

EVALUATION OF FUNCTIONAL OUTCOME OF INTRA-ARTICULAR DISTAL FEMUR FRACTURES MANAGED USING PRECONTOURED LOCKING COMPRESSION PLATE

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ABSTRACT

Background: Intra-articular distal femur fractures represent a challenging injury pattern due to complex anatomy, comminution, and involvement of the knee joint surface. Achieving stable fixation and early mobilization is essential for optimal recovery. Precontoured locking compression plates (LCP) have been developed to provide anatomical fixation and improved biomechanical stability. **Objective:** To evaluate the functional outcome of intra-articular distal femur fractures managed using a precontoured locking compression plate. **Study Design:** Descriptive study. **Setting:** Department of Orthopedic Surgery, Hayatabad Medical Complex, Peshawar, Pakistan. **Duration of Study:** From June 2024 to December 2024. **Methods:** A total of 45 patients aged 18 years and above with confirmed intra-articular distal femur fractures were included. All patients underwent open reduction and internal fixation using a precontoured locking compression plate. Functional outcomes were evaluated using the Knee Society Score (KSS) at three months postoperatively and categorized as excellent, good, fair, or poor. Postoperative complications, including infection and knee stiffness, were documented. Data were analyzed using SPSS version 23. **Results:** The mean age of patients was 44.84 ± 13.05 years, with males constituting 77.8% of the study population. Road traffic accidents were the most common cause of injury (73.3%). Functional outcome were excellent in 55.6% of patients, good in 33.3%, fair in 8.9%, and poor in 2.2%. The mean fracture union time was 16.53 ± 3.84 weeks. Postoperative complications included knee stiffness in 11.1% of patients, superficial infection in 4.4%, and deep infection in 2.2%. **Conclusion:** Open reduction and internal fixation of intra-articular distal femur fractures using precontoured locking compression plates yielded predominantly excellent to good functional outcomes with minimal complications. This method offers stable fixation and facilitates early mobilization, supporting its role as a reliable treatment option for complex distal femoral fractures.

Keywords: Intra-articular distal femur fracture, Locking compression plate, Functional outcome, Knee Society Score, Complications

INTRODUCTION

Distal femur fractures (DRFs) located in the lower segment of the femur adjacent to the knee joint consist of a fracture in the bone's distal region, which encompasses the metaphysis along with the epiphysis. Although they occur rarely, these events have the potential to cause considerable morbidity along with functional impairment, particularly in relation to the knee joint. Therefore, clinicians and researchers must understand the causes and therapeutic options to improve the patient experience and optimize healthcare practices (1-3). Intra-articular DRFs make up a significant category of knee joint injuries, usually happening due to high-energy trauma in younger patients and low-energy falls in older individuals with osteoporosis. Fractures typically result from mechanisms including direct axial loading with varus, high-velocity vehicular collisions, and falls, resulting in disruption of articular congruity of the distal femoral condyles (4, 5). Regaining alignment is essential to preserving extremity function and is a critical step in definitive therapy for DRFs. The range of motion in the knee is vital to achieving satisfactory results. Immobilization of the knee leads to joint stiffness and reduced range of motion, which negatively affects the overall outcome. Understanding the characteristics and challenges of DRF management is necessary to optimize outcomes (6-7).

Fractures that affect the joint surface of the distal femur require a cautious and comprehensive approach, as they may end up in secondary arthritis. DRFs are optimally managed with absolute anatomical reduction and rigid, stable internal fixation. The fixation of DRFs using plate application has an inherent disadvantage, as it creates a load-shielding device (1). The fixed-angle construct is

established by employing a locking compression plate (LCP), which helps preserve the periosteal blood supply by allowing the plate to be placed without direct contact with bone. Consequently, a distal femoral locking plate might be utilized in the management of metaphyseal comminution (8-10).

DRFs involving the articular surface are complex injuries that frequently result in functional impairment if not managed appropriately. The intricate anatomy of the distal femur and the need for precise articular reconstruction make these fractures particularly challenging. The advent of precontoured locking compression plates has revolutionized DRF management by providing fixed-angle stability and preserving the periosteal blood supply. Evaluating the functional outcomes of intra-articular DRFs treated with precontoured locking plates is therefore essential to determine the effectiveness of this fixation method and to contribute to the ongoing refinement of surgical strategies aimed at achieving optimal knee function and overall patient satisfaction.

METHODOLOGY

This descriptive study was conducted in the department of orthopedic and spine, Hayatabad Medical Comple, from June 2024 to December 2024. We secured ethical approval from the hospital before starting the study. We selected a cohort of 45 patients aged 18 years or older with a radiographically confirmed intra-articular distal femoral fracture suitable for operative fixation with a locking plate. Patients were excluded from the study if their fractures were pathological in nature, had significant pre-existing knee pathology, or had polytrauma.

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We secured consent from all the patients. Definitive fracture fixation was performed using a precontoured locking compression plate system in all patients. An experienced orthopedic consultant surgeon performed the surgical procedures. The specific surgical approach, such as lateral or parapatellar, was tailored to the fracture pattern to ensure adequate visualization and anatomical reduction of the joint surface.

Postoperatively, all patients underwent early range-of-motion exercises as tolerated, with progression to weight-bearing guided by radiological evidence of fracture healing. Functional outcome, assessed at 3-month follow-up using the Knee Society Score. This scoring system evaluates both objective clinical parameters of the knee joint and the patient's functional capacity during activities of daily living. The scores are categorized as excellent (80-100), good (70-79), fair (60-69), and poor (<60).

Data regarding patient demographics, functional outcomes, and complications were assessed using SPSS 25. We used means and standard deviations for numerical data and frequencies and percentages for categorical data.

RESULTS

We conducted this study on forty-five patients; their average age was 44.84 ± 13.05 years. A majority of the patients were male in this study (35, 77.8%), while females were 10 (22.2%). The primary mechanism of injury was road traffic accidents, reported in 33 patients (73.3%). Falls were the second most common cause responsible for injuries in 12 cases (26.7%) (Table 1).

We observed a mean union time of 16.53 ± 3.84 weeks. Functional outcomes showed that 25 (55.6%) cases achieved excellent outcomes. A good outcome was observed in 15 patients (33.3%), while a fair result was observed in 4 cases (8.9%). A poor functional outcome was observed in only one patient (2.2%). Regarding post-operative complications, 37 patients (82.2%) reported none. The most frequent complication was knee stiffness, observed in 5 patients (11.1%). Superficial infection was observed in 2 cases (4.4%), and deep infection (2.2%) was managed during the follow-up period (Table 2).

Table 1: Baseline characteristics

Baseline characteristics		n	%
Gender	Male	35	77.8%
	Female	10	22.2%
Residence	Urban	23	51.1%
	Rural	22	48.9%
Mechanism of injury	RTA	33	73.3%
	Fall	12	26.7%

n = frequency, % = percentage

Table 2: Functional outcomes & complications

		n	%
Functional outcome	Excellent	25	55.6%
	Good	15	33.3%
	Fair	4	8.9%
	Poor	1	2.2%
Complications	Deep infection	1	2.2%
	Stiffness	5	11.1%
	Superficial infection	2	4.4%
	No complications	37	82.2%

n = frequency, % = percentage

DISCUSSION

Well, with existing studies. Rai et al. reported a similar mean age of 41.23 years, with 73.3% males, and Kiran et al. reported a slightly younger cohort with a mean age of 35 years and 82% males (11, 12). Our data reinforce the notion that active working-age males are most commonly affected due to exposure to high-risk activities, such as road traffic accidents, which accounted for 73.3% of mechanisms of injury in our study. This is consistent with the findings of Rai et al., who reported that 80% of injuries were due to traffic accidents, and Bandaru et al., who noted that 75% of injuries were due to road traffic accidents (11, 13).

The functional outcomes observed in our patients provide strong evidence for the efficacy of precontoured locking compression plates. We noted excellent results in 55.6% patients and good results in 33.3% patients; a combined satisfactory outcome rate of 88.9% was observed in this study. This success rate aligns with Rai et al., who documented a 90% rate of excellent and good outcomes (11). Ali et al. reported a combined excellent and good outcome rate of 84% in their study (14). Similarly, Kiran et al. reported good to excellent outcomes in 86% patients (12). The consistency of these results across different studies and settings highlights the reliability of the LCP in achieving a favorable functional outcome.

An important factor in evaluating fracture management is the time to radiological union. In our study, the mean union time was 16.53 weeks. Our findings are similar to those of Kiran et al., who reported a mean union time of 14 weeks, and to those of Bandaru et al., who reported a mean union time of 15 weeks (12, 13). A slightly longer duration of 21 weeks was reported by Ali et al., which may be attributable to their older patient cohort, with a mean age of 52 years, in which biological healing potential may be relatively slower.

Regarding complications, 82.2% of our patients showed none. The most common complication was knee stiffness in 11.1% patients. This is a well-recognized complication following such fractures and extensive surgery around the knee joint. Our findings on stiffness are comparable to those of Rai et al., who observed stiffness as the most common complication and at a relatively higher rate, 26.7% (11).

Deep infection was a rare problem, occurring in only 1 of our patients (2.2%), which aligns with the 3.3% rate reported by Rai et al. (11). Superficial infection was observed in 4.4% patients, which is slightly higher than 3.3% reported by Rai et al. and is comparable to 4% by Bandaru et al. in their study. This low infection rate highlights the potential benefit of minimally invasive approaches that minimize soft-tissue dissection. In this study, we did not observe any non-unions, consistent with the results of Obiegbu et al., who also reported none.

We suggest that the precontoured LCP is a favorable implant for managing these challenging fractures. Its design facilitates anatomical reduction, particularly of the articular surface, and provides stable fixed-angle fixation that promotes union and allows for early functional rehabilitation. Despite the positive outcomes, our study has limitations, including a smaller patient sample and a shorter follow-up period.

CONCLUSION

In conclusion, management of intra-articular distal femoral fractures with precontoured locking compression plates resulted in excellent to good functional outcomes in the majority of patients, and the complication rate was lower with this procedure.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRB)

Consent for publication

Approved

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

MUHAMMAD SAEED (Assistant Professor)

Conception of study, Study design, Critical input, Manuscript drafting, Manuscript revisions, and Final approval of manuscript.

SHAFI UL HAQ (Specialist Registrar)

Literature search and Critical input

MAJID HUSSAIN (Trainee Medical Officer)

Literature search and Critical input

MUHAMMAD ZAHID KHAN (Assistant Professor)

Data entry, Data analysis and Critical input

REFERENCES

1. Nester M, Borrelli Jr J. Distal femur fractures management and evolution in the last century. *Int Orthop*. 2023;47(8):2125–35. <https://doi.org/10.1007/s00264-023-05782-1>
2. Larsen P, Ceccotti AA, Elsoe R. High mortality following distal femur fractures: a cohort study including three hundred and two distal femur fractures. *Int Orthop*. 2020;44(1):173–7. <https://doi.org/10.1007/s00264-019-04379-2>
3. Coon MS, Best BJ. Distal femur fractures. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jul 31.
4. Richards JA, Berkay FB, Davis CM, Zamora RA. Intra-articular fracture pattern in intercondylar distal femur fractures: an analysis of frequency and major fracture fragments. *Injury*. 2021;52(4):967–70. <https://doi.org/10.1016/j.injury.2020.11.061>
5. Nino S, Parry JA, Avilucea FR, Haidukewych GJ, Langford JR. Retrograde intramedullary nailing of comminuted intra-articular distal femur fractures results in a high union rate. *Eur J Orthop Surg Traumatol*. 2022;32(8):1577–82. <https://doi.org/10.1007/s00590-021-03041-8>
6. Shi BY, Zukotynski BK, Upfill-Brown A, Brodke DJ, Kelley BV, Devana SK, et al. Fracture lines and patterns in intra-articular distal femur fractures. *J Am Acad Orthop Surg*. 2024;32(19):e1020–e1026. <https://doi.org/10.5435/JAAOS-D-22-00805>
7. Nauth A, Haller J, Augat P, Anderson DD, McKee MD, Shearer D, et al. Distal femur fractures: basic science and international perspectives. *OTA Int*. 2024;7(2S):e320. <https://doi.org/10.1097/OI9.0000000000000320>
8. Siddiqui YS, Mohd J, Abbas M, Gupta K, Khan MJ, Istiyak M. Technical difficulties and mechanical failure of distal femoral locking compression plate (DFLCP) in management of unstable distal femoral fractures. *Int J Burns Trauma*. 2021;11(1):9–16. No DOI found.

9. Agrawal AK, Bansal A, Rawat S, Kapadiya S, Desai S, Golwala P. Surgical management of distal femur fracture using anatomical locking compression plate. *Int J Curr Res Rev*. 2021;13(2):176–81. <https://doi.org/10.31782/IJCRR.2021.13229>
10. Singh SJ, Sree KU, Srinivas S, Pasula S. A study of functional outcome of distal femur fractures internally fixed with distal femur locking compression plate. *ScienceRise: Med Sci*. 2022;(3[48]):15–20. <https://doi.org/10.15587/2519-4798.2022.257496>
11. Rai B, Kar BK, Rai A, Behera S, Maurya RK. Analysis of functional outcomes and PROMs after internal fixation of intra-articular distal femur fracture. *J Orthop Rep*. 2025;4:100784. <https://doi.org/10.1016/j.jorep.2025.100784>
12. Kiran Kumar GN, Sharma G, Farooque K, Sharma V, Ratan R, Yadav S, et al. Locking compression plate in distal femoral intra-articular fractures: our experience. *ISRN Orthop*. 2014;2014:372916. <https://doi.org/10.1155/2014/372916>
13. Bandaru H, Shanthappa AH. Plating for intra-articular fractures of the distal femur: functional and radiological outcomes. *Cureus*. 2023;15(1):e33207. <https://doi.org/10.7759/cureus.33207>
14. Ali SD, Shah SKA, Aliuddin AM, Javed I, Azam KS, Naqvi SZG. Functional outcome of the distal femur pre-contour locking plate. *J Liaquat Uni Med Health Sci*. 2021;20(3):193–7. <https://doi.org/10.22442/jlumhs.2021.00794>



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