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Original Article

Assessing the functional outcome after fixation of distal femoral fractures with DF-LCP: A prospective study.

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Abstract

Background: Management of distal femoral fractures remains a real challenge due to the involvement of unique and vital anatomical structures. These are usually treated with operative measures. Distal femoral locking compression plate (DF-LCP) has gained popularity due to favorable biological insertion and minimal periosteal damage, but locally little is known about it. Therefore, the present study aimed to identify the functional outcomes after fixation of distal femoral fractures with DF-LCP.

Methodology: This prospective cohort study, including 21 patients with distal femoral fractures, was conducted at Abbasi Shaheed Hospital from Jan 1, 2017, to Dec 31, 2018. All enrolled patients were treated with DF-LCP. The postoperative clinical and radiological outcomes were evaluated for one year. The data were statistically analyzed using SPSS version 22.0.

Results: There were 21 patients with distal femur fractures with a mean age of 46.6 ± 19.2 years. The majority of the fractures were due to road traffic accidents (RTA), i.e., 57.1%, followed by ground-level fall (33.3%). The mean time for fracture union was 20.2 ± 11.1 weeks, and the mean range of motion of the knee was 108.5 ± 18.5° (at one-year follow-up). The complications were minimal; superficial infection and stiffness of knee joint were observed in 2 patients each while there was 1 case each of non-union, delayed union, and implant failure.

Conclusion: DF-LCP is an effective treatment for distal femoral fractures as it permits stable fixation and early mobilization. Satisfactory to excellent functional and radiological outcomes were achieved.

Keywords

Distal Femoral Fracture, Functional Outcome, Distal Femoral Locking Compression Plate, Neer's Score.

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Introduction

Despite the advancement of orthopedic surgery, the management and treatment of distal femur fractures compared to other femoral fractures remain challenging due to the involvement of unique and vital anatomical structures[1]. Femoral fractures, specifically the distal femoral fractures, display greater potential for causing long-term disabilities due to the associated complications. It is suggested that distal femoral fractures account for 3 to 6% of all femoral fractures and < 1% of all the fracture types[2,3]. Comminuted, intra-articular distal femoral fractures are considered the most challenging type of fractures[4]. These fractures have a bimodal distribution, with fractures in young adults occurring commonly due to high-velocity trauma, while in elderly osteoporotic females, they occur as a result of falls at home[5].

With advanced and improved internal fixation devices by the Arbeitsgemeinschaft fur Osteosynthesefragen (AO) group, the treatment references for distal femur fractures have transformed. Previously, closed conservative management with traction or casting or both were used to treat these fractures[4,6]. However, the paradigm shifted from non-operative measures to operative measures to treat distal femoral fractures in the 1960s. There has been a long debate concerning the treatment preference regarding the hospital stay, immobilization, infection incidence, non-union, malunion, inadequate fixation, and lack of facilities, implants, and antibiotics[7]. However, the operative measures were not accepted instantly but are now recommended for most of the fractures. The main objective of the operative treatments includes the reduction, stable internal fixation, early functional rehabilitation of the knee, and early rapid mobilization of adjacent joints[8]. The surgical intervention is preferred over the conservative management as it has shown better outcomes, early mobility, and return to routine life[9]. At the same time, recent debates support the treatment involving reduction and surgical stabilization[10,11].

Most recent internal fixation devices commonly used for treating these fractures include dynamic condylar screw plate, and 95-degree angled blade plate, etc[12,13]. However, these implants may not be ideal since the complexity of fractures varies from simple extra-articular supra-condylar types to inter-condylar and metaphyseal comminuted types, based on the treatment needed[12, 13]. DF-LCP has gained popularity due to favorable biological insertion and minimal periosteal damage[14]. DF-LCP allows both locking and compression screw fixation of the femur shaft using a small application device6. Compared to condylar buttress plate, DF-LCP prevents varus collapse, and with the locking head screws, it provides better angular stability. Since it is pre-contoured, it offers rigid fixation[14, 15]. The current generation of DF-LCP combines conventional compression plating and locked plating techniques that help enhance the plate osteosynthesis[16, 17]. The plate placement in DF-LCP is in such a way that there is no contact with bone directly, which helps in the preservation of periosteal blood supply[17]. Therefore, it has multiple benefits over previously used implants and presents better outcomes in managing distal femoral fractures.

Regardless of these advances, there is a scarcity of local literature demonstrating the effectiveness of DF-LCP. Therefore, the aim of this study was to identify the functional outcomes after fixation of distal femur fractures with DF-LCP at a tertiary care center in Pakistan.

Methodology

A prospective cohort study was conducted at Abbasi Shaheed Hospital from Jan 1, 2017, to Dec 31, 2018. A total of 21 patients presenting in the emergency room and diagnosed with distal femur fractures were enrolled. All patients irrespective of gender and age > 18 years were kept under inclusion criteria, while patients with peri-implant fractures, fractures with neurovascular compromise, and compound fractures were excluded from the study sample.

After initial resuscitation and following the advanced trauma life support (ATLS) protocol, all patients underwent plain radiographs of the femur. The distal femur fracture was diagnosed on the

basis of plain anterior-posterior and lateral radiographs. CT scan with 3D reconstruction was performed in cases with comminuted or intra-articular fractures. Open reduction and internal fixation with DF-LCP were performed after pre-operative workup and review by anesthesia.

Baseline data, including age, gender, and mode of injury, were obtained before operative intervention. Post-operatively all patients were followed up both clinically and radiologically (X-rays) for one year. Neer's criteria were used to measure the functional outcome, where 86-100 scores suggest excellent outcome, 70-85 satisfactory, 55-69 unsatisfactory, and < 55 suggest failure.

The ethical approval was obtained from the institutional ethical review board (Reference no. ; Dated), and informed consent was acquired from all included patients. SPSS version 20.0 was used for statistical analysis; all qualitative variables were expressed as frequencies and percentages, while quantitative variables were expressed as mean ± standard deviation.

Results

Baseline characteristics of the studied population are given in table 1. The mean age of the enrolled patients was 46.6 ± 19.2 years; the majority were males (71.4%). RTA was the most common mode of injury (57.1%), followed by ground-level fall (33.3%), while others included fall from stairs, domestic injuries, etc.

The mean time for union of fracture was noted to be 20.2 ± 11.1 weeks, and the mean range of motion of the knee was 108.5 ± 18.5º (at one-year follow-up).

Table 1: Baseline characteristics of the study population (n=21).

Characteristics		n(%)
Gender	Male	15(71.4)
	Female	6(28.6)
Side	Right	13(61.9)
	Left	8(38.1)
Mode of injury	Road traffic accident	12(57.1)
	Ground-level fall	7(33.3)
	Others	2(9.6)

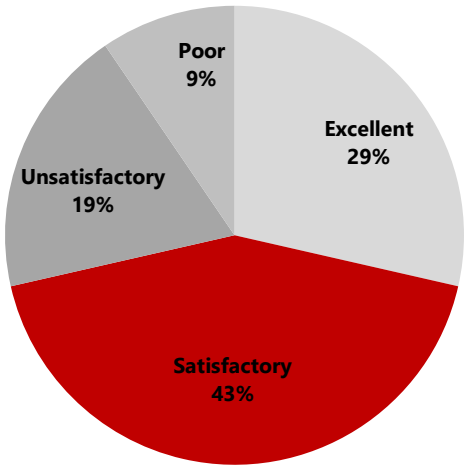

Figure 1: Functional outcome among the patients after fixation of the distal femur fractures with DF-LCP at one-year follow-up, based on Neer's scores.

Neer's scores were calculated to determine the functional outcomes at a one-year follow-up, and the results are shown in figure 1. Most of the patients (43%) had satisfactory scores, while 9% scored poorly. Table 2 shows the complications associated with DF-LCP. Superficial infection and stiffness of knee joint were observed in 2 patients each while there was 1 case each of non-union, delayed union, and implant failure.

Table 2: Complications after DF-LCP (n=21).

Complication	n(%)
Non-union	1(4.8)
Delayed union	1(4.8)
Superficial infection	2(9.6)
Knee stiffness	2(9.6)
Implant failure	1(4.8)

Discussion

The current study was conducted to identify the functional outcomes after fixation of distal femur fractures using DF-LCP. Studies in the past have suggested that fractures of the distal femur have always been a challenge to deal with for orthopedic surgeons, and its failure has been attributed to inadequate fixation[18]. There are few prognostic factors that are known to affect the tendency of these fractures, including patient's age, comminution, bone quality, and implant selection[5]. Distal femur fractures have a bi-modal age distribution, and peak incidence has been observed among individuals between 40 to 47 years of age[9,10,18]. Similarly, the mean age of the patients with distal femur fractures enrolled in the present study was 46.6 ± 19.2 years. Furthermore, RTA has been identified as the most common mode of injury-causing distal femur fractures10. Our findings were comparable with this; 57.1% of patients were injured from RTA, and 33.35 had ground-level falls.

Existing evidence suggests that DF-LCP is an effective treatment as it preserves the biological environment with minimum effect on soft tissues and vasculature and allows early weight bearing[9]. A study conducted in Nepal showed that 30% of the patients with distal femur fractures had excellent scores after fixation, and 45% had satisfactory scores in terms of functional outcomes[18]. The mean time for fracture healing was 19.3 weeks, and the mean final flexion at the knee joint was 111.4°. Another study by Virk et al. showed 44% excellent and 36% satisfactory results after DF-LCP. Moreover, the mean flexion at the knee joint was 109°, and the meantime for the radiological union was reported to be 19 weeks[14]. The results of the current study were alike; the majority of the patients had excellent to satisfactory results with respect to Neers scoring system. While the mean knee flexion was 108.5°, and the time to radiological union was of 20.2 weeks.

Mani et al. reported delayed union in 10% of patients followed by superficial infection in 5% and non-union and implant failure in 2.5% of patients[18]. In another study, Chander et al. reported a 13.3% implant failure rate after DF-LCP in addition to 6.6% deep infections and 3.3% non-union[5]. Our study also showed lower rates of complications compared to these, with 4.8% of patients suffering from non-union and implant failure, while the superficial infection was reported in 9.6% of the patients. Our study suggests that outcomes and complications after DF-LCP in a developing country like Pakistan are comparable to those reported internationally. Moreover, results also show knee stiffness in 9.6% of patients that may be related to non-compliance with physiotherapy and rehabilitation programs due to financial constraints.

However, the small sample size of the current study was a major limitation of the present study. Therefore, further comparative and multi-center studies are required to establish the effectiveness

of DF-LCP in comparison to other treatment modalities in Pakistan.

Conclusion

It is concluded from the study results that DF-LCP is an effective treatment for distal femur fractures as satisfactory to excellent functional and radiological outcome with minimal complications were achieved at one-year follow-up.

Conflicts of Interest

The authors have declared that no competing interests exist.

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