ORIGINAL RESEARCH

Randomised trial comparing outcome of distal femoral nail and distal femoral locking compression plate for distal shaft of femur fractures

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ABSTRACT

Background: The Less invasive stabilisation system (LISS), which was introduced in the middle to late 1990s, was further developed into the Distal Femoral Locking Compression Plate (DF-LCP). The LISS uses an outrigger device for shaft holes, basically acting as a locking guide jig, which is attached to the distal part of the plate and directs the placement of the proximal locking screws. This is the primary distinction between the DF-LCP and the LISS. The oval shaft holes on the DF-LCP allow for the use of either a locking screw or a compression screw. As aresult, the plate can be squeezed closer to the bone, allowing for a more exact implantation. **Aim:** To compare the clinic-radiological outcome of the distal femoral fractures treated by Distal FemoralLocking Compression Plate and Distal Femoral Nail. **Methods:** This study was carried out in Rajendra Institute of Medical Sciences, Ranchi. The study was a randomized trial in which patients were randomized in both the groups using Random lottery method by an independent observer. According to the prevalence of patients with distal shaft femur fractures admitted in RIMS in the years 2018-20, 40 patients,20 in nailing group and 20 in plating group were selected for our study. **Results:** In the study, mean AKS score was 65.6 + 13.4 in DFN group and in DFLCP group, it was 70.1 + 14.6. There is no statistically significant differences present in mean AKS scores in both the groups. **Conclusions:** Hence, on overall, through our study, it can be concluded that DFLCP scored better than DFN in terms of hospital stay, post-op complications, operative time, range of movements, uniontime, blood loss and AKS score.

Keyword: Fractures of proximal tibia, Distal FemoralLocking Compression Plate and Distal Femoral Nail

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INTRODUCTION

Distal femur fractures occur at a rate of about 37 per 100,000 person-years.[1] Two distinct damage mechanisms are the principal causes of distal femoral fractures. They are frequently brought on by high intensity trauma, primarily from car accidents. The majority of physicians concur that surgical treatment of distal femur fractures is necessary for the best patient outcomes.[2]

Although positive internal fixation outcomes with these fractures have been documented for more than 30 years, there have been a significant number of revisions due to implant failure, non-union, and loss of reduction. Traditional plating methods that require compression of the implant to the femoral shaft (blade plates, Dynamic Condylar Screws, non-locking condylar buttress plates), antegrade nailing fixation, retrograde nailing fixation, sub muscular locked internal fixation, and external fixation are the options for surgical treatment.[4] Techniques like double plating and, more recently, locked plating, have been promoted. However, with double plating, there is frequently significant soft tissue stripping on both sides of the femur, which reduces blood flow and increases the risk of non-union and implant failure.[3]

Fixed angle devices, most frequently in the form of Dynamic Condylar Screw (DCS) system, which consists of a supracondylar plate combined with a lag screw, are the most frequently utilised implant for the treatment of distal femur fractures. After the lag screw is placed, this two-piece device is more forgiving and allows adjustment in the sagittal plane.[7,8] The implant theoretically lessens the propensity for varuscollapse seen with conventional lateral plates by

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providing many points of fixed-angle contact between the plate and screws in the distal region of the femur. The Less invasive stabilisation system (LISS), which was introduced in the middle to late 1990s, was further developed into the Distal Femoral Locking Compression Plate (DF-LCP). The LISS uses an outrigger device for shaft holes, basically acting as a locking guide jig, which is attached to the distal part of the plate and directs the placement of the proximal locking screws. This is the primary distinction between the DF-LCP and the LISS. The oval shaft holes on the DF-LCP allow for the use of either a locking screw or a compression screw. As aresult, the plate can be squeezed closer to the bone, allowing for a more exact implantation.[4]

In order to compare locked compression plating and retrograde intramedullary nailing in the management of periprosthetic distal femur fractures, **Magill H et al[5] (2021)** did a systematic review and meta-analysis. According to the findings of this meta-analysis, there is no discernible difference between the use of a locked compression plate and retrograde intramedullary nailing for the treatment of periprosthetic distal femur fractures in terms of operating time, functional score, time to union, non-union rates, and revision rates.

AIM

To compare the clinic-radiological outcome of the distal femoral fractures treated by Distal Femoral Locking Compression Plate and Distal Femoral Nail.

METHODOLOGY

This study was carried out in Rajendra Institute of Medical Sciences, Ranchi. The study was a randomized trial in which patients were randomized in both the groups using Random lottery method by an independent observer. According to the prevalence of patients with distal shaft femur fractures admitted in RIMS in the years 2018-20, 40 patients, 20 in nailing group and 20 in plating group were selected for our study.

INCLUSION CRITERIA

1) Adult patients of Age more than 18 years and less than 70 years of age.
2) Closed fracture and grade I open fracture of distal femur without intraarticular extensions.

EXCLUSION CRITERIA

1) Grade II and III open fracture of distal femur.
2) Fracture with intra articular extensions.
3) Patients with other fractures in the ipsilateral/contralateral extremity.
4) Pathological fracture
5) Patients with severe head injury or any other severe comorbidities precluding surgical management
6) History of previous operation of the involved limb

METHODOLOGY

DISTAL FEMORAL NAILING TECHNIQUE

Under spinal anaesthesia the patient is placed supine on a radiolucent table.

An infrapatellar incision 4 to 5 cm long is made either directly over the patellar tendon or at its medial edge. The entry point is 5mm anterior to the attachment of posterior cruciate ligament and it lies slightly medial to the center of the distal femoral condyles. Direct visualization of the entry sitein the intercondylar notch can be accomplished by excision of the fat pad.C -arm guidance confirms that the entry site is along the axis of the distalfragment in both the AP and lateral planes. Either of the two intrapatellar incisions can easily be extended to a formal medial para patellar arthrotomy if necessary. A ¼ - inch twist drill or Steinman pain is used toperforate the subchondral cortex. The subsequent path created in the distalfragment by passage of hand-held reamers is the most crucial reduction maneuver of the entire procedure. A guide wire is then passed into the distal fragment, the fracture is reduced by manual traction and , the guide wire will be passed into the proximal canal. Over reaming by up to 2 mm may be necessary when the 250 mm length nail is used to minimize the distortion within the canal, which can complicate proximal interlocking. The reamers must be passed far enough proximally to accommodate the length of the nail being used. The distal end of the nail should be at least 1 mm deep to the subchondral bone. Length and alignment are confirmed on the image intensifier prior to interlocking. The nail should be statically locked in all cases. At least twoscrews should achieve secure bicortical purchase in the distal fragment. T Proper alignment and reduction must be completed using traction or manual manipulation to reduce the fracture.

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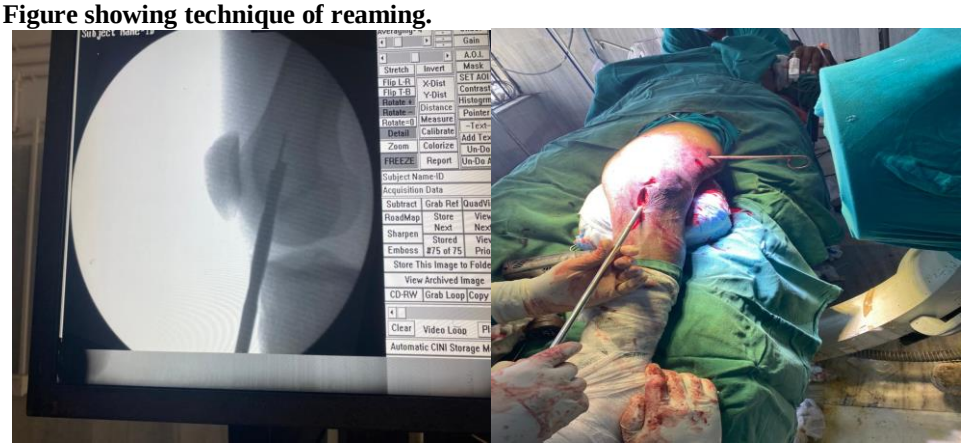
Figure A: Figure showing position of patient.
Figure B: showing important landmarks for skin incision.

Figure C: Figure showing entry point for DFN.
Figure D: Figure showing technique of reaming.



LOCKING COMPRESSION PLATE TECNHIQUE

For Locking compression plating patients were positioned in supine positions with both lower limbs extended and a small triangular bolster placed below the thigh in operative limb to make hip in neutral rotation and also make knee flex to aid in posterior vessels falls away from operative area. A 10-15cm long skin incision is made, Sub cutaneous tissue, , tensor fascia lata, vastus lateralis is incised till the lateral condyle is reached, reduction of the condyles done using point reduction clamp and image intensifier. Reduction held temporarily using two K wires by avoiding disturbance to plate positioning. The plate is slid along the shaft using the bevel. The plate is held with distal condylar portion with a temporary K wire. The condylar fragment is aligned with metaphyseal fragment by appropriate manipulation (traction and rotation) under image control. The locking head screws inserted using plate sleeve assembly with image intensifier in accordance with pre op planning. Wound is closed over a suction drain. Sterile bulky dressing applied.

Figure A: Figure showing important bony landmarks for skin incision
Figure B: Figure showing skin incison
Figure C: Figure showing DFLCP

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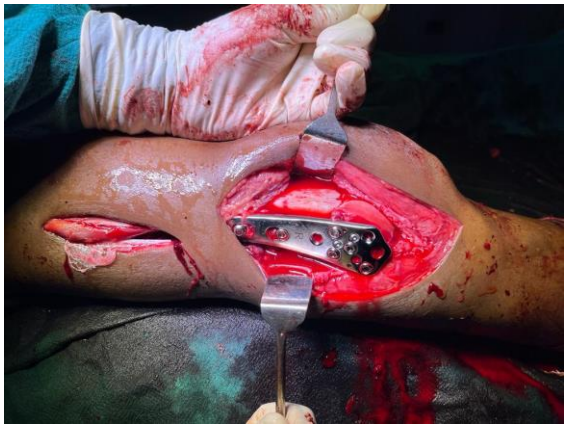

POST OPERATIVE CARE AND REHABILITATION

Postoperatively, patients in both groups were given intravenous third-generation cephalosporin antibiotics for 3 days. Isometric quadriceps strengthening exercises were started on the first postoperative day, followed by active and assisted knee bending on the second postoperative day. All patients were followed up at 2 and 6 weeks, 3 and 6 months, and 1 year postoperatively. Functional outcome of all patients analyzed using AKSS American Knee Society Score.

RESULTS

The statistical analysis of data was performed using the computer program, statistical package for social sciences (SPSS for windows, version 20.0 Chicago, SPSS Inc.) And Microsoft Excel 2010.

A total of 40 patients were analyzed. (20 DFN and 20 DFLCP). In the present study, most of the patients belonged to 41-50 years age group i.e., 13 (32.5%) where 5 (12.5%) belonged to DFN group and 8 (20%) belonged to DFLCP group. In 20-30 years age group, 7 DFN and 4 DFLCP patients were there. In 31-40 years age group, 5 DFN and 5 DFLCP patients were there. In >50 years age group, 3 DFN and 3 DFLCP patients were present. In the study, in both groups, 14 (70%) males and 6 (30%) females constituted in each group. In the study, as per etiology, RTA was the mode of injury in 14 (70%) patients in each group. Also, FFH (fall from height) was the reason in 6 (30%) patients in each group. In the present study, closed type of fracture was seen in 16 (80%) DFN patients and 13 (65%) DFLCP patients. GA1 type of fracture was noticed in 4 (20%) DFN and 7 (35%) DFLCP patients. In the present study, when hospital stay was analysed, 3 (15%) DFN and 4 (20%) DFLCP patients stayed for 3 days. 17 (85%) DFN and 16 (80%) DFLCP patients stayed for 5 days. No statistically significant difference was found in duration of hospital stay between two groups. In the present study, SSI was noticed in 3 (15%) DFN and 5 (25%) DFLCP patients. There is no statistically significant difference in surgical site infection between both groups. In the present study, when ROM was analysed, it was 0-50 degree in 2 (10%) DFN and 3 (15%) DFLCP patients, 51-100 in 13 (65%) DFN and 7 (35%) DFLCP patients, >100 in 5 (25%) DFN and 10 (50%) DFLCP patients. There is no statistically significant difference in range of movement between both groups. In this study, Mean operative time of DFN was 95.2 + 13.9 minutes and mean operative time of DFLCP was 114.0 + 16.1 minutes. There is statistically significant differences present in mean operative time in both the group with lesser time in DFN group. Mean blood loss in DFN group was 241.25 + 60.8 ml and in DFLCP group, it was 340 + 78.8ml. There is statistically significant differences present in mean blood loss between both the group with less bleeding in DFN group.

Table 1: Intergroup comparison of union in weeks

Group	N	Minimum	Maximum	Mean	Std. Deviation	Mean Difference	P value
DFN	20	12	21	14.10	2.770	2.40	0.023*
DFLCP	20	12	24	16.50	3.576		

*-Significant ($p<0.05$)

Data are presented in weeks ±SD

Mean union time in DFN group was 14.1 + 2.7 weeks and in DFLCP, it was 16.5 + 3.5 weeks

There is statistically significant differences present in mean union time in both the group with faster healing in DFN group.

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Figure 1: Bar chart showing Intergroup comparison of union time

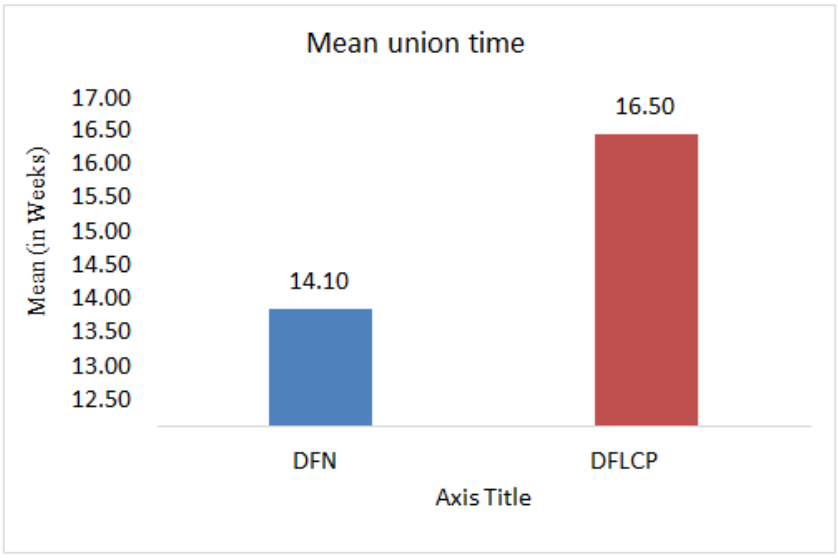

Table 2: Intergroup comparison of American knee society score (AKS score)

Group	N	Minimum	Maximum	Mean	Std. Deviation	Mean Difference	P value
DFN	20	36	82	65.65	13.437	4.45	0.322
DFLCP	20	38	84	70.10	14.607		NS

NS- Not significant (p>0.05)

In the study, mean AKS score was 65.6 + 13.4 in DFN group and in DFLCP group, it was 70.1 + 14.6. There is no statistically significant differences present in mean AKS scores inboth the groups.

Figure 2: Bar chart showing Intergroup comparison of mean AKS score

DISCUSSION

In the present study, most of the patients belonged to 41-50 years age group i.e., mean age was 38.5 years. In a similar study by Ramanand M et al[6], average age of nailing group was 46 years and for plating, it was 48 years. In other similar studies done by Ali F et al[7], Saridis A et al[8] and Wu CC et al[9], mean age was 35.4, 34.6 and 36 years respectively. This could be explained by the fact that younger men are more likely to suffer the sort of high-energy trauma associated with open fractures of the lower limb, the sort of trauma that can cause severe injuries even in the presence of normal bone quality.

In the study, RTA was the main mode of injury in 14

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(70%) patients in each group. Also, FFH was the reason in 6 (30%) patients in each group..Mode of injury in our stay was comparable to other studies. In a similar study by Ramanand M et al[6], mode of injury was high velocity RTA in 23 patients and other 17 had low velocity injury FFH.

In the present study, when hospital stay was analyzed, 3 (15%) DFN and 4 (20%) DFLCPpatients stayed for 3 days. 17 (85%) DFN and 16 (80%) DFLCP patients stayed for 5 days. No statistically significant difference was found in duration of hospital stay between two groups.

In the present study, SSI was noticed in 3 (15%) DFN and 5 (25%) DFLCP patients. There is no statistically significant difference in surgical site infection between both groups. In a similar study by Ramanand M et al[6], 7 patients had superficial infection.

In the present study, when ROM was analyzed, majority of patients achieved satisfactory movement-51-100 in 13 (65%) DFN and 7 (35%) DFLCP patients, >100 in 5 (25%) DFN and 10 (50%) DFLCP patients. There is no statistically significant difference in range of movement between both groups. In a similar study by Ramanand M et al[6],the average range of motion for nailing group was 79degrees against plating group, which had 99 degrees. Average knee flexion in this study was 104 degrees. More than 50% patients had knee range of motion more than 110°.

There is statistically significant differences present in mean operative time and in mean union time between both the group with lesser time and faster healing in DFN group. In a similar study by Ramanand M et al[6], average duration of surgery in nailing group was 90 minutes and that of in plating group was 65 minutes. The average time forunion was 20 weeks in closed fractures in plating group and 18 weeks in nailing group. In their prospective comparison of the condylar blade plate and retrograde intramedullary nail by Markmiller et al[10], it was found that, at 12 months, non-union, fixation failure, Small sample size infection, and secondary surgical procedure did not show any statistically significant differences. Mean blood loss in DFN group was 241.25 + 60.8 ml and in DFLCP group, it was 340 +78.8 ml. There is statistically significant differences present in mean blood loss in both the groupwith less bleeding in DFN group.

In a randomised study of the management of extra-articular fractures by retrograde intramedullary nailing and blade plate, Hartin et al[11] found no differences in functional recovery. The sole difference was that the group receiving retrograde nailing experienced more frequent knee pain, resulting in a 25% removal rate of the fixation material.

Hierholzer et al[12] described the indications for each technique. The plate can be adapted to all fractures, while retrograde nailing is better adapted to extra-articular fractures. Theyemphasized that high quality results are more dependent on the surgical technique than the choice of implant.

CONCLUSION

Advantage of DFN includes minimum invasive method, small incision, decreased blood loss, percutaneous joint fixation, better fixation and alignment. Maintaining this alignment is critical to the function and durability of the limb. It is indicated in type A, C1 and C2, severe obesity, ipsilateral segmental fracture. Better alignment can be achieved with locked DFN. Patient is mobilised early. Disadvantages of DFN are surgical technical expertise required, posterior angulation, cartilage damage and painful knee movements and joint infection. Hence, on overall, through our study, it can be concluded that DFLCP scored better than DFN in terms of hospital stay, post-op complications, operative time, range of movements, uniontime, blood loss and AKS score.

LIMITATION

Follow-up is very short. Long term complications may be missed.Due to inherent nature of the intervention, surgeon and observer could not be blinded.

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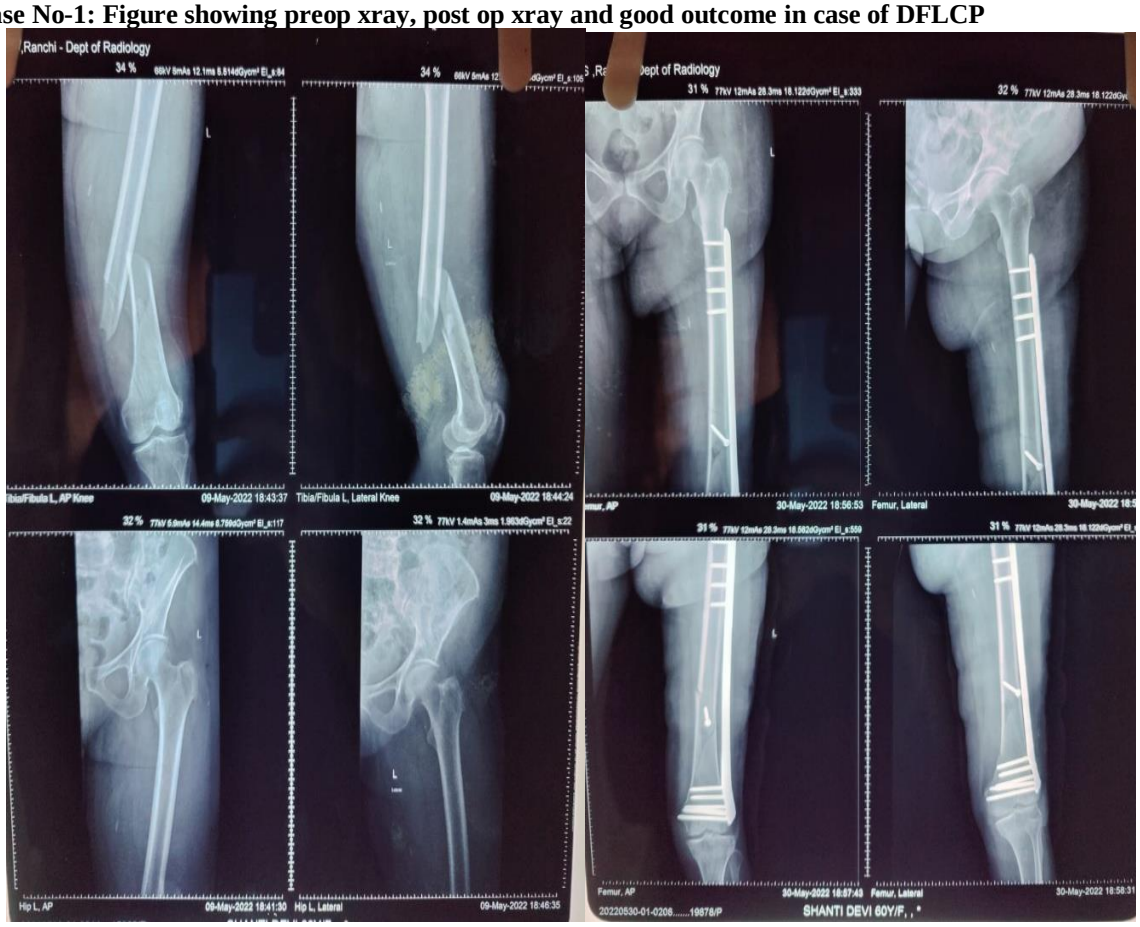
CASE ILLUSTRATIONS

Case No-1: Figure showing preop xray, post op xray and good outcome in case of DFLCP



PRE OP RADIOGRAPH **POST OP RADIOGRAPH**

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Case No-2: Figure showing preop xray, post op xray and good ROM in patients operated with DFN

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