femur. A study of one hundred and ten cases. J Bone Joint Surg. 1967;49(4):591–613.
3. Olerud S. Operative treatment of supracondylar—condylar fractures of the femur. Technique and results in fifteen cases. J Bone Joint Surg. 1972;54(5):1015–1032.
4. Schatzker J, Lambert DC. Supracondylar fractures of the femur. Clin Ortho Rel Res. 1979;138:77–83.
5. Higgins TF. Distal femoral fractures. Jour Knee Surg. 2007;20(1):56–66.
6. Krettek C, Schandelmaier P, Miclau T, and Tscherne H. Minimally invasive percutaneous plate osteosynthesis (MIPPO) using the DCS in proximal and distal femoral fracture. Injury. 1997;28(supp.1):A20–A30.
7. Krettek C, Schandelmaier P, Miclau T, Bertram R, Holmes W, and Tscherne H. Transarticular joint reconstruction and indirect plate osteosynthesis for complex distal supracondylar femoral fractures. Injury. 1997; 28(1):31–41.
8. Insall JN, Dorr LD, Scott RD and Scott WN. Rationale of the knee society clinical rating system. Clin Ortho Rel Res. 1989;248:13–14.
9. Frigg R, Appenzeller A, Christensen R, Frenk A, Gilbert S, and Schavan R. The development of the distal femur Less Invasive Stabilization System (LISS). Injury. 2001;32(supp. 3):C24–C31.
10. Kregor PJ, Stannard JA, Zlowodzki M, and Cole PA. Treatment of distal femur fractures using the Less Invasive Stabilization System: surgical experience and early clinical results in 103 fractures. J Ortho Trauma. 2004;18(8):509–520.
11. Hontzsch D. Distal femoral fracture-technical possibilities. Kongressband/Deutsche Gesellschaftfür Chirurgie. 2001;118:371–374.
12. Schandelmaier P, Partenheimer A, Koenemann B, Grün OA, and Krettek C. Distal femoral fractures and LISS stabilization. Injury. 2001;32(3)C-55–C-63.
13. Ru J, Hu Y, and Liu F. Treatment of distal femur fracture by less invasive stabilization system-distal femur. Zhongguo Xiu Fu Chong JianWaiKeZaZhi. 2007;21(12):1290–1294.

14. Kao FC, Tu YK, Su JY, Hsu KY, Wu CH and Chou MC. Treatment of distal femoral fracture by minimally invasive percutaneous plate osteosynthesis: comparison between the dynamic condylar screw and the less invasive stabilization system. Jour Trauma. 2009;67(4):719–726.
15. Kolb W, Guhlmann H, Windisch C, Marx F, Kolb K and Koller H. Fixation of distal femoral fractures with the less invasive stabilization system: a minimally invasive treatment with locked fixed-angle screws. Jour Trauma. 2008;65(6):1425–1434.
16. Kanabar P, Kumar V, Owen PJ and Rushton N. Less invasive stabilisation system plating for distal femoral fractures. Jour Ortho Surg. 2007;15(3):299–302.
17. Kregor PJ, Stannard J, Zlowodzki M, Cole PA and Alonso J. Distal femoral fracture fixation utilizing the Less Invasive Stabilization System (L.I.S.S.): the technique and early results. Injury. 2001;32(supp.3):32–47.
18. Schütz M, Müller M, Krettek C et al. Minimally invasive fracture stabilization of distal femoral fractures with the LISS: A Prospective Multicenter Study. Results of a clinical study with special emphasis on difficult cases. Injury. 2001; 32(3):48–54.
19. Miclau T, Holmes W, Martin RE, Krettek C and Schandelmaier P. Plate osteosynthesis of the distal femur: surgical techniques and results. J Southern Ortho Assoc. 1998;7(3):161–170.
20. Zehntner MK, Marchesi DG, Burch H and Ganz R. Alignment of supracondylar/intercondylar fractures of the femur after internal fixation by AO/ASIF technique. Jour Ortho Trauma. 1992;6(3):318–326.

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