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Original Research Article

Distal Femur Fracture Surgical Management Study Using Locking Compression Plate

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Abstract

Background: Throughout the history of fracture treatment, fractures in the distal femur have presented significant therapeutic obstacles. Because of the muscular forces operating on the distal piece, these fractures are frequently comminuted and easily distorted. As a result of the quadriceps system being injured, the knee joint and ankle suffer functional impairment. Additionally, frequently seen in elderly osteoporotic patients are distal femur fractures. It has been demonstrated that internal fixation with LCP yields some of the greatest outcomes in terms of healing, fracture union, and clinical outcome. In this study, we investigate whether a distal femur locking device can prevent extra-articular, partial, or intra-articular distal femur fractures. Various organizations from throughout the world have shown encouraging outcomes.

Aim: This study's objective is to assess the functional results, fracture healing, and comorbidities associated with distal femoral intra-articular fractures treated with locking compression plates. for the purpose of evaluating the surgical results of distal femur fractures treated with anatomical locking compression plates.

Material and Method: The current study was carried out between December 2019 and June 2022 at the Medical College and Hospital's Department of Orthopedics. Permission from the institutional ethical committee was obtained for the study. All study participants provided their written consent. Based on the inclusion and exclusion criteria, a total of 15 cases were chosen for the study. They were hospitalized and given a clinical and radiological examination in accordance with protocol. Following each patient for a minimum of six months, the result was evaluated using Neer's score. Patients were released from the hospital on the third postoperative day, and the stitches were removed on the fourteenth, giving them plenty of time to take a bath and maintain proper personal hygiene. All cases had routine follow-up at 6 weeks, 12 weeks, and 24 weeks.

Results: 10 (60%) of the 15 patients in our study were men, and 5% were women. In 9 patients (55%) the mode of injury was a motor vehicle accident, and in 6 patients (45%) it was a fall from a height or up some stairs. Two patients who had previously been hospitalized to another hospital and presented approximately 8 days after the accident were among the 12 patients who underwent surgery within one week of the injury. One patient's procedure had been postponed because of health issues. The average time for all fractures to heal was 16 weeks, which is comparable to other research. We saw two cases of varus collapse, one of which was brought on by early weight bearing and the other by poor communication. Early weight bearing resulted in implant failure (plate breaking) in one case. Cases requiring

hardware change are 10%, which is consistent with other studies. Neer's knee average score was 66.

Conclusion: We have discovered higher Neer's scores in this investigation, within the confines of the present study's constraints. Additionally, the LCP stops the compression of periosteal vessels. Despite the fact that it may not fully address the enduring issues with any fracture, such as non-union and malunion, it is nevertheless an important approach in the therapy of these fractures. But the prognosis is worse for fractures of type C.

Keywords: Locking Compression Plate, Locked Internal Fixators, Femoral Fractures, Implant Surgical Management, Distal Femur Fracture.

Introduction

RTA injuries and construction injuries (falls from height) have increased dramatically as a result of the rapid urbanization, land development, speedier transportation, etc., hurting many young lives. Due to osteoporosis, older individuals, particularly women, fracture more easily. Studies have shown that the distribution of femur supracondylar fractures in these circumstances is typically bimodal. [1] The distal femur fracture is a complex injury that causes long-term impairment. [2,3] 6% of all femur fractures are caused by them, and 31% if hip fractures are taken out of the equation. Open fractures are present in over 50% of distal femur intraarticular fractures. Due to the high incidence of infection, non-union, and mal-union, surgical therapy of fractures was generally avoided until the 1960s.

Four to seven percent of all femoral fractures are distal. A distal femoral fracture happens in about 37 out of 100,000 people each year. [4,5,6] This fracture occurs in a specific bimodal distribution; the first group of patients is under 40 years old, primarily male, and sustained high-energy trauma, such as a road traffic accident or a fall from a height; the second group is over 50 years old, primarily female, and sustained relatively low energy trauma due to osteoporosis. [7,8] Due to osteoporosis, significant comminution, and a too-short distal femoral fragment, these fractures are challenging to cure. [9]Meniscal, extensor mechanism, and compound injuries, as well as related ligament injuries. [10] Anatomic reduction of the articular surface, restoration of limb alignment, length, and rotation, bone grafting for severe bone loss, and a stable fixation that permits early mobilization should all be the objectives of surgical treatment. [11] The care of distal femoral fractures has changed from non-operative to operational methods as a result of the introduction of new implants and techniques. [12,13] The distal femoral locking compression plate enables realignment of the articular surface in addition to locking and compression screw repair of the distal femur fracture. [14,15]

In order to preserve local biodiversity, install these plates minimally invasively, and prevent infection and fracture healing issues. [16, 17]

Intra-articular fractures are more difficult to treat in elderly patients and people with osteoporosis. It is very concerning when stable fixation is lost. For these patients, the locking compression plate offers additional benefits. Distal femoral fractures are difficult to treat in many circumstances, despite improvements in surgical implants and technique. [18] The majority of distal femoral fractures can be successfully managed with early mobilization, limb alignment restoration,

and anatomic reduction of the articular surface. Combining compression plating, locked plating, and bridge plating gives the advantage of locking compression plate. Soft tissue injury is decreased as a result, and periosteal vessels are retained. It serves as a closed external fixator as a result. [19]

The benefit of combining compression plating, locked plating, and bridge plating is the locking compression plate. [20-21] Soft tissue injury is decreased as a result, and periosteal vessels are retained. It serves as a closed external fixator as a result. [22] This study aims to assess the functional outcome, fracture healing, and comorbidities of distal femoral fractures treated with open reduction and internal fixation and distal femoral locking compression plates, as well as the clinical results of such treatment.

Material and Methods

The current study was carried out between December 2019 and June 2022 at the Medical College and Hospital's Department of Orthopedics. Permission from the institutional ethical committee was obtained for the study. All study participants provided their written consent. Based on the inclusion and exclusion criteria, a total of 15 cases were chosen for the study.

Inclusion Criteria

Patients admitted to Medical College and Hospital with a lower femur fracture treated with LCP, all skeletally mature patients (>18 years), open distal femur fractures up to type I, II, and III A, and patients willing to participate in the study were the inclusion criteria.

Exclusion Criteria

- Patients under the age of 18.
- Open fractures of the distal femur.
- Fractures that are abnormal.
- Broken tibias that are related.
- Fractures of the distal femur with neurovascular impairment.
- Patient has several fractures in the same vertebra, hip, and leg.
- Patients with grade iii b and c open distal femoral fractures.

The patient was laid supine on the radiolucent table during all surgeries at our level 1 tertiary care trauma hospital. The area posterior to the supracondylar region was given a little towel hump. In 15 cases, a femoral distractor was employed. For C1 fractures, the lateral technique was adopted. Along the line of the skin incision, an iliotibial band was incised. The anterior Vastus lateralis was pulled back to reveal the distal femur. For C2 and C3 fractures, an anterolateral parapatellar technique was performed. The intra-articular fracture was reduced, and numerous K wires were used to repair it temporarily. Under fluoroscopic guidance, the articular surface was indirectly reduced with the femoral diaphysis. A suitable-sized distal femoral locking plate was sub muscularly slipped across the lateral surface of the distal femur in the distal to proximal direction.

With a cotton pad underneath the distal fragment, a Thomas splint was used to firstly immobilize the affected limb. Radiological evaluation: genuine lateral and anterior-posterior views of the injured limb, including the entire knee joint, the pelvis, and the affected femur. We performed the conventional lateral approach to the distal femur while the patient was under proper anesthesia. Sandbags were placed beneath the operating knee and the ipsilateral hip. An articulated tension device may be used to load the plate in tension after a successful reduction. Once the fractures have been confirmed to have been fully reduced, the plate shaft may be fastened with the proper cortical screws. With strong internal fixation, postoperative rehabilitation is simpler, more comfortable, and more secure because it was specifically designed

for the patient and the type of fracture. Therapy can begin as soon as the fracture fixation is stable.

In each case, there was an average blood loss of 300–400 ml. In none of the cases were tourniquets applied. The initial wound check was performed on the second postoperative day and the suction drain was withdrawn 24 to 48 hours after surgery. In closed fractures, intravenous antibiotics were maintained for a further 24 hours. According to the fracture pattern and degree of fixation, a specific post-operative physiotherapy program was created. Knee bending and aided knee Range of Motion (ROM) exercises were started on the first postoperative day whenever it was possible. According to the degree of bone quality, the seriousness of the injuries, and the pattern of fractures, patients were mobilized. Patients were mobile with crutches or walkers on the second to third postoperative day up until six weeks. The majority of subjects with radiological evidence of fracture union began full weight-bearing ambulation without any aids at around three months. Patients were released from the hospital on the third postoperative day, and the stitches were removed on the fourteenth, giving them plenty of time to take a bath and maintain proper personal hygiene. All cases had routine follow-up at 6 weeks, 12 weeks, and 24 weeks.

After initial indications of the clinical and radiological union, partial weight-bearing was initiated. Depending on the results of the radiological union and the clinical evaluation, patients were followed up with.

Statistical Analysis

A computer-based statistical analysis application called SPSS version 20 was used to analyze the statistical data (IBM, Chicago, USA). For the statistical data analysis, paired t-tests were employed between two correlated groups, whereas independent t-tests were utilized to compare the means of uncorrelated groups. P value.

Result

10 (60%) of the 15 patients in our study were men, and 5% were women. In 9 patients (or 55%) the mode of injury was a motor vehicle accident, and in 6 patients (or 45%) it was a fall from a height or up some stairs. Two patients who had previously been hospitalized to another hospital and presented approximately 8 days after the accident were among the 12 patients who underwent surgery within one week of the injury. One patient's procedure had been postponed because of health issues. Each patient underwent a thorough clinical evaluation, and any accompanying injuries received the appropriate care and documentation.

Table 1: Neer's scores at follow-up.

Neer's scores			
Neer's pain score			
Scores	Pain score 5	Pain score 4	Pain score 3
No. of patients	1	12	2
Neer's function score			
Scores	function score 5	function score 4	function score 3
No. of patients	2	10	3
Neer's knee flexion score			
Scores	knee flexion score 5	knee flexion score 4	knee flexion score 3
No. of patients	9	5	1
Neer's work score			
Scores	work score 5	work score 4	work score 3
No. of patients	5	9	1
Neer's score of gross anatomy			

Scores	Roentgenogram score 5	Roentgenogram score 4	Roentgenogram score 3
No. of patients	10	4	1

The Neer functional score was used to evaluate the 60-point average knee score. (Max 100) Functional (50 units) and Anatomical scores make up Neer's total (20 units). For adult distal femoral fractures, the Neer's pain score, functional score, knee flexion score, and score of gross anatomy were used to evaluate the success of surgery.

Table 2: Fracture type and outcome

Fracture type	**Outcome**		
	Excellent	Satisfactory	Unsatisfactory
Fracture type A	5	6	0
Fracture type B	0	1	0
Fracture type C	0	2	1

Table 3: Early and late complications in the patients.

S. No.	**Complications**	**No. of patients**
1.	Superficial wound infection	1
2.	Delayed wound healing	1
3.	Tibial Pin tract infection	1
4.	Malunion with varus	1
5.	Plate breakage	1
6.	Knee stiffness	1

During the first week of treatment, one patient experienced a superficial wound infection that was swiftly treated with the proper antibiotics, wound care, and secondary suturing. One diabetic patient experienced delayed wound healing, but everything else went smoothly. Tibial pin tract infection struck one patient. Late problems included knee stiffness in the patient, one of whom it was noted had a poor pain tolerance and was uncooperative for rehabilitation.

Discussion

In this study, we discovered higher Neer's scores, indicating that the LCP condylar plate is the preferred therapy strategy for comminuted distal femoral fractures, particularly type A fractures. LCP has the extra benefit of preventing compression of periosteal vessels. Despite the fact that it may not fully address the enduring issues with any fracture, such as non-union and mal-union, it is nevertheless an important treatment in the therapy of these fractures. However, we discovered that LCP had worse results in type C fractures. Even so, despite occasional issues like extensor lag and knee stiffness, LCP is still the implant of choice for type C fractures since its results are typically better than those of dynamic condylar screws and angle blades. [23,24]

For distal femoral fractures, locking plate devices like the LISS[25] have been widely used. [26,27] LISS enables early mobilization and rapid healing without bone grafting and has a reduced chance of early implant loosening than the dynamic condylar screw. [28] It also has a lower risk of infection and less blood loss. The LCP varies from the LISS in that it lacks a jig and has combination holes. [29,30] After LISS fixation, pain over the lateral part of the distal femur has been linked to the ji [27] Previous research on the use of minimally invasive plating procedures for distal femur fractures has shown promising early outcomes and relatively low complication rates. [31,32,33]

In osteoporotic bone and in the presence of periarticular or juxta-articular comminution, the outcomes of the insertion of plates with the option of locking screws are positive. Multiple points of contact between the fixed plate and screws are provided by the LCP condylar plates, resulting in increased stability and a decreased propensity for varus collapse. By inserting plates submuscularly, LISS plating enables a minimally invasive method while maintaining vascularity to the lateral cortex. [34,35]

Dr. Pugazhendhi et al. reported that out of 22 patients, 12 patients were in the 21–30 age group, 5 patients were in the 31–40 age group, 3 patients were in the 41–50 age group, and 2 patients were in the 51–60 age group. They conducted a short-term prospective study of the functional outcome in distal femoral fractures treated by locking compression plate. They found that the age range from 21 to 30 was the most prevalent. [36] Distal femur locking plates are only used for peri-prosthetic distal femur fractures in patients undergoing total hip replacement (THR) [37] and total knee replacement, in addition to isolated distal femur fractures (TKR). With a lateral locking plate, even severe distal peri-prosthetic supracondylar fractures can be treated with predictable outcomes that are similar to those of more proximal fractures. [38]

Pugazhendhi G., M.D., et al., 2007 It was determined that 3 patients experienced the first complications, 2 of whom acquired a superficial infection, and 1 of whom had a wound that was gaping. In two patients, late effects included knee stiffness. No patient experienced a loss of fixation, a malunion, or a non-Union.36 Studies by Parth Panchal et al. [39] on the use of locking compression plates to treat distal end femur fractures found that 5 patients experienced problems, including 4 (20%) patients who experienced superficial infection and 1 (5%) patients who experienced delayed union. In a research by Tapi Nalo et al. (2016) using condylar locking compression plating for the treatment of supracondylar fractures of the distal femur, they noted that there were 2 incidences of superficial infection. [40]

A locking condylar plate helps solve the issues associated with treating distal femoral fractures in patients with osteoporosis, significant comminution, and revision procedures after failed implants. [41] Locking plates, in our opinion, are an important development in the fracture therapy field. Long-term outcomes are awaited, however the restrictions of this novel technology and the indications for its usage have not yet been fully clarified. When physiological loads are outside of the plate-design parameters, the locking plates may fail. In addition to not seating properly into the plate, cross-threading, or using insufficient screw torque to engage the screw threads into the plate threads can cause the locked screws to come loose from the plate. [42,43]

Conclusion:

The best option for treating distal femur fractures is currently a distal femur locking plate. Researchers have reported successful outcomes when using implants for treating distal femur fractures, including distal femur nails, dynamic condylar screws, and even the insertion of a medial plate to a distal femur locking plate. By conducting this study, we can make the assumption with some degree of confidence that distal femur fractures of all varieties, including extra-articular, partial-articular, and intra-articular ones, non-comminuted as well as comminuted ones, can be successfully treated with a distal femur locking plate alone as the primary implant of choice. Additionally, it has lessened the need for additional surgeries like bone grafting, particularly in fractures involving metaphyseal comminution.

References

1. Martinet O, Cordey J, Harder Y, Maier A, Buhler M, Barraud GE. Epidemiology of Fracture of Distal Femur. Injury. 2000;31:62-3.
2. Reudi TP, Buckley RE, Moran CG. AO Principles of Fracture Management. Switzerland: AO Publishing; 2007;2.
3. Collne CA, Wiss DA. Rockwood and Green Fracture in adults. Philadelphia: LWW; 2009;7.
4. 2. Dasaraiah CV, Rao AS. Study of surgical management of supracondylar femoral fracture by locking compression plate. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 2016;15(2):23-33.
5. Martinet O, Cordey J, Harder Y, Maier A, Buhler M, Barraud GE. Epidemiology of fracture of distal femur. Injury 2000;31:62-63
6. Arneson TJ, Melton LJ III, Lewallen DG, O'Fallon WM. Epidemiology of diaphyseal and distal femoral fractures in Rochester, Minnesota, 1965-1984. Clin Orthop 1988;234:188-94
7. Gupta SKV, Govindappa CVS, Yalamanchili RK. Outcome of retrograde intramedullary nailing and locking compression plating of distal femoral fractures in adults. Open access Orthopaedics 2013;1(3):23.
8. Hakeem A, Khan N, Khan M, Ullah F. Dynamic condylar screw fixation in treatment of supracondylar fracture of distal femur. Rawal medical journal 2010;35(1):45-47.
9. Mahesh DV, Gunnaiah, Vishwanath. Management of distal femur fracture by locking compression plate. IJHSR. 2014;4(5):235-40
10. Krishna RK, Nayak MA. Study of surgical management of distal femoral fracture by distal femoral locking compression plate osteosynthesis. IJOS 2015;1(1):22-6.
11. Yeap EJ, Deepak AS. Distal femoral locking compression plate fixation in distal femoral fractures: early results. Malaysian Orthopaedic Journal 2007; 1(1):12-7.
12. Schatzker J, Lambert DC. Supracondylar fractures of the femur.Clin Orthop 1979;138:77-83.
13. Wilson JN. Watson Jone's: Fractures and joint injuries. 1982;6:1003-070,
14. Neer CSII, Grantham SA, Shelton ML. Supracondylar Fracture of the Adult Femur - A Study of One Hundred and Ten Cases. JBJS Am 1967;49(4):591-613.
15. Thomas P Reudi, Richard E Buckley, Christopher G Moran. An O Principles of Fracture Management. Switzerland: AO Publishing 2007;2.
16. C. Krettek, P. Schandelmaier, T. Miclau, and H. Tscherne, "Minimally invasive percutaneous plate osteosynthesis (MIPPO) using the DCS in proximal and distal femoral fracture," Injury, 1997;28(1):20–30.
17. C. Krettek, P. Schandelmaier, T. Miclau, R. Bertram, W. Holmes, and H. Tscherne, "Transarticular joint reconstruction and indirect plate osteosynthesis for complex distal supracondylar femoral fractures," Injury, 1997; 28(1):31–41.
18. Brown A, D'Arcy J. Internal fixation for supracondylar fractures of the femur in the elderly patient. J Bone Joint Surg1971;53(3):420-424.
19. Zickel R, Fietti V, Lawsing J, Van B. Cochran G. A New Intramedullary Fixation Device for the Distal Third of the Femur. Clin Orthop Relat Res 1977;12:185-191
20. Patterson B, Benirshcke S, Mayo K, Henley M. Comminuted, Intraarticular Fractures of the Distal Femur. J Orthop Trauma 1993;7(2):170.
21. Mize R, Bucholz R, Grogan D. Surgical treatment of displaced, comminuted fractures of the distal end of the femur. J Bone Joint Surg 1982;64(6):871-879.
22. Papagiannopoulos G, Clement D. Treatment of fractures of the distal third of the femur. A prospective trial

of the Derby intramedullary nail. J Bone Joint Surg 1987;69(1):67-70.
23. Krettek C, Schandelmaier P, Miclau T, Tscherne H. Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) using the DCS in Proximal and Distal Femoral Fractures. Injury. 1997;28(1):20-30.
24. Taylor DW, Bohm KC, Taylor JE, Gross AE. Use of fresh osteochondral allograft in repair of distal femur after trauma. MJM. 2010;13(1):22-7.
25. R. Frigg, A. Appenzeller, R. Christensen, A. Frenk, S. Gilbert, and R. Schavan, "The development of the distal femur Less Invasive Stabilization System (LISS)," Injury, 2001;32(3):24–31.
26. P. J. Kregor, J. A. Stannard, M. Zlowodzki, and P. A. Cole, "Treatment of distal femur fractures using the Less Invasive Stabilization System: surgical experience and early clinical results in 103 fractures," Journal of Orthopaedic Trauma, 2004; 18(8):509–520.
27. J. Ru, Y. Hu, and F. Liu, "Treatment of distal femur fracture by less invasive stabilization system-distal femur," Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi, 2007;21(12):1290–1294.
28. F. C. Kao, Y. K. Tu, J. Y. Su, K. Y. Hsu, C. H. Wu, and M. C. Chou, "Treatment of distal femoral fracture by minimally invasive percutaneous plate osteosynthesis: comparison between the dynamic condylar screw and the less invasive stabilization system," Journal of Trauma, 2009;67(4):719–726.
29. W. Kolb, H. Guhlmann, C. Windisch, F. Marx, K. Kolb, and H. Koller, "Fixation of distal femoral fractures with the less invasive stabilization system: a minimally invasive treatment with locked fixed-angle screws," Journal of Trauma, 2008; 5(6): 1425–1434.
30. P. Kanabar, V. Kumar, P. J. Owen, and N. Rushton, "Less invasive stabilisation system plating for distal femoral fractures," Journal of Orthopaedic Surgery, 2007; 15(3):299.
31. P. Schandelmaier, A. Partenheimer, B. Koenemann, O. A. Grun, ¨ and C. Krettek, "Distal femoral fractures and LISS stabilization," Injury, 2001;32 (3):55-63.
32. P. J. Kregor, J. Stannard, M. Zlowodzki, P. A. Cole, and J. Alonso, "Distal femoral fracture fixation utilizing the Less Invasive Stabilization System (L.I.S.S.): the technique and early results," Injury, 2001;32(3):32–47.
33. M. Schutz, M. M ¨ uller, C. Krettek 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.
34. Egol KA, Kubiak EN, Fulkerson E, Kummer FJ, Koval KJ. Biomechanics of Locked Plates and Screws. J Orthop Trauma. 2004;18(8):488-93
35. Kubiak EN, Fulkerson E, Strauss E, Egol KA. The Evolution of Locked Plates. JBJS. 2006;88(4):189- 200.
36. Chakravarthy J, Bansal R, Cooper J. Locking plate osteosynthesis for Vancouver Type B1 and Type C periprosthetic fractures of femur: a report on 12 patients. Injury 2007;38 (6):725-33
37. Streubel PN, Gardner MJ, Morshed S, Collinge CA, Gallagher B, Ricci WM et al. Are extreme distal periprosthetic supracondylar fractures of the femur too distal to fix using a lateral locked plate? J Bone Joint Surg Br 2010;92(4):527-34.
38. Sreedhar M, Luther ME, Anudeep B, Prashanth, Swaroopa, Madhav V. Functional and radiological outcome of distal femoral fractures treated with locking compression plate. Journal of Evolution of Medical and Dental Sciences 2015;4(38):6664-71.

39. Nalo T, Agrahari A, Datta S, Paul V, Singh SN, Langshong R. Treatment of Supracondylar Fracture of Distal Femur with Condylar Locking Compression Plating. International Journal of Science and Research (IJSR) ISSN: 2319-7064
40. Patil PB, Patil RS, Lad SA, Suren T, Jain UD. The study of functional outcome of distal end femur fractures operated with locking compression plate; Asian Pac J Health Sci 2016;3 (1):135-139
41. Giannoudis PV, Schneider E. Principles of fixation of osteoporotic fractures. JBJS Br. 2006;88(10):1272-8.
42. Sommer C, Babst R, Muller M, Hanson B. Locking Compression Plate Loosening and Plate Breakage – A Report of Four Cases. J Orthop Trauma. 2004;18(8):571-7.
43. Saccomanni B. Some words about fractures of radial head. Journal of Medical Research and Health Sciences. 2020; 3(10): 1106–1108.