Original Article

Outcome study of use of Locking Compressive Plates in Supracondylar femur fracture

Raghuwanshi Gajendra*, Aggarwal Sumit S**

*Assistant Professor, Dept. o f Orthopedics, **Assistant Professor, Dept of Community Medicine, Govt. Medical College, Akola, Maharashtra, India

DOI: 10.5455/jrmds.2015326

ABSTRACT

Background: The goal of fracture treatment is to obtain union of the fracture in the most compatible anatomical position which allows maximal functional restoration of the extremity. The increase in stability provided by Locking Compressive Plates (LCP) is most helpful to surgeons treating a fracture in poor-quality bone, and comminuted fracture. The use of bone-implant constructs through interfragmentary compression may result in devascularisation of bone fragments and delayed fracture healing.

Aims: To study outcome of the use of open reduction and internal fixation with Locking Compression Plate (LCP) implantation in Supracondylar femur fracture. Study design: Prospective descriptive study.

Methods: Study was conducted in Department of orthopedics, Government Medical College & Hospital, Akola, Maharashtra, India from January 2014 to March 2014. All 30 patients of Supracondylar femur fracture treated by LCP implantation were included in the study.

Results: Supracondylar femur fracture (38.4%) found to be most common fracture among lower limbs fractures. Majority of the cases 55 (70.5%) were injured due to road traffic accident (RTA).

Conclusion: Complications associated with the plate were few and the functional outcome was excellent. Thus, many of the common complications of the conventional plating can possibly be avoided. We therefore recommend the use of locking plate, especially in elderly patients with osteoporotic bone and comminuted fracture.

Keywords: Locking Compressive Plates (LCP), Supracondylar femur fracture

INTRODUCTION

In the modern world with the increase in speed and number of fast moving vehicles there is great increase in number and severity of fractures. Fractures may be associated with multiple system injuries and polytrauma. When a bone is fractured, it loses its structural continuity. The loss of the structural continuity renders it mechanically useless because it is unable to bear any load. The goal of fracture treatment is to obtain union of the fracture in the most compatible anatomical position which allows maximal functional restoration of the extremity. Long term disability following a fracture is almost never the result of damage to the bone itself; it is the result of damage to the soft tissues and of stiffness of neighboring joints [1]. Locking plates are fracture fixation devices with threaded screw holes, which allow screws to thread to the plate and function as a fixed-angle device. These plates may have a mixture of holes that allow placement of both locking and traditional no locking screws (so called combi plates). The main biomechanical difference from conventional plates is that the latter require compression of the plate to the bone-plate interface [2]. With increasing axial loading cycles, the screws can begin to toggle, which decreases the friction force and leads to plate loosening. If this occurs prematurely, fracture instability will occur, leading to implant failure. Thus, the more difficult it is to achieve and maintain tight screw fixation (as for example, in metaphyseal and osteoporotic bone), the more difficult it is to maintain stability [3]. Locking plates potentially provide high stability in to a degree that a second plate is not required. The increased stability is the result of the difference in the mechanics of conventional plate and locking plate fixation. Stability is maintained at the angular stable screw plate interface. Because the screws are locked to the plate, it is difficult for one screw to pull out or fail unless all adjacent screws fail [4]. The increase in stability provided by locking plates is most helpful to surgeons treating a fracture in poor-quality bone, a comminuted bicondylar fracture for

which a single plate may not provide adequate stability [5] . Some of the indication suggested for LCP are metaphyseal and intra-articular fractures, highly comminuted fractures, particularly those involving diaphyseal and metaphyseal bone, osteoporotic bone, Proximal tibia and distal femur fractures, Tumor surgery, Open wedge osteotomy, Secondary fractures after intramedullary nail etc [6-8].

The present study was conducted to show efficacy and outcome of Locking Compression Plate (LCP) implantation in Supracondylar femur fracture (distal femur).

MATERIAL AND METHODS

The present study was conducted in Department of orthopedics, Government Medical College & Hospital, Akola (Maharashtra, India) from January 2014 to March 2014. All patients (n==78) of lower limb fracture (femur and tibia) treated by LCP implantation were included in the study but main focus of study was on supracondylar femur fractures (n=30). So detail preoperative and post operative follow-up data was collected and analyzed for supracondylar femur fractures. All patients were evaluated clinically at the time of admission and first aid treatment was given. X-ray was done to assess the type of fractures and displacement and plan of the treatment. Patient was investigated completely for operative and anesthesia purpose. Any associated medical problems were taken care before patient is taken for operation. Cases with pathological fracture, history of long-term steroid therapy were excluded from the study. Preoperative counseling & informed consent of the patient and relatives regarding the treatment, operation and study was taken. Permission from ethical committee was taken prior to commencement of study.

In fracture of distal femur a lateral incision made and fracture site exposed. Intercondylar fragments were first reduced and hold with K-wires. Reductions of supracondylar fragments were achieved and a metaphyseal plate applied. Locking screw applied in distal metaphyseal portion & proximal diaphysis. K-wires used for holding the intercondylar portion were removed. In cases where LISS technique was used for supracondylar femur fracture (distal femur) first intercondylar fragments were reduced & fix with K wires. Then femoral plate was slide submuscular, distal metaphyseal portion of plate was fixed with locking head screw. Proximal diaphyseal screw was applied after applying stab incision & checking the reduction under image intensifier. K wires holding intercondylar portion were removed. Operations were performed directly by a consultant orthopedic trauma surgeon or under their immediate supervision. The LCP was used as a bridging construct across the diaphyseal—metaphyseal fracture. Where appropriate, articular fragments were anatomically reduced and rigidly fixed via separate small incisions. Splintage and immobilization was applied as per fixation achieved. After discharge from hospital patient was follow up after 2 weeks for suture removal and wound examination. Than after six weeks patient was assessed clinically and radiologically. Thereafter patient was assessed every four weekly. Full weight bearing was permitted to patient based on radiological evidence of callus formation and clinical evaluation.

For assessment of results of distal femur fracture reduction was done according to modified Mehrotra's Grading and Scoring was taken likewise Grade I = 3 points; Grade II = 2 points; Grade III = 1 point. Excellent = 21-27 points; Fair = 15-20 points; Poor = 9-14 points.

OBSERVATIONS AND DISCUSSION

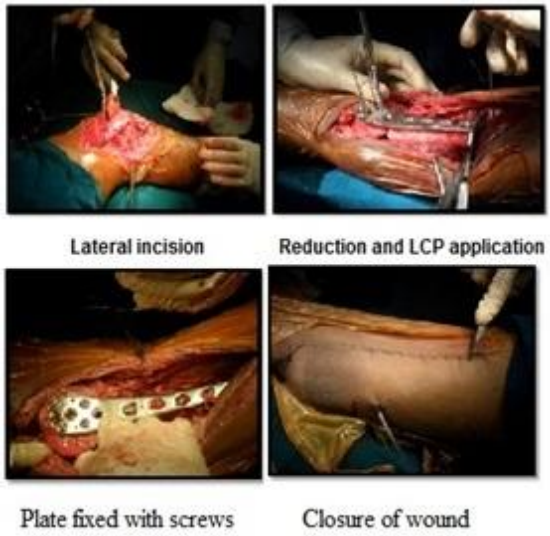
The principle of the locking compression plate (LCP) is represented by the combination of two completely different technologies and two opposed principles of osteosynthesis in one implant it combines the principles of conventional plate osteosynthesis for direct anatomical reduction with those of bridging plate osteosynthesis. Since the LCP can be used as a conventional plate using only dynamic compression, as a pure internal fixator using locking head screws, or as both combined, it provides the surgeon with multiple variations.

Image 1: X-ray of Supracondylar femur fracture

Preoperative X-ray of supracondylar fracture

Postoperative X-ray of Supracondylar Fracture

Image 2: Intraoperative pictures of supracondylar femur fracture



Out of 90 cases 76.70% were male and remaining patients were female. Majority of the cases 55 (70.5%) were injured due to road traffic accident (RTA) followed by 13 (16.66%) cases were of fall at home (Table 1).

Table 1: Distribution of All lower limb patients treated by LCP according to their age group and type of fracture (n=78)

Sex	No. of cases (%)
Male	59(75.6)
Female	19(24.4)
Total	78(100)
Mode of trauma to patients	
RTA	55(70.5)
Fall at home	13(16.7)
Assault	05(06.4)
Others	05(06.4)
Total	78(100)

Table 2: Distribution of patients according to their age group and type of fracture

Age group	Supracondylar femur (%)	Proximal tibia (%)	Distal tibia (%)	Total (%)
20-30	02 (6.7)	10 (41.7)	02 (08.3)	15 (19.2)
31-40	06 (20)	05 (20.8)	09 (37.5)	21 (26.9)
41-50	11 (36.6)	03 (12.5)	10 (41.7)	24 (30.8)
>50	11 (36.7)	06 (25)	03 (12.5)	18 (23.1)
Total (%)	30 (100)	24 (100)	24 (100)	78 (100)

Table 3: Distribution of injury according to nature of fracture (Gustilo-Anderson classification) [9]

Nature of fracture		No. Of cases	Percentage
Closed		52	66.70%
	Grade 1	5	6.40%
Open	Grade 2	8	10.30%
	Grade 3	7	8.90%
Old un-united		6	6.70%
Total		78	100

Table 4: Distribution of variable related to distal femur fracture and outcome of LCP implanted operative procedure (n=30)

Various variables	No. Of cases	Percentage
Fracture distal femur according to Muller AO classification [10]		
A1	6	20
A2	0	0
A3	3	10
C1	3	10
C2	12	40
C3	6	20
Operative technique in fracture distal femur		
LISS	6	20
Direct reduction	24	80
Full weight bearing allowed (weeks)		
16-Dec	18	60
17-20	9	30
> 20	3	10
Complication in distal femur fracture (n=10)		
Superficial infection	3	10
Deep infection	1	3.3
Non union	3	10
Shortening	3	10
Implant failure	0	0
Range of movement at knee in fracture distal Femur		
90 degree or more	21	70
70 - 89 degree	3	10
Less than 70 degree	6	20
Evaluation of result (mehrotra's) of distal femur		
Excellent	18	60
Fair	9	30
Poor	3	10

Table 2 shows that 41-50 year age group was the most common age group (30.8%) followed by 31-40

years (26.9%). Supracondylar femur fracture (38.4%) found to be most common fracture among lower limbs fractures.

Majorities (66.66%) of cases were 'closed' in nature, total 25.6% were open in nature, and 06.7% of the cases were old un-united fracture.

A comparison of published series of supracondylar femoral fractures and their treatment

Author	Study subjects	Treatment	Satisfactory Result (%)	Infection (%)	Nonunion (%)
Schtazker (1974) [13]	32	ORIF*	88	0	0
Schtazker & Lambert (1979) [14]	17	ORIF(AO technique)	71	5	5
	18	ORIF (AO technique not followed)	21	7	7
Krettek (1997)	8	ORIF (DCS or CBP)	75	0	0
Present study	30	ORIF with LCP	80	10	10

Most common type of fractured was observed was C2 type (40%), followed by C3 & A1 (both 20% each). In 80 % of cases direct reduction was done and in 20% cases LISS was done. 60% of cases were allowed full weight bearing by 12-16 weeks, 30% cases were allowed weight bearing by 17-20 weeks and three (10%) patient which was the case non union was allowed weight bearing with knee brace after 24 weeks. In complicated cases three cases (10%) were having superficial infection, non-union occurred in three cases where there was extensive bone loss. Shorting was also observed in 03 (10%) cases. Implant failure not observed in any case. 70% (21) of cases had ROM of 90 degree or more, 20% (6cases) had ROM <70 degree. 60% of cases had excellent results, 30% had fair results, and 10 % had poor result. The case of poor result had non union at distal femur and shortening.

Compound cases were managed initially by debridement and skeletal traction. These cases were operated after wound healing. Condylar butteress plate was used in 24 out of 30 cases. 06 cases in which LISS technique was used, distal femoral plate was applied. Post operative splintage of distal femoral fracture were applied in 06 cases out of 30, of which 1 case was continued splintage for more than 2 weeks, one patient had extensive bone loss and one patient had superficial infection. Cases in which splintage were applied, mobilization started after 2 wks i.e. after suture removal. 24 cases in which splintage were not applied mobilization were started after 3-4 day. 8 cases in which splintage were not applied mobilization was started after 3-4 day. Out of 30 cases of distal femur, Non-union occurred in one case where there was extensive bone loss. In the same case there was shortening of 2.5 cm. 21 cases out of 30 distal femur fracture achieved 90° or more flexion at knee joint. 20% (6 cases) had ROM <70 degree and 10% (3 cases) had ROM 70-89 degree. 60% of cases were allowed full weight bearing by 12-16 weeks, 30% cases were allowed wt. bearing by 17-20 weeks and three (10%) patient which was the case non union was allowed weight bearing with knee brace after 24 weeks.

Of the 10 cases of distal femur fracture when classified by modified Mehrotra's grading 18 cases (60%) were graded as excellent, 9 case (30%) were fair and 3 case (10%) had poor result. The one case which had poor result had non union at fracture femur and shortening 60% of cases were allowed full weight bearing by 12-16 weeks. In complicated cases 10% were having superficial infection, non-union occurred in three cases where there was extensive bone loss. Shorting was also observed in 10% cases. Implant failure not observed in any case. 70% of cases had ROM of 90 degree or more. 60% of cases had excellent results.

Giles et al (1982) [11] published a report of 26 patients of supracondylar-intercondylar fractures of the femur treated with a supracondylar plate and lag screw. 92% of patient had satisfactory results. There was no nonunion & no infection. Krettek C, Tscherne H, (1997) [12] made a prospective study of displaced Muller type C2-C3 intraarticular fractures of distal femur, treated using an indirect plate fixation technique and a lateral parapatellar arthrotomy for the direct reduction of the Condylar block. Out of 8 patients, according to Neer's score there were 6 excellent and 2 unsatisfactory results. There was no infection or non union.

In present study it was seen that the implant with locking head screw when used in difficult fractures like distal femur provides a good fixation. Even in osteoporotic bone the locking head implant provides a good anchorage also comparing the results in non osteoporotic patients even with conventional plates locking plate has better results in all subtype, more notably so in 3 and 4 part.

CONCLUSION

The results demonstrate several benefits of locking plate. More importantly, it is easy to use, it is biological in the sense that the blood circulation to the bone is not compromised, the plate does not need to be reconfigured and the angular screw fixation ensures fixed angle stabilization. Moreover, complications associated with the Plate were few and the functional outcome was excellent. Thus, many of the common complications of the conventional plating can possibly be avoided. The LCP is an effective bridging device used for treating comminuted fractures, but for treating simple fractures its superiority over conventional plating is yet to be proven. Although the locking plate is comparatively expensive, we therefore recommend the use of locking plate, especially in elderly patients with osteoporotic bone and comminuted fracture. Randomized studies will of course be needed in the future to validate the possible advantages associated with this method. Nevertheless, these new possibilities mean that preoperative planning and an understanding of the different biomechanical principles of osteosynthesis are essential if good clinical outcomes are to be achieved and maximum benefit is to be attained from the options offered by the LCP system.

REFERENCES

1. Singh S K, Kishore N, Singh A, Nag S, Hembram S. A Comparative Study - Plating Of Fracture Around Knee Joint By Mipo V/S Conventional Technique. IOSR Journal of Dental and Medical Sciences. 2015;14 (1):37-47.
2. Wade R S, Bruce H Z, Jeff O A, Philip F S. Locking Plates: Tips and Tricks. J Bone Joint Surg Am. 2007;89:2298-2307.
3. Fulkerson E, Egol KA Kubiak EN. Fixation of Diaphyseal Fractures with a segmental defect. A Biomechanical comparision of Locked and Conventional Plating Techniques. J Trauma. 2006;60:830-5.
4. Nayak R, Koichade MR, Umre A, Ingle MV. Minimally invasive plate osteosynthesis using a locking compression plate for distal femoral fractures. Journal of Orthopaedic Surgery 2011;19(2):185-90.
5. Egol KA, Kubiak EN, Fulkerson E, Kummer FJ, Koval KJ. Biomechanics of locked plates and screws. J Orthop Trauma. 2004 Sep;18(8):488-93.
6. Robert V Cantu, Kennneth J Kkoval The use of locking compression plates in fracture care. J am acad orthop surg 2006:14(3);183-190.
7. Wade R. S, Bruce H. Z, Jeff O. A, Philip F. S. Locking plates; tips and tricks The Journal Of Bone & Joint Surgery: 89A,10:2007;2298-2307
8. Stoffel K, Dieter U, Stachowiak G, Gächter A, Kuster MS. Biomechanical testing of LCP – how can stability in locked internal fixators be controlled? Injury. 2003 Nov;34 (Suppl 2):B 11-9.
9. Kim PH, Leopold SS. Gustilo-Anderson Classification. Clinical Orthopaedics and Related Research. 2012;470(11):3270-4.
10. Ruedi TP, Buckley RE, Moran CG. AO principle of fracture Management. IInd expanded edition, Volume 1, AO foundation publishers, Switzerland. p69.
11. Giles JB, DeLee JC, Heckman JD. Supracondylar-Intercondylar fractures of the femur treated with a Supracondylar Plate and Lag screw. J Bone Joint Surg [Am] 1982;64-A:864-70.
12. Krettek C. Tscherne H. Transarticular joint reconstruction and Indirect Plate Osteosynthesis for complex distal supracondylar femoral fractures Injury.1997; 28 (Suppl) :31-41.
13. Schatzker J, Home G, Waddell J. The Toronto experience with the supracondylar fracture of the femur, 1966-1972 Injury.1974; 6:113-28.
14. Schatzker J, Lambert DC. Supracondylar fractures of the femur. Clin Orthop. 1979; 10:77-83.

Corresponding Author:

Dr. Gajendra Raghuwanshi
Assistant Professor
Dept. of Orthopedics
Govt. Medical College
Akola 444001,
Maharashtra, India
Email: raghuvanshi.gajendra@gmail.com

Date of Submission: 04/06/2015
Date of Acceptance: 21/06/2015

How to cite this article: Gajendra R, Aggarwal S. Outcome study of use of Locking Compressive Plates in Supracondylar femur fracture. J Res Med Den Sci 2015;3(2):122-6.

Source of Support: None
Conflict of Interest: None declared