

Original Research Article

Evaluation of the functional outcome of locking compression plate for fractures around knee joint distal 1/3rd femur or proximal 1/3rd tibia

Surender Kumar¹, Himanshu Khichar^{2*}

¹Department of Orthopedics, Government Hospital, Barmer, Rajasthan, India

²Department of Orthopedics, Pacific Institute of Medical Sciences, Umarda, Udaipur, Rajasthan, India

Received: 04 January 2021

Revised: 18 January 2021

Accepted: 19 January 2021

*Correspondence:

Dr. Himanshu Khichar,

E-mail: drattirammeena@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The aim of the study was to evaluate the functional outcome of locking compression plate for fractures around knee joint (Distal 1/3rd femur or proximal 1/3rd tibia).

Methods: This multicentric prospective functional out-come study has been conducted in the department of orthopedics, Barmer medical college and hospital, Barmer, Rajasthan and department of orthopedics, Pacific institute of medical sciences, Udaipur, Rajasthan. A total of 90 patients were studied, out of which 60 patients were with fracture distal femur and 30 patients were with proximal tibia fractures. At the end of study, 20 patients were lost to the follow-up (16 patients were with distal femur fracture and 04 patients were with proximal tibia fracture).

Results: According to modified Mehrotra's criteria for distal femur fracture excellent (43.18%) and fair (43.18%) and (13.64%) had poor result. All followed-up patients of proximal tibia fracture managed with MIPO technique had excellent (11.11%), good (66.67%) and fair (22.22%) functional outcome and no failure. While 17.65% followed patients of proximal tibia fracture who were managed with ORIF technique had failure.

Conclusions: Locking compression plate is the optimal tool for many supracondylar fractures of femur and proximal tibia fractures. It provides rigid fixation, where a widening canal, thin cortices and frequently poor bone stock make fixation difficult.

Keywords: Femur, Tibia, Locking plate, MIPO, Outcome

INTRODUCTION

In the modern world with the increased density of automobile traffic on roads and ever-increasing number of road accidents, there is great increase in number and severity of fractures. Fractures around knee joint have assumed an importance and frequency. In the precarious plight of city pedestrian, the knee seems to be the most vulnerable point. A hinge joint at the exact level of automobile bumper is most commonly struck on its lateral side resulting in torn ligaments, sprains or fractures of either lower 1/3rd femur or upper 1/3rd leg bones, or both.¹ LCP heals fractures by secondary bone healing (enchondral ossification). Secondary bone healing occurs

when relative stability is provided and strain (change in fracture gap/fracture gap) is kept between 2 and 10%.² Secondary bone healing is characterized by callus formation. Other methods by which fracture heals by secondary bone healing are splints, casts, intramedullary nail and external fixators.⁶ Stability determines the amount of strain at the fracture site and strain determines the type of healing that can occur at fracture site. Primary bone healing occurs when strain is kept to less than 2%. Bone cannot be formed when strain is greater than 10%.³ The increase in stability provided by locking plates is most helpful to surgeons treating a fracture in poor-quality bone, comminuted bicondylar fracture for which a single plate may not provide adequate stability. Also, since only a

single plate is needed and the plate does not depend on a tight fit to the bone for stability, substantially less soft tissue dissection may be required, thus preserving the local blood supply and enhancing fracture healing.⁴

METHODS

This multicentric prospective functional out-come study has been conducted in the department of orthopedics, Barmer medical college and hospital, Barmer, Rajasthan and department of orthopedics, Pacific institute of medical sciences, Udaipur, Rajasthan from 1/12/2018 to 31/7/2020.

Sampling technique used was systematic random sampling.

Sample size- $n = 4pq/l^2$

P=Distal femoral fractures currently account for less than 1% of all fractures, q=1-P, l=Margin of error, Minimum sample size=15 patients.

This multicentric prospective functional out-come study has been conducted in the department of orthopedics, Barmer medical college and hospital, Barmer, Rajasthan and department of orthopedics, Pacific institute of medical sciences, Udaipur, Rajasthan from 1/12/2018 to 31/7/2020. A total of 90 patients were studied, out of which 60 patients were with fracture distal femur and 30 patients were with proximal tibia fractures. At the end of study, 20 patients were lost to the follow-up (16 patients were with distal femur fracture and 04 patients were with proximal tibia fracture).

Inclusion criteria

Inclusion criteria included the all patients who got admitted in orthopedic department with closed or

compound fractures around knee joint (either distal 1/3rd femur or proximal 1/3rd tibia) regardless of patient's sex and side, skeletally mature patient and non union distal 1/3rd femur or proximal 1/3rd tibia.

Exclusion criteria

Exclusion criteria for the study excluded fracture distal 1/3rd femur or proximal 1/3rd tibia with vascular injury, floating knee injuries, skeletally immature patients (age<18 years). All patients were evaluated clinically at the time of admission and first aid treatment was given. For distal femur fracture radiograph of entire femur with one joint above and one joint below taken. For proximal tibia fracture radiograph of entire leg with one joint above and one joint below was done to assess the type of fracture and displacement and plan of the treatment.

History, general examination and local examination were recorded on the proforma attached. Patient was investigated completely for operative and anesthesia purpose. Associated medical problems were evaluated and taken care before patient is taken for operation.

Statistical analysis

Statistical analysis will be done by SPSS software (20.0 trial version) and appropriate statistical tests were used for finding the final results.

RESULTS

Majority (31.67%) of the patients with distal femur fracture were of 28-37 years. age group while majority (66.66%) of the patients with proximal tibia fracture were of 28-37 years (33.33%) and 38-47 years (33.33%) age group (Table 1).

Table 1: Distribution of type of fracture according to age and sex (n=90).

Age group (in years)	Femur			Tibia		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
18-27	10 (16.66)	2 (3.33)	12 (20.00)	3 (10.00)	0 (0.00)	3 (10.00)
28-37	16 (26.67)	3 (5.00)	19 (31.67)	10 (33.33)	0 (0.00)	10 (33.33)
38-47	8 (13.33)	2 (3.33)	10 (16.67)	6 (20.00)	4 (13.33)	10 (33.33)
48-57	7 (11.67)	2 (3.33)	9 (15.00)	1 (3.33)	3 (10.00)	4 (13.33)
58+	4 (6.66)	6 (10.00)	10 (16.66)	3 (10.00)	0 (0.00)	3 (10.00)
Total	45 (75.00)	15 (25.00)	60 (100.00)	23 (77.67)	7 (22.33)	30 (100.00)
P value	0.091			0.015		

Majority of the patients with distal femur fracture (75%) and proximal tibia fracture (77.67) were male. Association between femur fracture and age was found statistically insignificant and association between tibia fracture and age was found statistically significant (Table 1).

Majority of distal femur fracture were on right side whereas there was an equidistributional of proximal tibia

fracture according to the side. The association between type of fracture and side of fracture was found statistically Insignificant (Table 2).

Majority of distal femur fracture (66.67%) and proximal tibia fracture (70%) patients combined (conventional and locking) principle of locking plate fixation was used. While in 33.33% of distal femur and 30% of proximal tibia

fracture patients Internal fixation (locking screw only) principle of plate fixation was used (Table 3).

Table 2: Distribution of type of fracture according to side of fracture (n=90).

Side	Femur		Tibia	
	No.	%	No.	%
Right	36	60.00	15	50.00
Left	24	40.00	15	50.00
Total	60	100.00	30	100.00
P	0.498			

Table 3: Distribution of principle used for implant fixation (n=90).

Principle	Femur		Tibia	
	No.	%	No.	%
Combined (conventional and locking)	40	66.67	21	70
Internal fixation (locking only)	20	33.33	9	30
Total	60	100	30	100

Table 4: Distribution of technique used for management of tibia fracture (n=30).

Technique	No.	Percentage (%)
MIPO	10	33.33
ORIF	20	66.67
Total	30	100.00

MIPO (minimally invasive plate osteosynthesis) technique was used in 33.33% patients of proximal tibia fracture. While ORIF (open reduction internal fixation) technique was used in 66.67% of proximal tibia fracture patients and in all patients of distal femur fracture.

Table 5: Functional out-come of distal femur fracture according to modified Mehrotra's criteria (n=44).

Grading	Total
Excellent	19 (43.18)
Fair	19 (43.18)
Poor	6 (13.64)
Total	44 (100.00)

According to the modified Mehrotra's criteria, the excellent (43.18%) and fair (43.18%) and (13.64%) had poor result. 16 patients were lost to follow up.

According to Schatzker Lambert's criteria excellent (26.92%), good (30.77%), fair (30.77%) and 3 (11.54%) had failure. 4 patients were lost to the follow up.

Techniques used for management of tibial fractures (n=26)-all followed patients of proximal tibia fracture

managed with MIPO technique had excellent (11.11%), good (66.67%) and fair (22.22%) functional outcome no failure. While in case of ORIF technique of proximal tibia fracture (17.65%) had failure.

Table 6: Functional outcome of proximal tibia fracture according to Schatzker Lambert's criteria (n=26).

Grading	No.	Percentage (%)
Excellent	7	26.92
Good	8	30.77
Fair	8	30.77
Failure	3	11.54
Total	26	100.00

Table 7: Functional outcome according to Schatzker Lambert's criteria in different.

Grading	Implant		Total
	MIPO	ORIF	
Excellent	1 (11.11)	6 (35.29)	7 (26.92)
Good	6 (66.67)	2 (11.76)	8 (30.77)
Fair	2 (22.22)	6 (35.29)	8 (30.77)
Failure	0 (0.00)	3 (17.65)	3 (11.54)
Total	9 (100.00)	17 (100.0)	26 (100.0)



Figure 1: Equipments used.

Pre-op, Intra-Op, Post Op Photographs and Functional Outcome

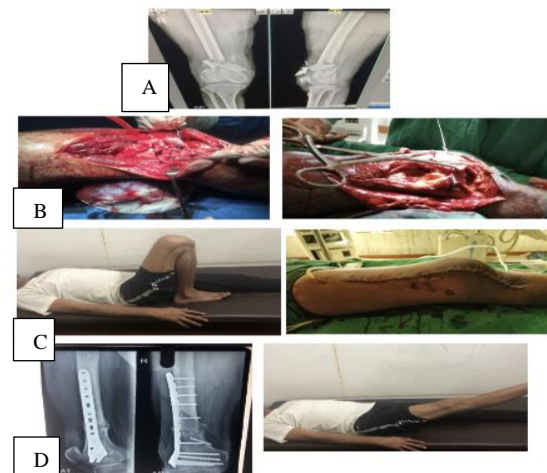


Figure 2: (A) Pre-op, (B) intra-op, (C and D) post-op picture and functional outcome.

Pre-op, Intra-Op, Post Op Photographs and Functional Outcome



Figure 2: (A) Two column on CT and post-op X-ray of treated with dual plating, (B and C) Early post-op mobilization and (D and E) good functional outcome at 6 months of follow up.

Table 8: A comparison of published series of periarticular fractures of knee and their treatment.

Year	Author	No. of cases	Treatment	Satisfactory result (%)	Infection (%)	Non-union (%)
2006	Vallier et al ¹²	46	CRIF with LCP	86.9	2.17	15.21
2006	Krettek et al ⁹	54	LCP	94	3.5	2.5
2010	Present study	70	ORIF with LCP	86.36	22.72	4.5

Limitations

The time duration was limited and the sample size was less.

CONCLUSION

Locking compression plate is the optimal tool for many supracondylar fractures of femur and proximal tibia fractures. It provides rigid fixation, where a widening canal, thin cortices and frequently poor bone stock makes fixation difficult. This study results also suggested MIPO was superior to ORIF in case of proximal tibia fracture.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Berkson EM, Virkus WW. High Energy Tibial Plateau Fractures. J Am Acad Orthop Surg. 2008;14:20-31.
2. Egol KA. Biomechanics of locked plates and screws. Orthop trauma. 2004;18:8.

DISCUSSION

The distal femur and proximal tibia fractures (fracture around knee joint) results from high energy trauma. These fractures usually have intraarticular extension and associated with metaphyseal comminution. When there is associated coronal plane extension and extensive comminution of these fractures generally preclude the use of traditional implants like fixed angle device, retrograde nail. The use of single lateral plate results in either nonunion or varus collapse in both distal femur and proximal tibia fractures.^{6,7}

The introduction of locking compression plate (LCP/LISS) has provided the means to increase the rigidity of fixation of fractures around the knee joint in the presence of osteoporosis and severe juxta articular comminution.⁸ The LISS/LCP also allows minimally invasive insertion and preservation of vascularity to the fractured bone. Early clinical results following use of the LISS/LCP in the distal part of the femur have been promising as have been the early results of the use of LCP implants for other fractures.⁹⁻¹¹

3. Perren SM. Point contact fixator: part 1. scientific background, design and application. Injury. 1995;22(1):1-10.
4. Perren SM. Physical and biological aspect of fracture healing with special reference to internal fixation. Clin Orthop. 1979;138:175-96.
5. Hente R, Cordy J, Perren SM. In vivo measurement of bending stiffness in fracture healing. Biomed Eng online. 2003;2:8.
6. Jazrawi LM, Kummer FJ, Simon JA, Bai B, Hunt SA, Egol KA et al. New technique for treatment of unstable distal femur fractures by locked doubleplating: case report and biomechanical evaluation. J Trauma. 2000;48:87-92.
7. Sanders R, Swiontkowski M, Rosen H, Helfet D. Double-plating of comminuted, unstable fractures of the distal part of the femur. J Bone Joint Surg Am. 1991;73:341-6.
8. Kregor PJ, Stannard JA, Zlowodzki M, Cole PA. Treatment of distal femur fractures using the less invasive stabilization system: surgical experience and early clinical results in 103 fractures. J Orthop Trauma. 2004;18:509-20.
9. Krettek C, Schandelmaier P, Miocla T, Bertram R, Holmes W, Tscherne H. Transarticular joint reconstruction and indirect plate osteosynthesis for

- complex distal supracondylar femoral fractures. *Injury*. 1997;28(1):31-41.
10. Rockwood CA, Green DP, Bucholz RW, eds. *Fractures in adults*, 4th ed. Philadelphia: Lippincott-Raven, with permission. 1996.
 11. Drake R, Vogl AW, Mitchell A. *Henry Gray's Anatomy Anatomy for Students*. Churchill Livingstone. 2009;513-7.
 12. Vallier HA, Hennessey TA, Sontich JK, Patterson BM. Failure of lcp Condylar Plate Fixation in the Distal Part of the Femur. *J Bone Joint Surg Am*. 2006;88(4):846-53.

Cite this article as: Kumar S, Khichar H. Evaluation of the functional outcome of locking compression plate for fractures around knee joint distal 1/3rd femur or proximal 1/3rd tibia. *Int J Res Orthop* 2021;7:357-61.