Original Article

Journal of Orthopedic Education
Volume 4 Number 2, May - August 2018
DOI: http://dx.doi.org/10.21088/joe.2454.7956.4218.4

A Study of 23 Patients of Distal Femur Fractures Treated with Locking Plates

Chawda R.V.[1], Tank P.M.[2], Patel V.J.[3]

Author Affiliation: [1]Associate Professor [2]Assistant Professor [3]Postgraduate Resident, Department of Orthopaedics, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat 380006, India.

Corresponding Author: Parag M. Tank, Assistant Professor, Department of Orthopaedics, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat 380006, India.
E-mail: paragtank1@gmail.com

Received: 24 July 2018 **Accepted on:** 09 August 2018

Abstract

Background: It is only seven percent of all femoral fractures which constitutes distal femur a very low incidence of injury in population. The complexity of understanding the fractures and aim of anatomical reduction and internal fixation with early vigorous rehabilitation offer comparative results. *Methodology:* Twenty three consecutive patients with 20-80 years were included with AO/ OTA type A,B,C fracture patterns which were treated by locking plates and followed up upto one year and analysed with American Knee Score. *Result*: Mean age of 43years with 11 patients had RTA while 10 patients had fall at home. Hospital stay average was 7 days. Average flexion 40 degrees at 2 weeks and 100 degrees at 6 weeks of follow up. 5 patients had extension lag of 10 degrees at 3 months. We observed excellent result in 14 patients (60.8%), good result in 8 patients (34.7%) while 1 patient (4%) showed fair result. No infections, varus valgus deformity or implant related problems were observed. *Conclusion*: Locking plates have promising results in distal femur fractures with less complications and excellent to good outcome.

Keywords: Distal Femur Fracture; DFLP; Locking Compression Plate; AKSS.

Introduction

Due to consistently poor results of varied fracture geometry of distal femur evoke controversial plan of management and its approaches with resultant variable outcomes. Muller classified these complicated fractures in simple fracture types. According to different literatures, distal 7.6 cm to 15 cm of area is known to be supracondylar area. This transition flare of distal femur is most prone to fracture while axial as well as bending or twisting loading in majority of vehicular accidents and sports injuries. Strong hamstring drag the distal portion posteriorly while even strong quadriceps shorten the limb in these fractures. Reduction becomes even more difficult in coronal rather than sagittal fractures due to muscle bracing and rarely dorsal neurovascular structures are at risk intraoperatively.

AO scientists strongly believe in open reduction and internal fixation in these difficult but conquerable fractures. Biological fixation techniques evolved in few decades after deep understanding of preservation of periosteal blood supply gives good outcome. Periarticular locking plates as an alternative to intramedullary nails, condylar buttress plates and dynamic condylar screws are in vogue due to research and technology as well as surgeon's better learning objective skills.

In this study we demonstrated the functional outcome of locking plates in wide age range irrespective of gender as well as extensive fracture involvement of distal femur.

Material and Methods

Twenty three patients with age group of 20-80 years were selected in our prospective study conducted at our institute between June 2013 to December 2015. 18 males and 5 females were included in the study. We operated all patients of intercondylar supracondylar fractures of distal femur with lateral distal femoral locking plate (DFLP) with standard lateral and Swashbuckler approach after written informed consent of surgery and anaesthesia. The study was approved by Institutional Ethical Committee.

Inclusion Criteria

1. AO/OTA classification type A,B & C
2. Gustillo Andersson type I
3. Skeletally mature patients

Exclusion Criteria

1. Gustillo Anderson type II, III
2. Periprosthetic fractures
3. Old malunited fractures
4. Associated tibial condyles/patella fracture

After thorough clinical and radiological workup of patients, further fracture assessment with CT scan in 3 patients with AO/OTA B3 with coronal fracture geometry was done.

All patients were operated in supine position under spinal anesthesia without tourniquete under adequate provision of blood transfusion. Broad spectrum iv antibiotics administered before incision. Standard lateral approach were taken in 20 patients. Swashbuckler approach was taken in 3 patients of AO/OTA B3 type. Intra-articular fracture assessment shows chondral and patellofemoral articular fragments fracture lines which are addressed initially held with smooth 1.6 mm Kirschner wires. Hoffa fragments are held with blunt c-clamp and provisionally fixed with 2mm Kirschner wires and fixed with 6.5mm cannulated cancellous screws or 5mm locking head screws. Intercondylar fractures are held with large patella holding clamps and fixed with 6.5mm CCS following epicondylar axis and blummensaat line. Supracondylar extensions of fracture lines are addressed with femoral clamps and held temporarily with 18G SS wires or 4.5 cortical lag screws. Locking plates of working length calibrated by working length of fracture spanning four to five locking or cortical compression units of the plate. Reduction achieved by any means are fixed with locking compression screws distally reaching medial condylar cortices with due care of collateral ligaments. Closure done of iliotibial band with continuous fashion with no 0 vicryl OS 6. Keeping negative suction drainage wound closed with standard fashion. Above knee posterior plaster slab applied in each case.

Postoperative standard protocols were followed routinely. Physiotherapy of quadriceps muscles and ankle pump started immediately on day one. Negative drain removed on day two postoperatively with Xrays. Assisted knee bending started in all patients on day three to four under pain control medications. Dressing were done on day two and on day five. Patients are discharged after 7 to 10 days with brace support.

Follow up after 2 weeks, 4 weeks and 6 weeks for clinical evaluation with X-rays at 6 weeks and 3 months to evaluate radiological union status were done. Patients movement and other parameters were evaluated with American knee society score system.

Results

We demonstrated clinical, radiological and functional outcome of our prospective study of 23 patients conducted at our institute between June 2013 to December 2015. We showed 18 male (78%) and and 5 females (5%). Of all patients, age range from 20-80 years with mean age was 43 years. Minimum age was 22 years and upper age of the patient included in the study was 68 years old.

11 patients (47%) had fracture on right side of leg while 12 patients (52%) had on left side.

7 patients (30%) of the study had AO/OTA fracture classification type A, 8 patients (34.7%) had type B while 8 patients (34.7%) also had type C fracture type. Among 8 patients of type B AO classification system, 3 patients (13%) had medial and lateral coronal fractures (type B3).

CT scans were done in 3 patients (13%) with type B2 AO fractures.

Close fractures were observed in 22 patients (95%) while 1 patient (4%) showed Gustillo Anderson compound wound of grade I.

Mode of injury were observed as road traffic accidents in 11 patients (47%), fall at occupation site in 2 patients (8%) while fall at home were observed in 10 patients (43%).

Average length of hospital stay of all patients were 7 days with range of 5-11 days.

Blood transfusions were required in 3 patients (13%) of sixth decade of age.

Patients were followed up at two, four, six weeks and at the end of three, six months and at one year for clinicoradiological as well as functional outcome with American Knee Society Scoring System (see table 1).

No bone grafts of autograft or allografts were required in any of the patients of our study.

We observed 40 degrees of average flexion with 0-80 degrees of range at the end of 2 weeks. And at the end of 6 weeks we analysed average flexion 100 degrees with an average of 0-140 degrees. We observed 5 patients (21.7%) with 10 degrees of extension lag at the end of 3 months. 2 patients (8.6%) had flexion contracture upto 5-10 degrees.

1 patient (4%) at the end of 6 months and even at the verge of one year showed mild pain on walking and stair climbing. He is waking with cane.

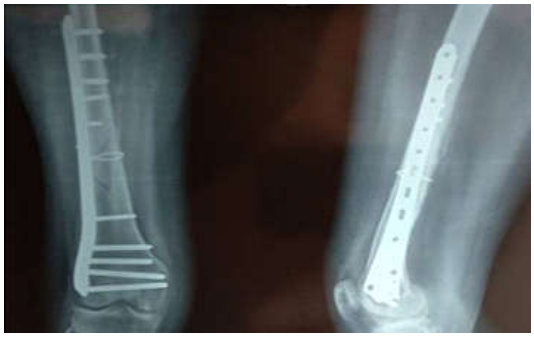
4 patients (17%) of AO type C fractures had limb length discrepancy of 0.5 cm to 1cm at the end of 6 months of follow up.

No patients in our study had infections of any form. 1 patient (4%) with grade I compound fracture was also showed complete wound healing except mild warmth at the end of upto 3 months.

We observed excellent result in 14 patients (60.8%), good result in 8 patients (34.7%) while 1 patient (4%) showed fair result. (Figure 1 and 2). No patients were showed poor result.

No patients in our study group showed varus or valgus deformity or non-union at the end of one year of final followup.clinical functional outcome and range of motion at final follow up (Figure 2)

Pre Operative X ray



Xray at final follow up

Fig. 1: Preop and post operative final follow up x rays

Table 1: Results of Present Study Based on "American Knee Society Score" (AKSS) scale [11]

Results	No of patients	Percentage
Excellent	14	60.8%
Good	08	34.7%
Fair	01	04%
Poor	--	--

Table 2: Comparison of Different Methods as Well as Results with Other Studies

Studies	No of Cases	Classification	Compound Fractures	Flexion Range	Bone Graft	Extensor Lag	Infection	Score used	Result
Saumya agrawal et al[13]	40	MULLER	09	106.3^0	-	4.5^0 (20 CASES)	-	Modified Neer Criteria	65% Excellent
Virk et al[14]	25	AO/OTA	-	109^0	9	-	3 CASES	Neer system	80% Execellent
Kanav padha et al[15]	50	AO/OTA	06	109^0	-	-	3 CASES	Schatzker and lambert criteria	76% Excellent
Present study	23	AO/OTA	01	100^0	-	10^0 (05 Cases)	-	Akss scale	60.8 % Excellent

Clinical outcomes at final follow up (Range of motion)

Fig. 2: Clinical range of motion at final follow up

Discussion

Distal femur fractures need adequate mechanical stability and early rehabilitation to alleviate stiffness, wound related problems, early or late deformity and implant associated complications. Although wide spectrum of implants available from condylar plate, dynamic compression screws and recent retrograde intramedullary nails, Wang et al. [1] sugggested no implant is superior in distal femur fracture treatment.

Since inception biomechanical properties of locked plates has shifting paradigm from compression plating to low contact implant bone interface without friction along with friction fit for stability [2].

Locked plates are superior biomechanically to gain torsional, axial, three point bending along with fracture stability to conventional non locking plates which requires biplanar neutralisation [3].

Gupta et al. [4] had in their study include 40 patients, 26 (65%) were male and 14 (35%) were females. Ehlinger et al. [5] study demonstrated peak incidence of these fractures in men in their third to forth decade and in 50% elderly population of more than 65 years of age. We also had mean age of incidence 43 years.

EJ Yeap, et al. [6] study demonstrated seven patients with right side of the limb and four patients had left side of the limb injured. In our study we observed nearly unequivocal affection of the dexterity of the limbs.

Lars Kolmer, et al. [7] in their huge study of distal femur fractures epidemiology displayed 135 patients with 137 fractures of all pattern supracondylar, intercondylar as well as unicondylar fractures.

Babak Siavashi [8] described selective need of preoperative ct scan to understand chondral fractures, articular step offs, degree of intraarticular comminution and coronal fractures. We did CT scan in 3 patients of intraarticular coronal unicondylar fractures.

Chander et al. [9] study of utility of different implant in distal femur fractures concluded locking plates results are far better in form of stability of fractures, less operative duration, fast healing of fractures and less revision operations.

In a comparative study of Malik et al. [10] between dynamic condylar screw and locking plate construct include 72% close fracture and 28% open fracture series of patients. Furthermore they concluded range of motion of knee at subsequent follow up was 107.60 degrees. And following the Schatzker's and Lambert criteria 80% had good to excellent results.

In comparision to different views and studies locking plates with its combi construct offer adequate axial stiffness and more elasticity. Moreover torsional stiffness is also gained with these locked implants especially with broad distal multiple locking screws hold metaphyseal osteoporotic old bone more securely where screws cut out are the main concern.

American knee society score scale was upto the limits of subjective as well as inter observer reliability which target almost all validation studies of knee scoring systems. In an effort to decrease inter observer variability and to increase construct validity inter observer consistency is maintained with this scoring system [11].

Biomechanical properties like global displacement, strain and bending moment study showed lateral

plate has as less wedge displacement as it spans the fracture due to viscoelastic nature [12].

We did not noticed any medial side plating requirement as lateral plating exposure confer ease of application without much soft tissue stretching as well as postoperative rehabilitation issues rather medial plating in some literature had vascular complications as midline incisions for dual plating and wound related deep infections. Comparision of various methods and results with other studies has been depicted in a Table 2.

Conclusions

Considering the intra articular and extraarticular comminution in young as well as older age group locking plates are moderately better choice of implant which address less comminuted medial column and sometimes bridge plating with less complications and early rehabilitation.

Conflicts of Interest: NIL

Acknowledgements

NIL

References

1. Aijun Wang, Shuangle Zong, Lixin Su, Weidong Liang, Xiaoqiang Cao, Qiutao Zheng, Lidong Li, Xiaoming Zhao, Shilian Kan. Meta-analysis of postoperative complications in distal femoral fractures: retrograde intramedullary nailing versus plating; Int J Clin Exp Med 2016;9(10):18900-11.
2. Kiner Dirk W., Rouhipour Varqa, Kellam James F. Biomechanics of Locked Plate Fixation 2007 Sep;22(3):151-55.
3. Kubiak Erik N., Fulkerson Eric, Strauss Eric, Egol Kenneth A. The evolution of locked plates; The Journal of Bone and Joint Surgery-American 2006 Dec;88:189–200.
4. Govind Kumar Gupta, Sudha Rani, Raj Kumar, Bhoopendra Singh.Analysis of management of supracondylar femur fracture by locking compression plate; International Journal of Orthopaedics Sciences 2016;2(4):218-22.
5. Ehlinger M, Ducrot G, Adam P, Bonnomet F. Distal femur fractures. Surgical techniques and a review of the literature; Orthop Traumatol Surg Res. 2013 May;99(3):353-60.
6. EJ Yeap, AS Deepak. Distal Femoral Locking Compression Plate Fixation in Distal Femoral Fractures: Early Results; Malaysian Orthopaedic Journal 2007;1(1).
7. Lars Kolmert & Krister Wulff. Epidemiology and Treatment of Distal Femoral Fractures in Adults, Acta Orthopaedica Scandinavica, 1982;53(6):957-62.
8. Babak Siavashi. Pitfalls in Distal Femur Fracture Fixation and a Literature Review; JOrthopSpine Trauma. 2016December;2(4):e12966.
9. Anil Chander, Ganesan Ram Ganesan, Vignesh Jayabalan. Is Distal Femur Locking Plate a Superior Implant in Distal Femur Fracture?. Open Journal of Orthopedics, 2015;5:258-63.
10. Malik I, Khan R, khurana R, Sharma S. Comparative study of management of distal femoral fractures managed by dynamic condylar screw and distal femoral locking compression plate. WebmedCentral Orthopaedics 2015;6(9):WMC 004976.
11. Ana Luiza Cabrera Martimbianco, Fernanda Rizzo Calabrese, Luiz Alberto Nakao Iha, Marcelo Petrilli, Ozório Lira Neto, and Mário Carneiro Filho. Reliability of the "American Knee Society Score" (AKSS). Acta Ortop Bras 2012;20(1):34-38.
12. Nikolai Briffa, Raju Karthickeyan, Joshua Jacob, Arshad Khaleel. Comminuted supracondylar femoral fractures: a biomechanical analysis comparing the stability of medial versus lateral plating in axial loading. Strat Traum Limb Recon 2016;11:187–191.
13. Saumya Agarwal, Shailesh Udapudi, Srinath Gupta. To Assess Functional Outcome for Intra Articular and Extra-Articular Distal Femur Fracture in Patients using Retrograde Nailing or Locked Compression Plating. Journal of Clinical and Diagnostic Research. 2018 Mar;12(3):RC21-RC24.
14. Jagandeep Singh Virk, Sudhir Kumar Garg, parmanand Gupta, Vivek Jangira, Jagdeep Singh, Sudhir Rana. Distal Femur Locking Plate: The Answer to All Distal Femoral Fractures. Journal of Clinical and Diagnostic Research. 2016 Oct;10(10): RC01-RC05.
15. Kanav Padha, Sandeep Singh, Abdul Ghani, Harish Dang. Distal Femur Fractures and its Treatment with Distal Femur Locking Plate Distal Femur Fractures and its Treatment with Distal Femur Locking Plate. 2016 Apr-Jun;18(2):76-80.