

Assessment of Surgical Management of Distal Femur Fracture using Locking Compression Plate: A Retrospective Study

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Received: 10-06-2023 / Revised: 15-07-2023 / Accepted: 09-08-2023

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to evaluate the functional and radiological outcome in distal femur fractures treated with locking compression plate.

Methods: The present study was conducted at King Hussein Medical Centre, Jordanian Royal Medical Services, Amman, Jordan. 50 patients were included in the study.

Results: Participants in the study varied in age from 22 to 76, with an average age of 51.29 ± 12.58 . Twenty-one women and 29 men were patients. Patients over 60 dominated the population. The most common fractures were extra-articular (68%), complete articular (26%), and partial articular (6%), according to Muller AO-classification. Ten patients (34%) had left-sided femur fractures, whereas 68% had right-sided fractures. Fifteen (30%) patients received fractures from automobile accidents, whereas thirty-five (70%) from falls. Before leaving the hospital, 90% of patients had normal radiographs, 6% had delayed union, and 4% had superficial infection, all of which were addressed. Scores for the Oxford knee test ranged from 38 to 44, with an average of 42.56 ± 1.64 . Results were exceptional in 64% of 32 patients, good in 36% (18 individuals), and mediocre or unsatisfactory in the absence of ratings.

Conclusion: LCP has shown very good radiological and functional outcomes with hundred percent union of the distal femur fractures. Hence it can be used successfully in distal femur fractures.

Keywords: Locking compression plate, Distal femur fracture, Extra-articular fractures

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Introduction

Approximately 3-6% of all musculoskeletal injuries are femur fractures, with approximately 1% of those cases involving the distal femur.[1] Injuries to the femur follow a bimodal distribution, resulting from high-energy trauma, such as traffic accidents, in young patients and low-energy trauma, such as tripping, in older patients.[2] Fractures of the distal femur are most common in young men (15–24 years old) and elderly women (>75 years old).² Roughly 37 out of 1,000 persons get a distal femur fracture each year.[3] Among the two groups affected by this kind of trauma, young adults are more likely to experience high-energy trauma, while the osteoporotic population is more likely to experience low-energy or trivial trauma. The use of an intramedullary force carrier during surgery is an option for some kinds of fractures.[4,5] Previously the trend in treatment of these fractures leaned towards closed conservative management with traction, casting, or a combination of both. A significant surgical hurdle is the treatment of distal femur intra-articular fractures. These fractures are

notoriously hard to repair, and surgery is often the only option for a good result.[2,3,6,7]

Plate fixation has a wide indication for various types of fractures, while retrograde intramedullary nail fixation is another surgical option.[8,9] In comminuted fractures, rigid internal fixation cannot provide absolute stability.

The goal of surgical management of these fractures is anatomic reduction, maintaining the articular congruity and restoring limb alignment and early mobilization.[10] There are different surgical options available: Antegrade nailing, retrograde nailing, blade-plate fixation, isolated screw fixation, locked plating, and as a part of damage control orthopaedics, external fixator use. Moreover, it is impossible to achieve absolute stability with rigid internal fixation in comminuted fractures. In such cases, it is necessary to use a locking plate as a bridging plate to fix the fracture site.[11] The optimal insertion holes for the screws on the proximal side of the locking plate (when used as a bridge) are currently debated.[12,13] Conventional

plate/screw systems require precise adaptation of the plate to the underlying bone.

Current generation of distal femoral locking compression plates is precontoured based on the average bony anatomy of the adult population and they form a fixed angled construct. The pull-out strength of locking screws is higher than the conventional screws and is particularly useful in osteoporotic bones. These plates are designed to apply in minimally invasive fashion to preserve local biology and avoid problems with fracture healing and infection.[14,15]

The purpose of the current research was to examine the functional and radiological result in distal femur fractures treated with locking compression plate.

Materials and Methods

The present study was conducted at King Hussein Medical Centre, Jordanian Royal Medical Services, Amman, Jordan for one year . 50 patients were included in the study.

Inclusion criteria

All patients above the age of 18 years of either sex with closed or compound fractures of distal femur up to grade II or patients with osteoporotic bones were included in the study.

Exclusion criteria

Head injury, chest injury, pathological fractures, ASA criteria >3, and patients with Gustilo type III compound injuries or previously treated fractures were excluded from the study.

Study procedure

We chose all patients who had surgery for locking plate-treated distal femur fractures (closed/up to Gustilo Anderson type 2/osteoporotic). The patient is placed in a supine position on a c-arm compatible table with a sandbag below the knee after spinal anesthesia has been administered. The entire injured extremity is then prepared and clothed with a tourniquet. The incision is made laterally, running parallel to the femoral shaft, beginning at Gerdy's tubercle and moving proximally. For anatomical fracture reduction, the traction and counter traction approach is used when the femur shaft is trapped between two condyles.

All patients who had fractures were treated using the lateral technique. Manual traction was used to minimize fractures under direct view. Reduction was easier to acquire and keep going with the help of a knee roll. Under the microscope, we verified the axial and rotational alignment of the plates as well as their length. With the help of Kirschner wires, a temporary fixing was accomplished. Prior to DF-

LCP fixation, fractures of the intercondylar type were transformed into a single condylar block. The insertion of proximal screws was done using minimally invasive procedures wherever feasible.[16] Plates were approximated to the femoral shafts using compression screws.

During surgery, traction and counter traction were employed to gently manipulate fractures; in a few instances, a Steinmann pin was used as a joystick approach for reduction. Intraoperative confirmation was made using an image intensifier that the condyles were initially fixed with 2 mm Kirschner wires and a plate. Following reduction, the condyles were further secured with 6.5 mm cancellous screws and 4.5 mm locking screws.

The patient's care was carried out in accordance with the established protocols of the hospital. This included administering antibiotics and analgesics as prescribed, monitoring vital signs, drawing up input-output charts, and elevating the patient's feet as needed. A patient's preoperative health status and the amount of blood lost during surgery determined the need for a blood transfusion. Knee exercises allowed the patient to be moved on the third or fourth day after surgery. Non-weight bearing was commenced after first post-operative week to 6 weeks depending on the fracture pattern. Exercises involving partial and full weight bearing were initiated at different stages of the healing process, respectively, until the fracture had fused.

Case sheets and other patient records were routinely reviewed at 2 weeks, 6 weeks, 12 weeks, and 6-months following surgery to obtain data on postoperative follow-up. For the radiological outcome, researchers utilized follow-up data that included serial knee x-rays; for the functional outcome, they used oxford knee scores. We used X-rays in both AP and lateral views to examine the radiological result. The functional outcome was evaluated using the Oxford Knee Score.

To measure the functional outcome, the Oxford knee score was utilized. The patient's functional status is evaluated using a 12-question questionnaire. With a maximum score of 48, a score of more than 41 is graded as exceptional, 34 to 40 as good functional status, 27 to 33 as fair and score less than 27 as bad functional outcome.[17]

Statistical analysis

In this research, data was input into an Excel sheet and analyzed using descriptive and inferential statistics. To find out how effective the results were, the data from this research was statistically analyzed using SPSS version 20 software.

Results

Table 1: Socio demographic and clinical details of the patients

Variables		Frequency(n)	Percentage(%)
Age- group (years)	<40	10	20
	41-50	13	26
	51-60	10	20
	>60	17	34
Gender	Males	29	58
	Females	21	42
Type of fracture	Type 33.A (A.1+A.2+A.3)	34	68
	Type 33.B(B.2+B.3)	3	6
	Type 33.C(C.2+C.3)	13	26
Side of injury	Right	34	68
	Left	16	34
Mode of injury	Road traffic accident (RTA)	15	30
	Fall	35	70

The individuals who took part in the research ranged in age from 22 to 76 years old, with an average age of 51.29 ± 12.58 . Twenty-one patients were female and 29 were male. Patients older than 60 years old made up the bulk of the patient population. Muller AO-classification showed that of the three types of fractures, the most prevalent were extra-articular

(68%), full articular (26%), and partial articular (6%). The majority of patients had injuries to the right side of their femurs (68%), whereas 10 individuals (34%) suffered fractures to the left side. Fifteen patients (30%) had fractures as a result of car accidents, while thirty-five patients (70%) had fractures as a result of falls.

Table 2: Radiological outcome of the patients

Radiological outcome	N	Percent (%)
United	45	90
Delayed union	3	6
Superficial infection	2	4

Prior to their release from the hospital, 90% of patients showed no problems and had joined properly on radiographs; 6% had delayed union, and 4% had superficial infections, both of which were treated.

Table 3: Functional outcome of the patients

Functional outcome in terms of Oxford knee score	N	Percent (%)
Excellent (>40)	32	64
Good (34-40)	18	36

The range of scores for the Oxford knee test was 38 to 44, with an average score of 42.56 ± 1.64 . Outcomes were rated as outstanding in the largest percentage of patients (64%) with 32 patients, good in the second-highest proportion (18 patients, or 36%), and fair or bad in the absence of any such ratings.

Discussion

Distal femur fractures notably AO Type C fractures are difficult to treat and account for an estimated 6% of all femur fractures. However, the non-union rate of distal femoral fractures falls between 0 and 34%, demonstrating substantial heterogeneity.[18,19] Roughly 37 out of 1,000 persons get a distal femur fracture each year.[20] Among the two groups affected by this kind of trauma, young individuals are more likely to experience high-energy trauma, whereas the osteoporotic population is more likely to experience low-energy or trivial trauma. Osteoarthritis may arise when there is a diastasis of 3 or more mm. Previously the tendency in treatment

of these fractures skewed towards closed conservative care with traction, casting, or a combination of both. The issues linked with conservative management include the limits of reduction and difficulty of sustaining decrease. Associated problems of extended immobilisation and cost concerns of increasing hospital stay further restrict their applicability. Plate fixation has a wide indication for various types of fractures, while retrograde intramedullary nail fixation is another surgical option.[21,22]

The individuals who took part in the research ranged in age from 22 to 76 years old, with an average age of 51.29 ± 12.58 . Twenty-one patients were female and 29 were male. Patients older than 60 years old made up the bulk of the patient population. Muller AO-classification showed that of the three types of fractures, the most prevalent were extra-articular (68%), full articular (26%), and partial articular (6%). Distal femoral fractures are recognized for their ambiguity in the realm of orthopaedics. Open reduction with internal fixation has replaced

management of closed conservative and external fixation over a period and conservative therapy rarely guarantee the outcomes equivalent to surgical management.[23,24] DF-LCP has a smaller application device which allows both locking and compression screw fixation of the femur shaft. The DF-LCP is a single beam construct where the strength of its fixation is equal to the sum of all screw-bone interfaces rather than a single screw's axial stiffness and pull-out resistance in unlocked plates.[25] Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilisation, avoidance of stress shielding and induction of callus formation.[25]

The main difference between the DF-LCP and the LISS is that the LISS utilizes an outrigger device for shaft holes, functioning essentially as a locking guide jig, which is attached to the distal part of the plate and guides the placement of the proximal locking screws. You can choose between a compression screw and a locking screw with the DF-Oval LCP's shaft holes. The plate can be compressed closer to the bone, resulting in a more precise placement. The new concept of LCP with option of locked screws has provided the means to increase the rigidity of fixation in osteoporotic bone or in the presence of periarticular fractures. The study was conducted to examine the short-term results, early complications and healing rate of distal femoral fractures treated with the DF-LCP. 20 Most of them had right sided femur injury (68%) and ten patients (34%) involved the left side fracture. Fifteen patients (30%) had fractures as a result of car accidents, while thirty-five patients (70%) had fractures as a result of falls.

On radiology, 90% of patients showed no problems and had joined properly; 6% had delayed union; and 4% had superficial infection, all of which were treated before patients were released from the hospital. The range of scores for the Oxford knee test was 38 to 44, with an average score of 42.56 ± 1.64 . Outcomes were rated as outstanding in the largest percentage of patients (64%) with 32 patients, good in the second-highest proportion (18 patients, or 36%), and fair or bad in the absence of any such ratings. In his study, Jhathoth discovered that the participants' ages varied from 18 to 74, with a mean of 44. In our study the mean age was slightly higher which might be due to different study setting and the different cause of fracture where RTA was commonest which marks the presence of the younger age group (18- 30 years) as predominant rather in our study, above 50 years and history of fall was the commonest.²³ Distal femur fractures are known to show a bimodal age distribution where high-speed vehicular accidents are commonly observed in the young and middle aged especially 15 to 50 years and men and fall at home are noted to be responsible for producing fractures of distal femur

in elderly osteoporotic population especially among women, the postmenopausal women.[22,26]

Results by Pipal et al²⁴, showed A.O. type C2 fractures (40%) as commonest type of fractures as commonest and Saumya et al found type C1 as the commonest and in ours it was type A3 and the two study settings are different which might have led to this difference in the findings.[14,19] Patel et al[27], found similar findings to ours wherein type A was commonest followed by type C which accounted for most of the fractures. Also, their study showed right sided predominance similar to ours. Lal et al[28] reported mean Oxford knee score of 40.6 which is in concordance with our findings and also majority showed excellent functional outcome similar to ours.[21] In consideration to biology, it is of utmost importance that the muscle and periosteal bone cover are preserved.

Conclusion

Radiological and functional results after LCP for distal femur fractures have been excellent, with 100% union. Therefore, it is effective in treating fractures of the distal femur. To get good results, however, you have to be precise with your posture and fixation. In our environment, DF-LCF has shown excellent to good functional outcomes with hundred percent union of the distal femur fractures and very low side effects that may be readily handled. The radiological results have also been very favorable. In order for the procedure to be included in the toolbox of orthopaedic trauma surgeons, long-term trials are necessary to demonstrate conclusively acceptable outcomes, although our study's findings are promising. Therefore, it is effective in treating fractures of the distal femur.

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